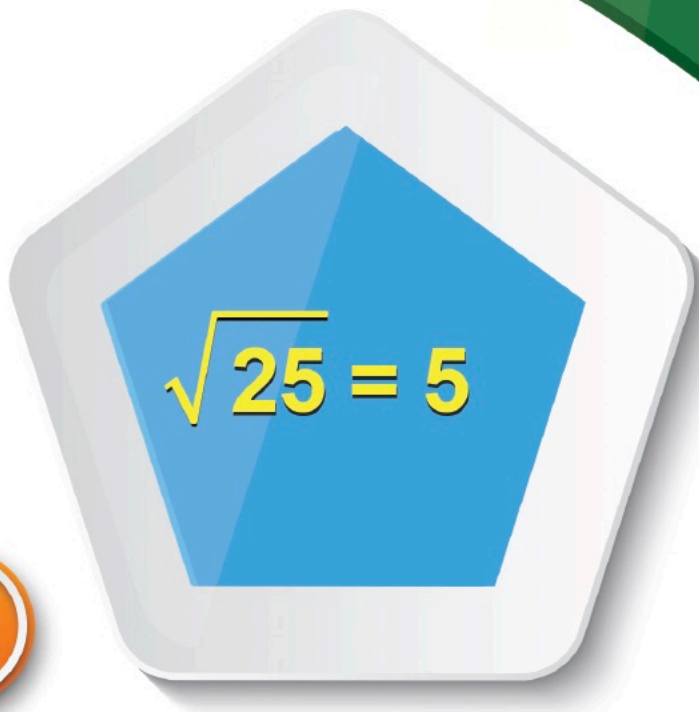
Mathematics

Standard Five

Pupil's Book





Tanzania Institute of Education

Mathematics Standard Five Pupil's Book

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Mathematics

Standard Five
Pupils Book



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MINISTRY OF EDUCATION,
SCIENCE AND TECHNOLOGY

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Commissioner for Education

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Dr Aneth A. Komba
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Introduction

This is the third book in a series of five books for Mathematics in primary schools. The book is prepared according to the 2016 Mathematics Syllabus for primary schools issued by the Ministry of Education, Science and Technology. The book consists of sixteen chapters namely, Whole numbers, Addition of whole numbers, Subtraction of whole numbers, Multiplication of numbers, Division of numbers, Roman numbers, Types of numbers, factors and multiples of numbers, Fractions, Decimals, Square numbers and square roots, Time, Metric units, Tanzanian Currency, Geometry, Algebra and Statistics. Each chapter contains exercises and activities which will enable you to acquire the expected mathematical concepts. You are encouraged to do all activities and answer all questions. The activities and exercises provided will help you to develop competences in mathematical numeracy.

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Chapter One

Whole numbers

Introduction

Whole numbers are numbers that do not contain any fractional or decimal parts. These numbers do not contain any negative numbers at all. Examples of whole numbers are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 and so on. In Standard Four, you learnt how to determine the place value of a digit in a number as well as to count, read, and write numbers up to 99 999. In this chapter, you will learn how to determine the place value of a digit in a number, count, read, and write numbers up to one million (1 000 000). This competence will help you to count things, measure quantities, price items for sale, do calculations and solve daily life problems.

Exercise 1: Revision

Answer the following questions:

1. Study the following patterns of numbers and fill in the blanks:
   (a) 3 220, 3 230, 3 240, 3 250, 3 260, _____, _____, _____.
   (b) ____, _____, _____, 99 996, 99 997, 99 998, 99 999.
   (c) 59 100, 59 200, 59 300, 59 400, _____, _____, _____.
   (d) ____, _____, 30 000, 40 000, 50 000, _____, _____, _____, 90 000.

2. Fill in the blanks by subtracting 1 from each of the following numbers:
   (a) 40 000, _____.
   (b) 69 992, _____.
   (c) 11 145, _____.

3. Fill in the blanks by subtracting 1 from each of the following numbers:
   (a) _____, 20 000.
   (b) _____, 51 202.
   (c) _____, 98 433.

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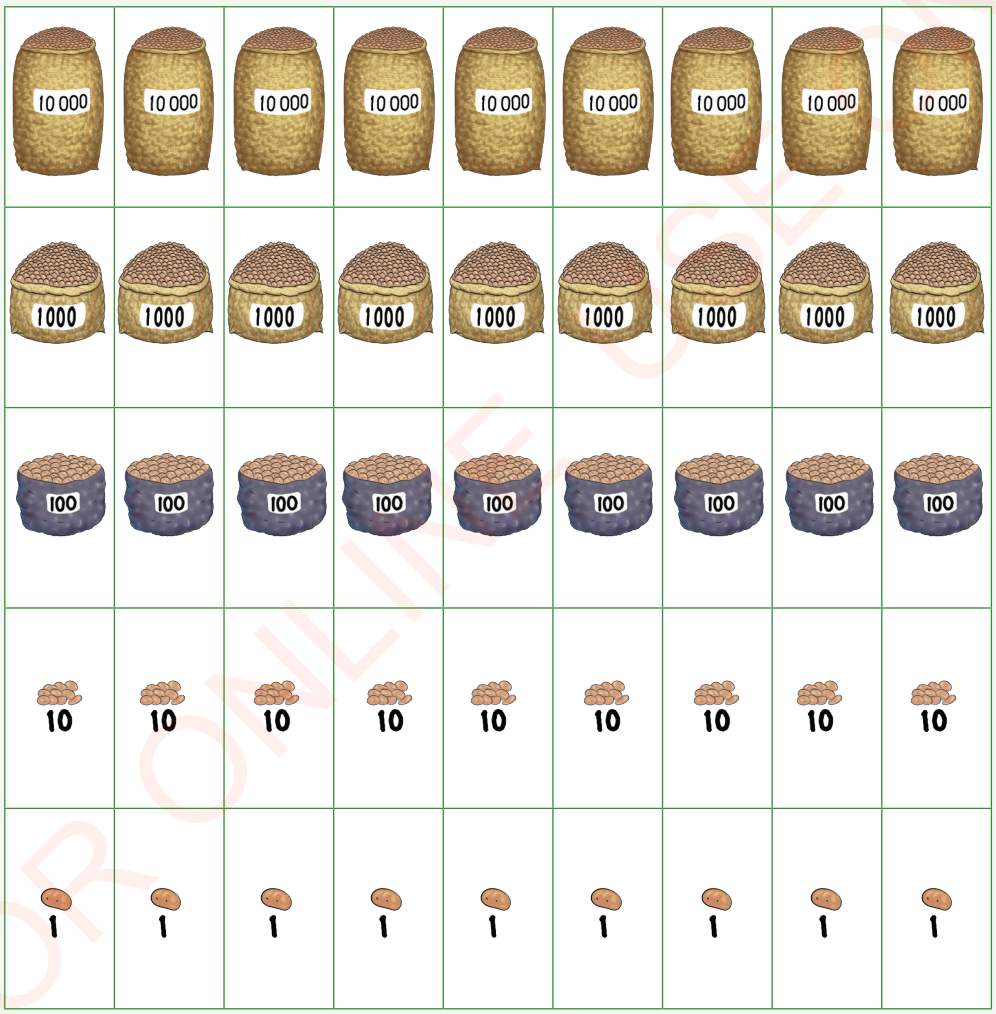
4. Use each of the digits 7, 8, 3, 2 and 1 only once to write the following in numerals:

(a) The smallest number to be formed.

(b) The largest number to be formed.

5. How many hundreds are there in ten thousand?

6. Clearly, study the following figure and then write the total number of potatoes in numeral and in words:



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7. Fill in the blanks by writing the following numbers in numerals or in words:

Number in numerals	Number in words
12 767	
	Thirty-five thousand and twenty-three
87 654	
	Twelve thousand seven hundred and eighty
56 789	
	Ten thousand and five

8. Write down the place value of each digit in the following numbers:

(a) 27 256 (b) 35 268 (c) 17 890

(d) 97 871 (e) 82 337

9. Study the numbers 19 574, 99 861, 65 439, 74 200, 45 617 and answer the following questions:

(a) Which number has the digit 5 in the hundreds place?

(b) Which number has the digit 1 in the ones place?

(c) Which number has the digit 4 in the thousands place?

(d) Which number has the digit 6 in the ten thousands place?

(e) Which number has the digit 7 in the tens place?

10. Write in numerals the numbers which correspond to the following place values:

(a) Five ten thousands, two thousands, zero hundreds, three tens and nine ones.

(b) One ten thousands, eight thousands, nine hundreds, zero tens and one ones.

(c) Nine ten thousands, two thousands, zero hundreds, eight tens and seven ones.

(d) Seven ten thousands, eight thousands, four hundreds, six tens and eight ones.

(e) Two ten thousands, three thousands, six hundreds, four tens and two ones.

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Counting by grouping

Objects are counted either one by one or in groups. Counting objects one by one is possible if the number of objects is small. If the number of objects to be counted is large, counting is made simpler by grouping the objects.

Counting up to 500 000

Example 1

Count the following number cards which are in ten thousand each:

10 000	10 000	10 000	10 000	10 000
10 000	10 000	10 000	10 000	10 000

After counting, you will get a total of ten cards each having a value of ten thousand. The total of all the number cards is one hundred thousand.

Example 2

Study the following figures, and answer the question that follow:



Figure 1: Ten thousand shillings notes

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Figure 2: One thousand shillings notes



Figure 3: Five hundred shillings notes

Question

Count and write the total amount of money in all figures.

Solution

1. Count the ten thousand shillings notes in Figure 1. There are 9 notes with a total amount of 90 000 shillings.
2. Count the one thousand shillings notes in Figure 2. There are 9 notes with a total amount of 9 000 shillings.
3. Count the five hundred shillings notes in Figure 3. There are 2 notes with a total amount of 1 000 shillings.
4. If you add the values of all the notes in all the figures you will get a total of 100 000 shillings.

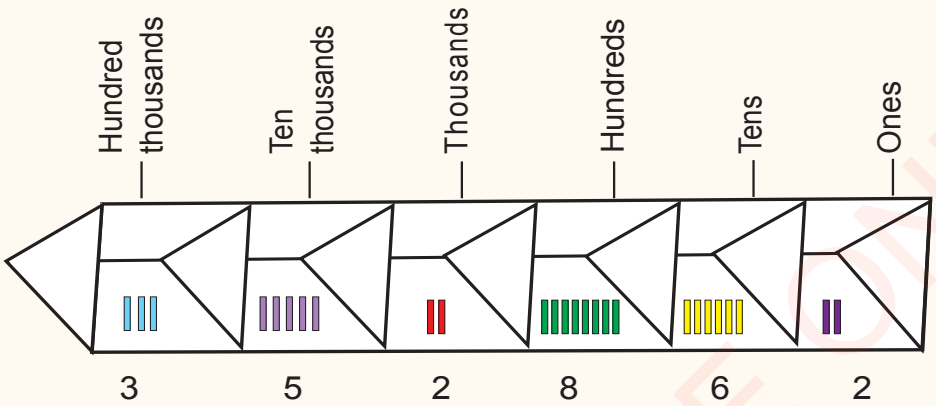
Therefore, the total amount of money is 100 000 shillings.

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Example 3

Count and write down the number of pieces of chalk in the following counting basin:



Steps:

1. Count the pieces of chalk in the ones place. There are 2 pieces of chalk. Write 2 in the ones place.
2. Count the pieces of chalk in the tens place. There are 6 pieces of chalk. Write 6 in the tens place.
3. Count the pieces of chalk in the hundreds place. There are 8 pieces of chalk. Write 8 in the hundreds place.
4. Count the pieces of chalk in the thousands place. There are 2 pieces of chalk. Write 2 in the thousands place.
5. Count the pieces of chalk in the ten thousands place. There are 5 pieces of chalk. Write 5 in the ten thousands place.
6. Count the pieces of chalk in the hundred thousands place. There are 3 pieces of chalk. Write 3 in the ten thousands place.

The result of the steps above is the number written under the counting basin. It is read as three hundred fifty-two thousand eight hundred and sixty-two. This number can be written in numeral as 352 862.

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Exercise 2

Answer the following questions:

1. Fill in the blanks by subtracting 2 from the previous number.

(a) 1 200, _____, _____, _____.

(b) 2 153, _____, _____, _____.

2. Write down three numbers after each of the following numbers by adding 1 successively:

(a) 99 995 (b) 34 628

(c) 222 222 (d) 102 100

3. Complete the following table by writing each digit in its place value:

Number	Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Ones
(a) 100 000						
(b) 65 232						
(c) 364 207						
(d) 200 001						
(e) 42 761						

4. Write down three consecutive numbers obtained by subtracting one thousand from each of the following:

(a) 400 000 (b) 300 107

(c) 290 050 (d) 165 000

5. Fill in the blanks by adding 5 to the following numbers in numerals successively:

(a) 12 456, _____, _____, _____.

(b) Two hundred thousand, _____, _____, _____.

(c) _____, _____, _____, 305 005.

(d) Fifteen thousand, _____, _____, _____.

(e) Four hundred and fifteen thousand, _____, _____, _____.

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6. Write down all the numbers from 300 000 up to 500 000 by adding forty thousand to the previous number.

Counting up to 1 000 000

Example 1

Carefully, study Figure 4 which shows ten thousand shillings notes bound in packages of one hundred thousand each, then count the number of packages and their total.



Figure 4: Ten packages of 100 000 shillings

Solution

In Figure 4, there are ten packages of one hundred thousand shillings, which altogether give a total of one million shillings as shown in Figure 5. Therefore, one million shillings is equal to ten groups of one hundred thousand shillings.

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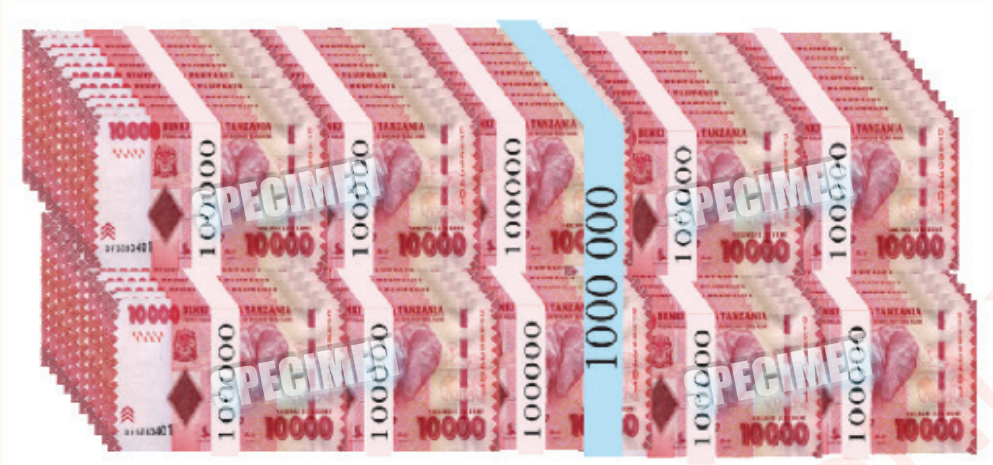
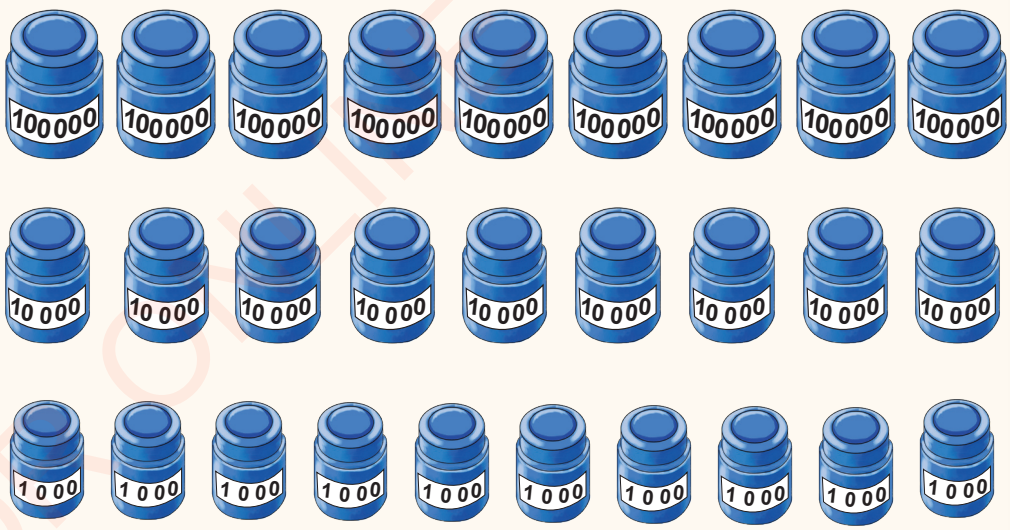


Figure 5: A package of one million shillings

Example 2

The following drug containers have the number of tablets in them written on the label of each container. Count the number of containers and then, write the total number of tablets in all the containers.



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Steps:

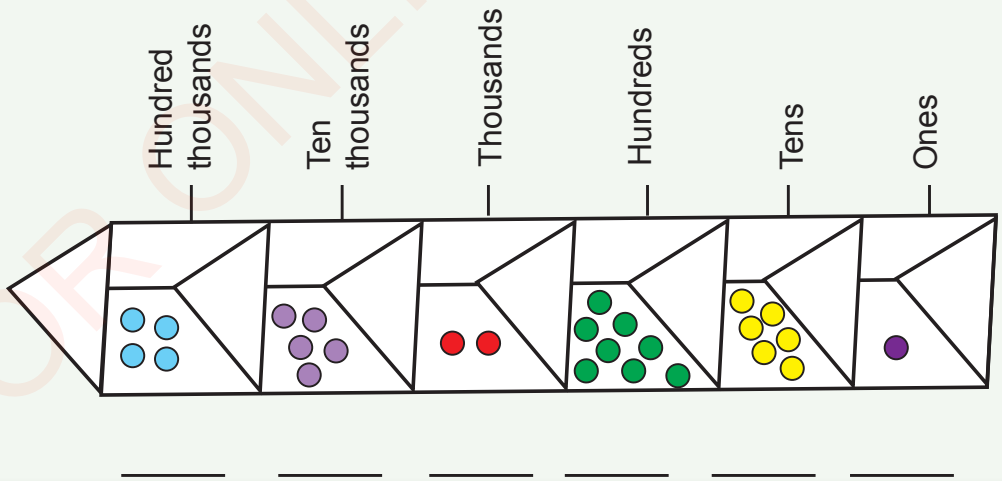
1. Count the containers with a label of 100 000, there are 9 containers, with a total number of 900 000 tablets.
2. Count the containers with a label of 10 000, there are 9 containers, with a total number of 90 000 tablets.
3. Count the containers with a label of 1 000, there are 10 containers, with a total number of 10 000 tablets.
4. The number of tablets in all the containers is 900 000 plus 90 000 plus 10 000, giving a total of 1 000 000, which is read as one million.

Therefore, all the containers contain a total of one million tablets.

Exercise 3

Answer the following questions:

1. Count the counters in the following counting basin, then write the result in the blank spaces provided both in words and in numerals.



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2. Write the place value of the digit 1 in the number 1 000 000.

3. Fill in the blanks with the missing numbers:

(a) 100 000, _____, 300 000, 400 000, _____.

(b) 729 600, 729 590, _____, _____, _____, 729 550, 729 540.

(c) _____, _____, _____, 141 000, 142 000, _____, 144 000.

4. Write down three numbers in the following patterns by adding one hundred to the previous number:

(a) 699 200, _____, _____, _____.

(b) 300 000, _____, _____, _____.

(c) 100 480, _____, _____, _____.

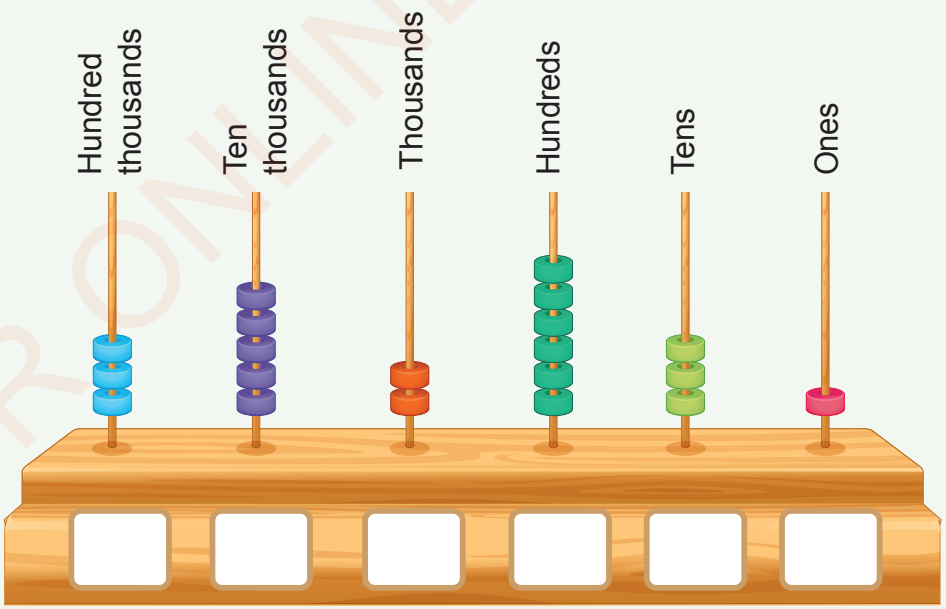
(d) 899 000, _____, _____, _____.

5. Use each of the digits 4, 2, 9, 7, 8 and 1 only once to write;

(a) The largest number to be formed.

(b) The smallest number to be formed.

6. Count and write down in numeral the number represented by the following abacus:



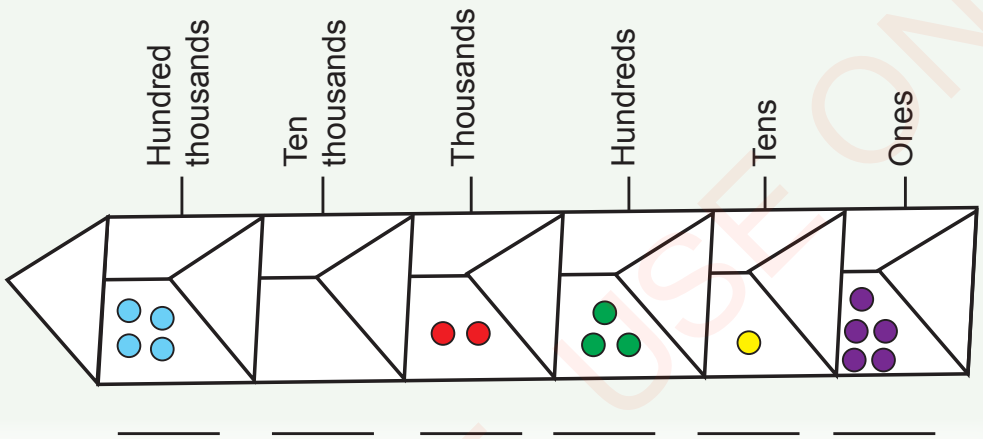
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7. If counting is done by adding one thousand, write the next five numbers after five hundred thousand.

8. Form a number pattern from two hundred and seventy thousand to three hundred and fifty thousand by adding ten thousand to a previous number to obtain the next number.

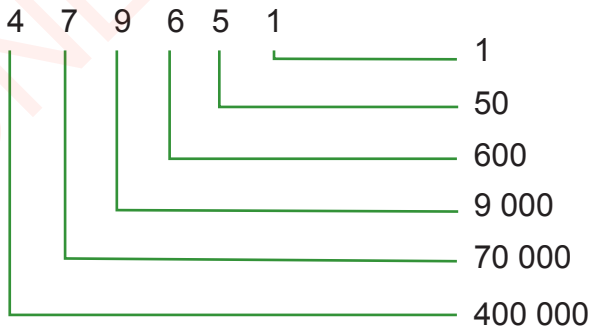
9. Write in numerals the number shown by the counters in the following counting basin.



Total value of a digit in a number

Total value of a digit in a number shows how much is that digit worth.

For example, the total value of each digit in the number 479 651 is as follows:



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Example

Write the total value of 9 in 89 670.

Answer

The total value of 9 in 89 670 is 9 000.

Expanded form

A number is in expanded form if it is written as the sum of the total values of its digits. This form identifies the total value of each digit in the number.

Example

Write down the following numerals in expanded form:

(a) 26 713 (b) 41 023 (c) 129 567

Solution

Number in numerals	Number in expanded form
(a) 26 713	20 000 + 6 000 + 700 + 10 + 3
(b) 41 023	40 000 + 1 000 + 0 + 20 + 3
(c) 129 567	100 000 + 20 000 + 9 000 + 500 + 60 + 7

Exercise 4

Answer the following questions:

1. Write down the total value of each digit in the following numbers:
   (a) 461 585 (b) 147 295
   (c) 947 231 (d) 417 293
   (e) 531 278

2. Write down the following numbers in expanded form:
   (a) 401 627 (b) 561 894
   (c) 300 002 (d) 261 578
   (e) 987 351

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3. Use the digits in the following numbers to fill in the blanks:

(a) 724 564 has _____ hundred thousands, _____ ten thousands, _____ thousands, _____ hundreds, _____ tens and _____ ones.

(b) 612 702 has _____ hundred thousands, _____ ten thousands, _____ thousands, _____ hundreds, _____ tens and _____ ones.

(c) 394 189 has _____ hundred thousands, _____ ten thousands, _____ thousands, _____ hundreds, _____ tens and _____ ones.

(d) 100 364 has _____ hundred thousands, _____ ten thousands, _____ thousands, _____ hundreds, _____ tens and _____ ones.

(e) 999 998 has _____ hundred thousands, _____ ten thousands, _____ thousands, _____ hundreds, _____ tens and _____ ones.

4. Which number is greater than the other numbers among the following?
444 144, 444 444, 444 441, 434 444, 414 444

5. Which number is smaller than the other numbers among the following?
661 256, 663 666, 666 166, 666 646, 616 666

6. Write down the total value of 9 in each of the following numbers:
(a) 392 527 (b) 579 711 (c) 418 692

Reading and writing numbers up to 1 000 000

Reading numbers

A number is read by considering the place value of its digits, starting with the leftmost digit to the rightmost digit.

Example 1

Read loudly the following numbers:

Number in numerals	Number in words
105 202	One hundred five thousand two hundred and two
254 000	Two hundred fifty-four thousand
100 006	One hundred thousand and six

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Example 2

Read the following numbers:

(a) 311 008 Three hundred eleven thousand and eight.
(b) 101 008 One hundred one thousand and eight.
(c) 411 000 Four hundred eleven thousand.
(d) 500 709 Five hundred thousand seven hundred and nine.
(e) 1 000 000 One million.

Exercise 5

Answer the following questions:

1. Read the following numbers loudly:

(a) 99 999, 100 000, 100 001, 100 002, 100 003, 100 004, 100 005.

(b) 100 010, 100 020, 100 030, 100 040, 100 050, 100 060, 100 070.

(c) 200 200, 200 400, 200 600, 200 800, 201 000, 201 200, 201 400.

(d) 113 999, 199 922, 497 007, 931 311, 100 003.

2. Read loudly the numbers in the following table and write them in words:

Number in Numeral	Number in words
128 749	
338 952	
876 187	
997 000	
872 006	
984 901	
888 888	
440 690	
300 003	
772 024	

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Writing numbers in words and in numerals

Example 1

Write down the following numbers in numerals:

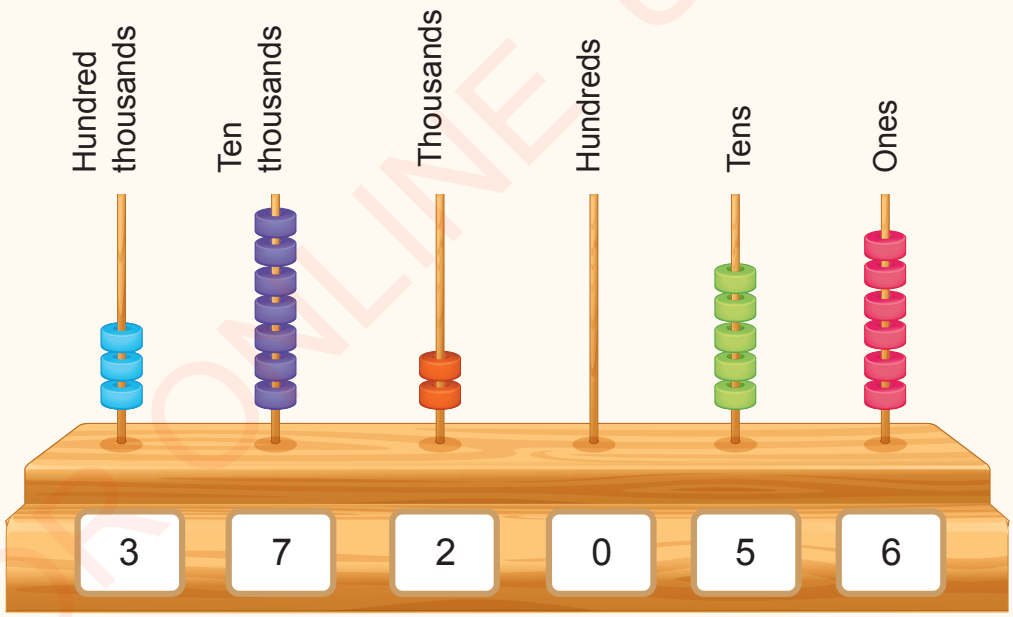
1. One hundred seven thousand five hundred and five
2. Seven hundred eighty-nine thousand
3. Two hundred sixty-six thousand and eight

Solution

1. One hundred seven thousand five hundred and five = 107 505.
2. Seven hundred eighty-nine thousand = 789 000.
3. Two hundred sixty-six thousand and eight = 266 008.

Example 2

Write and read the number represented by the following abacus:



The number which is represented by the abacus is 372 056 and is read as three hundred seventy-two thousand and fifty-six.

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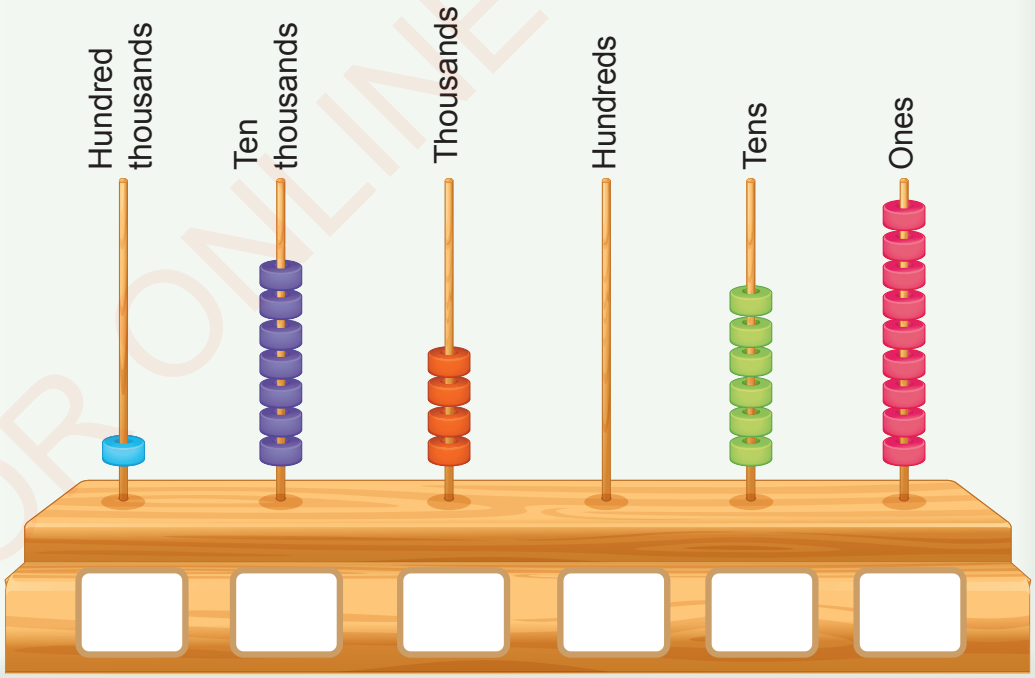
Exercise 6

Answer the following questions:

1. Read loudly the numbers in the following table and write them in numerals:

Number in words	Number in numerals
(a) One million	
(b) Five hundred thousand four hundred and thirty	
(c) Nine hundred eighty thousand and forty-two	
(d) One hundred twenty-seven thousand, nine hundred	
(e) Four hundred thousand	
(f) Four hundred thousand and four	
(g) Three hundred seventy thousand and twenty	
(h) Eight hundred thousand, five hundred and fifty-seven	
(i) One hundred thousand and one	

2. Write the number represented by the following abacus both in words and in numerals:



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Exercise 7

Answer the following questions:

1. Fill in the blanks:

(a) 234 566,_____,_____,234 569, _____, _____, 234 572.

(b) 359 000, 358 000 _____, _____, _____, 354 000.

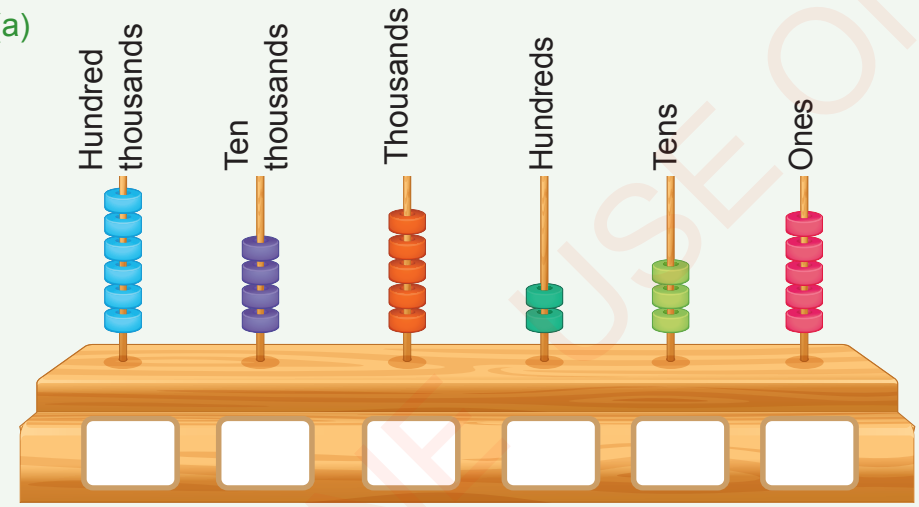
(c) _____, _____, _____, 400 000, 500 000, 600 000.

(d) 155 600, _____,_____,155 300, 155 200, _____, _____.

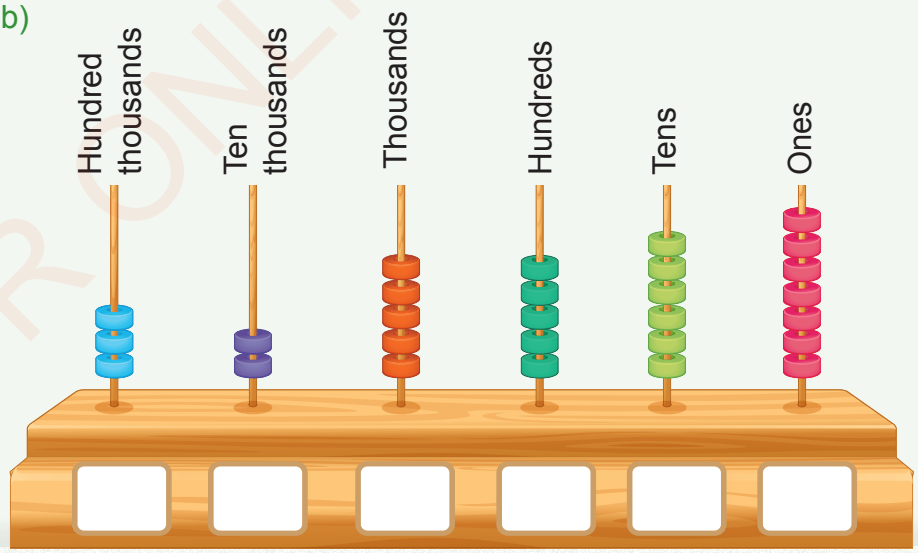
(e) _____,_____,_____,840 000, _____, 860 000, 870 000.

2. Count and write the numbers represented by the following abacus:

(a)



(b)



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3. Write the number 300 110 in words.

4. Write the following numbers in numerals:

Number in words	Number in numerals
(a) Two hundred ninety-five thousand seven hundred and fifty	
(b) Three hundred thousand and sixty-five	
(c) Nine hundred ninety-nine thousand, nine hundred and ninety-nine	
(d) One hundred fifty thousand	
(e) Seven hundred eighty-seven thousand and seven	

5. Write the number 763 631 in its expanded form.

6. Write the number 900 000 + 30 000 + 1 000 + 300 + 50 + 4 in numeral.

7. Write the place value of 7 in each of the following numbers:
   (a) 867 652
   (b) 879 543
   (c) 236 374
   (d) 374 964
   (e) 721 603

8. Write the following numbers in words:
   (a) 311 321
   (b) 401 719
   (c) 572 900
   (d) 200 535
   (e) 145 130

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Summary

1. To obtain the place value of a digit in a number, you have to identify the position of that digit in the number.
2. Groups of objects to be counted may be of different sizes and colours.
3. To write a number in its expanded form, start with the digit with the largest place value going down to the digit with the smallest place value.

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Chapter Two

Addition of whole numbers

Introduction

Addition is a process of bringing two or more numbers (or objects) together to obtain their total. The numbers to be added are called addends, while the result you get after adding is the sum or the total. In Standard Four, you learnt how to add whole numbers up to 99 999. In this chapter, you will learn how to add numbers up to 999 999. You will also learn about solving word problems involving addition. The ability to add up numbers is important in all aspects of life, at home, at school, at work and to the society. This chapter will help you to master the relationships between numbers and understand how quantities relate to one another.

Exercise 1: Revision

Answer the following questions:

1. 61 345 + 32 134 =

2. 82 071 + 7 928 =

3. 463 + 11 125 =

4. 44 455 + 3 342 =

5. 35 678 + 4 375 =

6. 3 607 + 56 124 =

7. 25 041 + 7 268 =

8. 65 487 + 25 380 =

9.
$$\begin{array}{r} 48\,507 \\ +\ 38\,690 \\ \hline \\ \hline \end{array}$$

10.
$$\begin{array}{r} 6\,457 \\ +\ 23\,564 \\ \hline \\ \hline \end{array}$$

11.
$$\begin{array}{r} 38\,735 \\ +\ 51\,306 \\ \hline \\ \hline \end{array}$$

12.
$$\begin{array}{r} 62\,664 \\ +\ 817 \\ \hline \\ \hline \end{array}$$

13.
$$\begin{array}{r} 26\,663 \\ +\ 32\,310 \\ \hline \\ \hline \end{array}$$

14.
$$\begin{array}{r} 4\,073 \\ +\ 21\,825 \\ \hline \\ \hline \end{array}$$

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15.
$$\begin{array}{r} 36\,457 \\ +\ 53\,442 \\ \hline \\ \hline \end{array}$$

16.
$$\begin{array}{r} 75\,543 \\ +\ 432 \\ \hline \\ \hline \end{array}$$

17. If Elineema has 56 784 oranges and Flora has 33 912 oranges, how many oranges do they have in total?

18. Mvomero District had 34 006 primary school pupils and 28 543 secondary school pupils. Find the total number of pupils in the district.

19. Ujamaa village has 78 000 goats and Muungano village has 16 492 goats. What is the total number of goats in the two villages?

20. Teachers attended a training seminar in two groups. The first group had 44 200 teachers while the second group had 55 407 teachers. How many teachers attended the seminar?

Adding numbers without regrouping

When adding numbers, it is important to consider the place value of the digits in the numbers being added. Start by adding the ones followed by the tens, hundreds, thousands, ten thousands and hundred thousands digits.

Addition of numbers arranged horizontally

Numbers arranged horizontally can be added without regrouping as follows:

Example 1

888 888 + 110 011 =

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Solution

Steps:

1.	Add ones: 8 + 1 = 9. Write 9 in the ones position.	888 888 + 110 011= _ _ _ _ _ 9
2.	Add tens: 8 + 1 = 9. Write 9 in the tens position.	888 888 + 110 011 = _ _ _ _ 99
3.	Add hundreds: 8 + 0 = 8. Write 8 in the hundreds position.	888 888 + 110 011= _ _ _ 899
4.	Add thousands : 8 + 0 = 8. Write 8 in the thousands position.	888 888 + 110 011= _ _ 8 899
5.	Add ten thousands: 8 + 1 = 9. Write 9 in the ten thousands position.	888 888 + 110 011= _ 98 899
6.	Add hundred thousands: 8 + 1 = 9. Write 9 in the hundred thousands position.	888 888 + 110 011 = 998 899

Therefore, 888 888 + 110 011 = 998 899.

Example 2

34 487 + 42 002 =

Solution

34 487 + 42 002 = 76 489

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Exercise 2

Add the following numbers:

1. 445 702 + 231 264 =
2. 45 536 + 210 431 =
3. 647 775 + 200 003 =
4. 803 414 + 121 405 =
5. 715 109 + 263 780 =
6. 610 243 + 379 542 =
7. 665 544 + 332 255 =
8. 785 432 + 213 467 =
9. 835 201 + 163 348 =
10. 631 594 + 246 305 =
11. 13 451 + 240 037 =
12. 524 321 + 143 442 =
13. 912 340 + 45 426 =
14. 230 000 + 144 348 =
15. 374 136 + 25 862 =
16. 811 133 + 141 556 =
17. 666 777 + 333 222 =
18. 344 342 + 454 656 =
19. 334 434 + 544 204 =
20. 567 891 + 431 107 =

Addition of numbers arranged vertically

Numbers arranged vertically can be added without regrouping as follows:

Example 1

$$\begin{array}{r} 235\,641 \\ +\ 621\,357 \\ \hline \\ \hline \end{array}$$

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Solution

Arrange the numbers vertically as follows to match their place values:

	Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Ones
	2	3	5	6	4	1
+	6	2	1	3	5	7
	8	5	6	9	9	8

Therefore, the answer is 856 998.

Example 2

$$\begin{array}{r} 453\,472 \\ +\ 316\,513 \\ \hline \\ \hline \end{array}$$

Solution

Steps:

1. Arrange the numbers vertically as follows to match their place values:

	Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Ones
	4	5	3	4	7	2
+	3	1	6	5	1	3
	7	6	9	9	8	5

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2. Add ones: 2 + 3 = 5. Write 5 in the ones position.
3. Add tens: 7 + 1 = 8. Write 8 in the tens position.
4. Add hundreds: 4 + 5 = 9. Write 9 in the hundreds position.
5. Add thousands: 3 + 6 = 9. Write 9 in the thousands position.
6. Add ten thousands: 5 + 1 = 6.Write 6 in the ten thousands position.
7. Add hundred thousands: 4 + 3 = 7. Write 7 in the hundred thousands position.

Therefore, the answer is 769 985.

Example 3

$$\begin{array}{rr} & 238\ 275 \\ + & 500\ 623 \\ \hline & \\ \hline \end{array}$$

Solution

$$\begin{array}{rr} & 238\ 275 \\ + & 500\ 623 \\ \hline & 738\ 898 \\ \hline \end{array}$$

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Exercise 3

Answer the following questions:

1. 731 546 + 166 422 = _____

2. 99 999 + 100 000 = _____

3. 342 643 + 455 136 = _____

4. 232 738 + 756 041 = _____

5. 857 432 + 131 456 = _____

6. 41 755 + 328 142 = _____

7. 800 000 + 167 489 = _____

8. 224 466 + 200 000 + 550 533 = _____

9. 340 405 + 314 582 = _____

10. 137 452 + 62 540 = _____

11. 75 000 + 504 643 = _____

12. 934 533 + 45 302 = _____

13. 630 402 + 207 294 = _____

14. 720 340 + 108 637 = _____

15. 244 336 + 135 452 + 210 111 = _____

16. 712 734 + 275 005 = _____

17. 710 247 + 9 340 = _____

18. 569 732 + 430 021 = _____

19. 10 113 + 129 274 + 60 612 = _____

20. 430 124 + 546 004 = _____

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Adding numbers by regrouping

Addition of numbers arranged horizontally

Numbers arranged horizontally can be added by regrouping as follows:

Example 1

846 484 + 152 486 =

Solution

1.	Add ones: 4 + 6 = 10. Regroup ten ones as 1 tens and 0 ones. Write 0 in the ones position. Take 1 group of tens to the tens position.	846 484 + 152 486 = _ _ _ _ _ 0
2.	Add tens: 1 + 8 + 8 = 17. Regroup 17 tens as 1 hundreds and 7 tens. Write 7 in the tens position. Take 1 group of hundreds to the hundreds position.	846 484 + 152 486 = _ _ _ _ 70
3.	Add hundreds: 1 + 4 + 4 = 9. Write 9 in the hundreds position.	846 484 + 152 486 = _ _ _ 970
4.	Add thousands: 6 + 2 = 8. Write 8 in the thousands position.	846 484 + 152 486 = _ _ 8 970
5.	Add ten thousands: 4 + 5 = 9. Write 9 in the ten thousands position.	846 484 + 152 486 = _ 98 870
6.	Add hundred thousands: 8 + 1 = 9. Write 9 in the hundred thousands position.	846 484 + 152 486 = 998 970

Therefore, 846 484 + 152 486 = 998 970.

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Example 2

239 879 + 46 823 =

Solution

239 879 + 46 823 = 286 702

Exercise 4

Answer the following questions:

1. 162 845 + 134 027 =
2. 293 586 + 26 323 =
3. 721 318 + 183 518 =
4. 526 517 + 34 048 =
5. 2 964 + 298 576 =
6. 784 049 + 108 187 =
7. 881 054 + 9 999 =
8. 786 951 + 118 275 =
9. 216 783 + 678 357 =
10. 484 888 + 200 286 =
11. 69 000 + 209 179 =
12. 567 183 + 384 921 =
13. 943 573 + 56 327 =
14. 700 852 + 279 168 =
15. 526 507 + 386 549 =
16. 298 745 + 650 124 =
17. 465 327 + 388 169 =
18. 7 250 + 428 866 =
19. 881 178 + 11 356 =
20. 877 778 + 66 665 =

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Addition of numbers arranged vertically

Numbers arranged vertically can be added by regrouping as follows:

Example 1

$$\begin{array}{rr} & 228\ 186 \\ + & 374\ 899 \\ \hline & \\ \hline \end{array}$$

Solution

Steps:

1. Arrange the numbers vertically as follows to match their place values

Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Ones
2+1	2+1	8+1	1+1	8+1	6
+3	7	4	8	9	9
6	1 0	1 3	1 0	1 8	1 5
6	0	3	0	8	5

2. Add ones: 6 + 9 = 15. Regroup 15 as 1 tens and 5 ones. Write 5 in the ones position and add 1 to the tens position.
3. Add tens: 1+ 8 + 9 = 18. Regroup 18 as 1 hundreds and 8 tens. Write 8 in the tens position and add 1 to the hundreds position.
4. Add hundreds: 1 + 1 + 8 = 10. Regroup 10 as 1 thousands and 0 hundreds. Write 0 in the hundreds position and add 1 to the thousands position.
5. Add thousands: 1 + 8 + 4 = 13. Regroup 13 as 1 ten thousands and 3 thousands. Write 3 in the thousands position and add 1 to the ten thousands position.

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6. Add ten thousands: 1 + 2 + 7 = 10. Regroup 10 as 1 hundred thousands and 0 ten thousands. Write 0 in the ten thousands position and add 1 to the hundred thousands position.
7. Add hundred thousands: 1 + 2 + 3 = 6. Write 6 in the hundred thousands position.

Therefore, the answer is 603 085.

Example 2

$$\begin{array}{r} 456\,736 \\ +\ 13\,497 \\ \hline \\ \hline \end{array}$$

Solution

Steps:

1.	Add ones: 6 + 7 = 13. Regroup 13 as 1 tens and 3 ones. Write 3 in the ones position and add 1 to the tens position.	$\begin{array}{r} 456\,736 \\ +\ 13\,497 \\ \hline 3 \\ \hline \end{array}$
2.	Add tens: 1 + 3 + 9 = 13. Regroup 13 as 1 hundreds and 3 tens. Write 3 in the tens position, and add 1 to the hundreds position.	$\begin{array}{r} 456\,736 \\ +\ 13\,497 \\ \hline 33 \\ \hline \end{array}$
3.	Add hundreds: 1 + 7 + 4 = 12. Regroup 12 as 1 thousands and 2 hundreds. Write 2 in the hundreds position, and add 1 to the thousands position.	$\begin{array}{r} 456\,736 \\ +\ 13\,497 \\ \hline 233 \\ \hline \end{array}$

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4.	Add thousands: 1 + 6 + 3 = 10. Regroup 10 as 1 ten thousands and 0 thousands. Write 0 in the thousands position, and add 1 to the ten thousands position.	456 736 + 13 497 0 233
5.	Add ten thousands: 1 + 5 + 1 = 7. Write 7 in the ten thousands position.	456 736 + 13 497 70 233
6.	Add hundred thousands: 4 + 0 = 4. Write 4 in the hundred thousands position.	456 736 + 13 497 470 233

Therefore, the answer is 470 233.

Example 3

192 574
+ 3 648

Solution

192 574
+ 3 648
196 222

Exercise 5

Answer the following questions:

1. 856 956 + 134 689

2. 88 456 + 134 689

3. 489 765 + 94 538

4. 324 857 + 143 073

5. 708 924 + 79 989

6. 889 900 + 73 281

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7.
454 899
378 716
+ 120 102

8.
818 819
+ 71 719

9.
834 532
+ 134 068

10.
40 546
+ 221 768

11.
679 448
298 765
+ 1 000

12.
489 660
+ 427 488

13.
507 609
382 517
+ 13 170

14.
779 988
+ 78 866

15.
24 454
+ 138 457

16.
679 884
+ 243 029

17.
666 777
+ 112 990

18.
488 574
+ 433 126

19.
884 007
+ 107 994

20.
555 666
111 000
200 234
+ 32 152

Word problems involving addition of numbers

Example 1

A meat processing factory bought 137 527 cows the year before last year. The same factory bought 222 062 cows last year. How many cows were bought by the factory in both years?

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Solution

Number of cows bought the year before last year		137 527
Number of cows bought last year	+	222 062
Total number of cows bought		359 589

Therefore, the factory bought 359 589 cows.

Example 2

Three lorries transported mangoes as follows:
The first lorry transported 225 768 mangoes, the second lorry transported 19 435 mangoes, and the third lorry transported 22 202 mangoes. How many mangoes were transported by the three lorries?

Solution

Number of mangoes transported by the first lorry		225 768
Number of mangoes transported by the second lorry		19 435
Number of mangoes transported by the third lorry	+	22 202
Total number of mangoes transported by three lorries		267 405

Therefore, 267 405 mangoes were transported by the three lorries.

Exercise 6

Answer the following questions:

1. The number of residents in three wards are as follows:
   Mgori ward has 216 819 residents, Mhonda ward has 258 776 residents and Balangida ward has 126 000 residents. What is the total number of residents in the three wards?

2. Hango has a saving of 830 900 shillings. If he received a loan of 160 550 shillings from a bank, what is the total amount of money does he have?

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3. Handeni district has 561 217 tree seedlings while Manyoni district has 393 888 tree seedlings. How many tree seedlings do the two districts have?

4. Dodoma Regional Library has 678 213 books and Mbeya Regional Library has 298 994 books. What is the total number of books in both libraries?

5. Students enrollment into Form V for three consecutive years was as follows: 65 123 students were enrolled in 2015, 87 112 students were enrolled in 2016, and 98 430 students were enrolled in 2017. What was the total number of students enrolled during the three years?

6. The harvests of various crops were as follows:
216 997 bags of beans, 230 000 bags of maize and 340 775 bags of sunflower seeds. What were the total number of bags of crops harvested?

7. Kongwa National Ranch has 483 125 cattle while Sagara National Ranch has 375 166 cattle. Find the total number of cattle kept by both Ranches.

8. Njombe Region harvested 713 128 pieces of timber while Iringa Region harvested 280 193 pieces of timber. How many pieces of timber were harvested by both regions?

9. Jamhuri Primary School has 2 588 desks, Mwanga Primary School has 8 813 desks and Mihayo Primary School has 10 554 desks. Find the total number of desks in the three schools.

10. A certain company bought 491 235 cars by cash and 508 761 cars on loan. How many cars did the company buy?

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Exercise 7

Answer the following questions:

1. 431 635 + 200 163 =

2. 888 887 + 66 677 =

3. 548867 + 33 567 =

4. 213 + 56 334 + 700 451 =

5. 566 780 + 11 002 + 300 054 =

6. 19 610 + 40 133 + 20 223 =

7. 243 489 + 452 007 =

8. 7 840 + 63 450 + 220 006 =

9. 244 444 + 677 555 =

10. 777 784 + 112 241 =

11.
$$\begin{array}{r} 666\,666 \\ +\ 332\,113 \\ \hline \\ \hline \end{array}$$

12.
$$\begin{array}{r} 405\,306 \\ +\ 379\,908 \\ \hline \\ \hline \end{array}$$

13.
$$\begin{array}{r} 244\,726 \\ +\ 339\,493 \\ \hline \\ \hline \end{array}$$

14.
$$\begin{array}{r} 340\,045 \\ +\ 35\,975 \\ \hline \\ \hline \end{array}$$

15.
$$\begin{array}{r} 453\,659 \\ +\ 546\,341 \\ \hline \\ \hline \end{array}$$

16.
$$\begin{array}{r} 467\,438 \\ +\ 6\,005 \\ \hline \\ \hline \end{array}$$

17.
$$\begin{array}{r} 355\,325 \\ +\ 241\,023 \\ \hline \\ \hline \end{array}$$

18.
$$\begin{array}{r} 389\,535 \\ +\ 1\,003 \\ \hline \\ \hline \end{array}$$

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19.
$$\begin{array}{r} 723\,461 \\ 126\,873 \\ +\ 138\,912 \\ \hline \\ \hline \end{array}$$

20.
$$\begin{array}{r} 989\,999 \\ +\ 1\,492 \\ \hline \\ \hline \end{array}$$

21. Pohama village has 98 214 chickens and Mazae village has 415 999 chickens. How many chickens are there in both villages?

22. My aunt has 168 000 shillings. If she gets a loan of 90 000 shillings, find the total amount of money that my aunt will have.

23. A farmer got 400 000 shillings after selling chickens. He also got 500 000 shillings by selling goats. How much money did he receive from both sales?

24. Mwanza Region sold 304 301 tons of cotton and Shinyanga Region sold 532 175 tons of cotton. How many tons of cotton were sold by both regions?

25. My father bought a television set for 689 000 shillings, a sewing machine for 150 000 shillings and a bicycle for 160 000 shillings. How much money did my father spend on all three items?

Summary

1. When adding numbers, arrange the numbers either horizontally or vertically. Start by adding the ones digits, followed by the tens digits, the hundreds digits, the thousands digits, the ten thousands digits and the hundred thousands digits.
2. When adding numbers, always start from the rightmost digit and end with the leftmost digit.
3. In solving word problems, consider the following:
   (a) Read the word problem to identify the mathematical operation to be performed.
   (b) Perform the operation on the numbers mentioned in the problem.
   (c) After calculations, conclude by answering the question.

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Chapter Three

Subtraction of whole numbers

Introduction

Subtraction is a process of taking away some objects from a collection of objects. It is the opposite of addition. In Standard Four, you learnt how to subtract numbers with not more than five digits. You subtracted numbers by regrouping and without regrouping. You also learnt how to solve word problems involving subtraction of whole numbers. In this chapter, you will learn subtraction of numbers with not more than six digits by regrouping and without regrouping. You will also learn how to solve word problems involving subtraction of numbers. You need to understand how to subtract numbers in order to perform some activities in real life. Subtraction is used when dealing with money, cooking, travelling, time and other daily life activities.

Exercise 1: Revision

Answer the following questions:

1. 68 549 – 25 127 =

2. 73 458 – 32 135 =

3. 92 406 – 1 304 =

4. 62 694 – 30 521 =

5. 62 345 – 4 672 =

6. 81 505 – 61 426 =

7.
$$\begin{array}{r} 92\,914 \\ -\ 67\,083 \\ \hline \\ \hline \end{array}$$

8.
$$\begin{array}{r} 79\,461 \\ -\ 2\,330 \\ \hline \\ \hline \end{array}$$

9.
$$\begin{array}{r} 72\,345 \\ -\ 12\,204 \\ \hline \\ \hline \end{array}$$

10.
$$\begin{array}{r} 87\,910 \\ -\ 45\,710 \\ \hline \\ \hline \end{array}$$

11.
$$\begin{array}{r} 55\,423 \\ -\ 5\,211 \\ \hline \\ \hline \end{array}$$

12.
$$\begin{array}{r} 63\,348 \\ -\ 1\,419 \\ \hline \\ \hline \end{array}$$

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13. 12 467
– 11 448

14. 54 678
– 47 629

15. 78 934
– 69 983

16. Yohana deposited 98 550 shillings in his bank account. If he withdrew 12 400 shillings from his bank account, what balance remained in his bank account?

17. The residents of Songambele village planted 75 620 trees. If 3 210 trees were burnt, how many trees were not burnt?

18. If 89 777 pupils sat for the standard four examination and 2 899 pupils failed the examination, find the number of pupils who passed the examination.

19. Residents of Maendeleo village owned 25 495 cattle. If they sold 16 726 cattle, how many cattle remained?

20. Miriamu's mother had 57 000 shillings. She wanted to buy a television set costing 75 000 shillings. How much money did she lack to buy the television set?

Subtraction of numbers without regrouping

Subtracting numbers arranged horizontally

Numbers arranged horizontally can be subtracted without regrouping as follows:

Example 1

257 645 – 34 413 =

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Solution

Steps:

1.	Subtract ones: 5 – 3 = 2. Write 2 in the ones position.	257 645 – 34 413 = _ _ _ _ _ 2
2.	Subtract tens: 4 – 1 = 3. Write 3 in the tens position.	257 645 – 34 413 = _ _ _ _ 32
3.	Subtract hundreds: 6 – 4 = 2. Write 2 in the hundreds position.	257 645 – 34 413 = _ _ _ 232
4.	Subtract thousands: 7 – 4 = 3. Write 3 in the thousands position.	257 645 – 34 413 = _ _ 3 232
5.	Subtract ten thousands: 5 – 3 = 2. Write 2 in the ten thousands position.	257 645 – 34 413 = _ 23 232
6.	Subtract hundred thousands: 2 – 0 = 2. Write 2 in the hundred thousands position.	257 645 – 34 413 = 223 232

Therefore, 257 645 – 34 413 = 223 232.

Example 2

478 376 – 255 142 =

Solution

The question can be answered by using the counting basin.

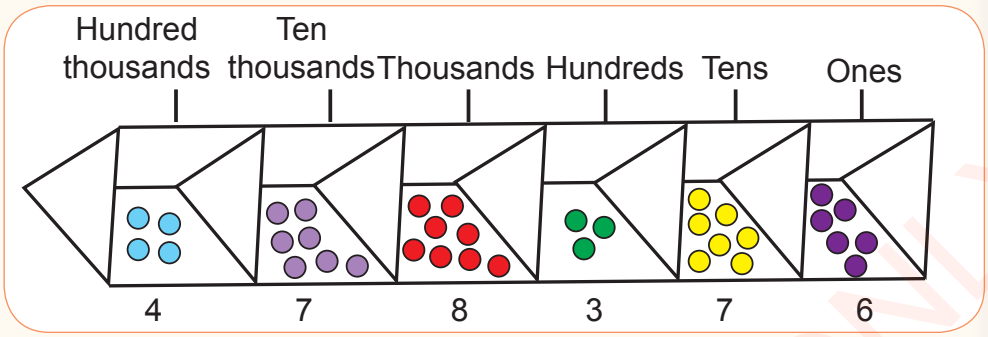
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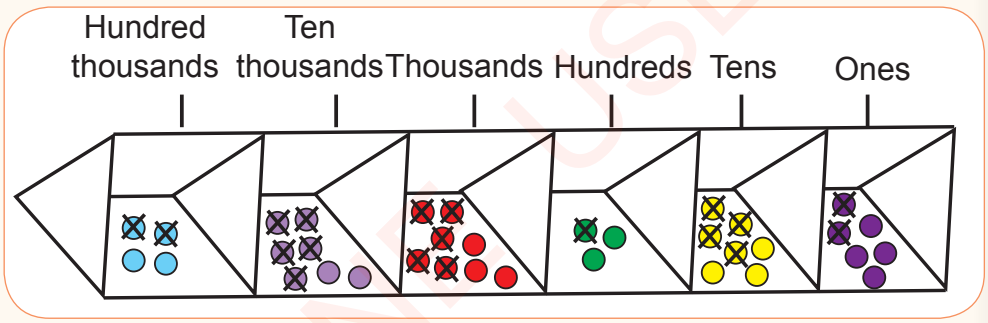
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Steps:

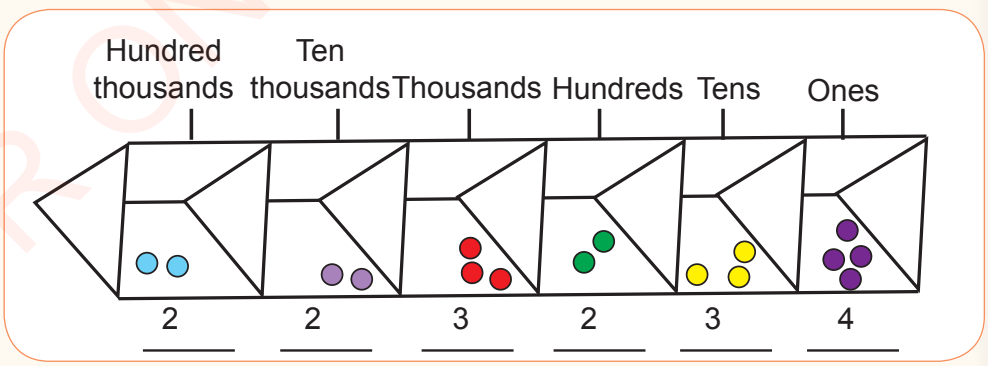
1. Put the counters in the counting basin to match the digits of 478 376 and their place values as shown in the following figure:



2. Since the operation is subtraction, cross the counters in each compartment to match the digits 255 142 and their place values as shown in the following figure:



3. Count and record the uncrossed counters in each compartment of the counting basin according to their place values as shown in the following figure:



Therefore, 478 376 – 255 142 = 223 234.

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Example 3

643 270 – 541 240 =

Solution

643 270 – 541 240 = 102 030.

Exercise 2

Answer the following questions:

1. 153 652 – 41 331 =
2. 889 998 – 664 322 =
3. 706 605 – 602 303 =
4. 824 335 – 13 112=
5. 623 440 – 2 010 =
6. 753 872 – 641 631 =
7. 568 237 – 18 113 =
8. 995 698 –12 254 =
9. 156 789 – 130 000 =
10. 425 310 – 213 110 =
11. 524 885 – 112 432 =
12. 357 603 – 223 402 =
13. 654 235 – 232 113 =
14. 115 752 – 15 231 =
15. 788 500 – 501 000 =
16. 534 728 – 134 617 =
17. 399 728 – 188 314 =
18. 496 623 – 285 413 =
19. 247 568 – 113 254 =
20. 524 804 – 103 501 =

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Subtraction of numbers arranged vertically

Numbers arranged vertically can be subtracted without regrouping as follows:

Example 1

```
  457 234
– 134 102
---------
```

Solution

Steps:

1.	Subtract ones: 4 – 2 = 2. Write 2 in the ones position.	457 234 – 134 102 2
2.	Subtract tens: 3 – 0 = 3. Write 3 in the tens position.	457 234 – 134 102 32
3.	Subtract hundreds: 2 – 1 = 1. Write 1 in the hundreds position.	457 234 – 134 102 132
4.	Subtract thousands: 7 – 4 = 3. Write 3 in the thousands position.	457 234 – 134 102 3 132
5.	Subtract ten thousands: 5 – 3 = 2. Write 2 in the ten thousands position.	457 234 – 134 102 23 132

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6.	Subtract hundred thousands digits: 4 – 1 = 3. Write 3 in the hundred thousands position.	457 234 – 134 102 323 132

Therefore, the answer is 323 132.

You can also subtract the given numbers by using their expanded forms as shown in the following example.

Example 2

463 257
– 221 125

Solution

Steps:

	Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Ones
	4	6	3	2	5	7
	– 2	2	1	1	2	5
7 – 5						2
50 – 20					3	0
200 – 100				1	0	0
3 000 – 1 000			2	0	0	0
60 000 – 20 000		4	0	0	0	0
400 000 – 200 000	2	0	0	0	0	0
	2	4	2	1	3	2

Therefore, the answer is 242 132.

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Example 2 can be done directly as follows:

463 257
– 221 125

Solution

463 257
– 221 125
242 132

Example 3

649 283
– 34 162

Solution

649 283
– 34 162
615 121

Exercise 3

Answer the following questions:

1. 652 451 – 331 041

2. 826 666 – 714 232

3. 527 238 – 20 014

4. 237 972 – 112 451

5. 823 574 – 1 230

6. 912 345 – 810 212

7. 587 645 – 335 243

8. 353 821 – 141 711

9. 734 726 – 512 413

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10.	789 235 – 227 122	**11.**	773 002 – 521 001	**12.**	315 241 – 111 131
13.	632 541 – 11 231	**14.**	825 789 – 13 578	**15.**	127 834 – 114 321
16.	953 275 – 132 143	**17.**	483 255 – 351 013	**18.**	517 599 – 414 328
19.	889 659 – 64 236	**20.**	172 637 – 41 332		

Subtraction of numbers by regrouping

Subtraction of numbers arranged horizontally

Numbers arranged horizontally can be subtracted by regrouping as follows:

Example 1

981 746 – 274 272 =

Solution

Steps:

1.	Subtract ones: 6 – 2 = 4. Write 4 in the ones position.	981 746 – 274 272 = _ _ _ _ _ 4

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2.	Subtract tens: 4 – 7. This is not sufficient.Take 1 group of hundreds from the 7 hundreds and change it into tens. This gives 10 tens. Add the tens: 10 + 4 = 14. Now, subtract tens: 14 – 7 = 7. Write 7 in the tens position.	981 746 – 274 272=_ _ _ _ 74
3.	Remember that, one group of hundreds was taken from the 7 hundreds. Thus only 6 hundreds remained. Subtract hundreds: 6 – 2 = 4. Write 4 in the hundreds position.	981 746 – 274 272 = _ _ _ 474
4.	Subtract thousands: 1 – 4. This is not sufficient. Take 1 group of ten thousands from the 8 ten thousands and change it into thousands. This gives 10 thousands. Add thousands: 10 + 1 = 11. Now, subtract thousands: 11 – 4 = 7. Write 7 in the thousands position.	981 746 – 274 272 = _ _ 7 474
5.	Remember that, one group of ten thousands was taken from the 8 ten thousands. Thus, only 7 ten thousands remained. Subtract thousands: 7 – 7. Write 0 in the ten thousands position.	981 746 – 274 272 = _ 07 474
6.	Subtract hundred thousands: 9 – 2 = 7. Write 7 in the hundred thousands position.	981 746 – 274 272 = 707 474

Therefore, 981 746 – 274 272 = 707 474.

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Example 2

634 207 – 253 478 =

Solution

Following the steps in example 1, you will get

634 207 – 253 478 = 380 729.

Exercise 4

Answer the following questions:

1. 864 624 – 25 206 =
2. 685 378 – 123 553 =
3. 938 765 – 737 846 =
4. 748 760 – 144 690 =
5. 992 478 – 966 257 =
6. 998 897 – 669 999 =
7. 576 788 – 2 899 =
8. 534 609 – 514 799 =
9. 947 842 – 88 847 =
10. 979 988 – 79 999 =
11. 479 149 – 288 601 =
12. 398 694 – 296 498 =
13. 754 382 – 289 =
14. 990 000 – 90 270 =
15. 319 728 – 187 379 =
16. 489 756 – 298 587 =
17. 156 742 – 137 833 =
18. 567 810 – 369 523 =
19. 246 483 – 137 552 =
20. 615 807 – 326 675 =

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Subtraction of numbers arranged vertically

Numbers arranged vertically can be subtracted by regrouping as follows:

Example 1

$$\begin{array}{r} 756\,456 \\ -\ 484\,417 \\ \hline \end{array}$$

Solution

$$\begin{array}{r} 756\,456 \\ -\ 484\,417 \\ \hline 272\,039 \end{array}$$

Example 2

$$\begin{array}{r} 560\,947 \\ -\ 67\,328 \\ \hline \end{array}$$

Solution

$$\begin{array}{r} 560\,947 \\ -\ 67\,328 \\ \hline 493\,619 \end{array}$$

Example 3

$$\begin{array}{r} 537\,902 \\ -\ 449\,651 \\ \hline \end{array}$$

Solution

$$\begin{array}{r} 537\,902 \\ -\ 449\,651 \\ \hline 88\,251 \end{array}$$

Exercise 5

Answer the following questions:

1. $\begin{array}{r} 854\,623 \\ -\ 24\,205 \\ \hline \end{array}$

2. $\begin{array}{r} 664\,378 \\ -\ 123\,453 \\ \hline \end{array}$

3. $\begin{array}{r} 928\,765 \\ -\ 726\,847 \\ \hline \end{array}$

4. $\begin{array}{r} 148\,760 \\ -\ 145\,619 \\ \hline \end{array}$

5. $\begin{array}{r} 678\,246 \\ -\ 76\,254 \\ \hline \end{array}$

6. $\begin{array}{r} 999\,898 \\ -\ 769\,979 \\ \hline \end{array}$

7. $\begin{array}{r} 996\,788 \\ -\ 239\,879 \\ \hline \end{array}$

8. $\begin{array}{r} 964\,234 \\ -\ 78\,927 \\ \hline \end{array}$

9. $\begin{array}{r} 167\,897 \\ -\ 56\,908 \\ \hline \end{array}$

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10.	624 573	**11.**	367 129	**12.**	409 530
	– 468 786		– 135 237		– 357 142
13.	800 000	**14.**	650 124	**15.**	461 385
	– 222 075		– 236 745		– 172 843
16.	555 073	**17.**	562 782	**18.**	853 076
	– 396 164		– 389 351		– 68 684
19.	785 438	**20.**	295 745		
	– 90 900		– 276 836		

Word problems involving subtraction

Example 1

A factory manufactures 789 828 bottles of soda daily. Due to electricity shortage, the factory manufactured only 537 014 bottles of soda on one of the days. What was the deficit in the production of bottles of soda on that day?

Solution

Daily production of bottles = 789 828.
Production of bottles due to shortage of electricity = 537 014.
The shortage of production was 789 828 – 537 014 = 252 814.
Therefore, the deficit in the production on that day was 252 814 bottles of soda.

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Example 2

A total of 678 520 people had eye examination at a hospital. If 382 140 people examined were found to have eyes problems, how many people were declared free from eyes problems?

Solution

Number of people given eye examination = 678 520
Number of people found with defective eyes = 382 140
Number of people found to be free from eyes problems was
678 520 – 382 140 = 296 380.

Therefore, the number of people who were declared free from eye problems was 296 380.

Exercise 6

Answer the following questions:

1. A total of 635 740 pupils sat for the standard seven Primary School Leaving Examination. If the number of boys was 312 520, how many girls sat for the examination?

2. In a certain region, 796 599 people were vaccinated against a certain disease. If the number of women vaccinated was 396 479, how many men were vaccinated?

3. A certain food processing factory produced 572 895 litres of sunflower oil. If 351 453 litres were sold, how many litres were not sold?

4. During the first week of production, a steel company produced 763 264 pieces of steel rods. In the second week, the same company produced only 642 143 pieces of steel rods. What was the shortfall of steel rods in the second week?

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5. A total of 705 990 bricks were needed for construction of a village health centre. If the villagers had made only 504 550 bricks, how many more bricks were needed for construction?

6. Muna's monthly salary is 970 645 shillings. He pays 98 850 shillings as monthly house rent. How much money does Muna remain with after paying house rent each month?

7. A total of 545 768 fans watched a football match on television. If 213 554 among them were women, how many of the fans were men?

8. A certain region needed 625 800 bags of maize to meet its requirement. The region was supplied with 540 780 bags of maize. How many more bags of maize were needed to meet the region's maize requirement?

9. In June, pupils at Mwachonja primary School used 643 650 litres of water. In July, they used 599 650 litres. By how many litres did the pupils reduce their water consumption in July compared to June?

10. In a certain district, 780 558 cattle were marked. If the cattle population of the district is 978 445, how many cattle were not marked?

11. Four tyres of a car cost 745 000 shillings. If Agnes has 680 500 shillings, how much more money does she need for buying the four tyres of her car?

12. On Monday, 855 600 shillings tax were collected at a village market. The tax collection on Tuesday was 678 450 shillings. By how much was the Tuesday tax collection less than the tax collection on Monday?

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Exercise 7

Answer the following questions:

1. 280 000 – 17 000 =
2. 586 424 – 343 315 =
3. 748 869 – 26 879 =
4. 892 135 – 72 013 =
5. 966 617 – 134 215 =
6. 873 977 – 762 582 =
7. 538 993 – 429 926 =
8. 969 897 – 2 672 =
9. 672 354 – 51 132 =
10. 554 732 – 318 472 =
11. 826 592 – 648 257 =
12. 487 925 – 35 725 =
13. 289 355 – 199 264 =
14. 999 999 – 1 285 =
15. 278 914 – 18 288 =
16. 586 424 – 343 315 =
17. 697 415 – 28 928 =
18. 892 135 – 72 013 =
19. 842 316 – 145 820 =
20. 423 450 – 230 004 =
21. 897 050 – 530 478 =

22. 167 898 − 12 378 =

23. 987 025 − 35 012 =

24. 873 977 − 762 582 =

25. 504 040 − 139 012 =

26. 567 893 − 125 698 =

27. 761 405 − 234 503 =

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28. The exercise books requirement for ten schools is 175 038. If the benefactors donated 10 750 exercise books, what is the shortage of exercise books at the schools?

29. A cooperative society made 287 891 cement bricks out of a total of 482 674 bricks that are needed. How many more bricks must be made by the cooperative society?

30. Kilimanjaro Region planted 988 000 trees in various parts of the Region. If only 798 000 trees grew, how many trees did not grow?

31. A constructor was paid 845 750 shillings for paying labours during the construction of a school toilet. If the labour charge was 974 500 shillings, how many more shillings were needed to complete payment of the labour charge?

32. A total of 905 700 litres of water flow into a water tank daily. If the daily water consumption is 700 478 litres, how many litres of water remain in the tank?

33. A school has a chicken farming project. The annual profit of the project is 745 850 shillings. If 420 500 shillings are used annually to buy chicks, how much money remains for the school each year?

34. A factory used 797 800 Kilowatts of electricity in a first period of three months. During a second period of three months, the factory used 580 730 Kilowatts. What is the difference in electricity consumption between the two periods?

35. Last year, Kilosa district admitted 345 730 pupils into Standard One. If 2 320 pupils dropped out, how many Standard One pupils remained at the school?

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Summary

1. Subtraction of numbers is done by arranging numbers either horizontally or vertically.
2. In subtraction, start by subtracting ones, then tens, hundreds, thousands, ten thousands and hundred thousands.
3. In solving word problems, consider the following:
   (a) Read the given word problem to identify the arithmetic operation to be performed.
   (b) Perform the operation on the numbers mentioned in the problem.
   (c) After the calculations, conclude by answering the question asked in the problem.
4. In any situation where you are required to subtract a larger digit from a smaller digit, always look at the digit immediately to the left of the smaller digit, and take 1 group from it. Change the taken group into 10 ones, or 10 tens, or 10 hundreds, or 10 thousands, or 10 ten thousands, depending on the place value of the digit being subtracted. Add 10 to the smaller digit which was insufficient to subtract in the first place and then perform the subtraction.
5. When subtracting numbers by vertical arrangement, make sure that the digits are properly aligned, ones placed under ones, tens placed under tens, and so on.

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Chapter Four

Multiplication of numbers

Introduction

Multiplication is a mathematical operation performed on a pair of numbers in order to obtain a number called a product. In Standard Four, you learnt how to multiply numbers with up to three digits. In this chapter, you will learn to multiply numbers that give a product with not more than six digits. You will also solve word problems involving multiplication of numbers. Learning multiplication will provide you with appropriate knowledge to work on other mathematical concepts like division, fraction and algebra. Multiplication is used in real life activities like calculating pay rates, profits, variety of sums, expenses and so on.

Exercise 1: Revision

Answer the following questions:

1. 509 × 1 =
2. 243 × 4 =
3. 999 × 9 =
4. 541 × 10 =
5. 143 × 50 =
6. 172 × 80 =
7. 104 × 100 =
8. 312 × 13 =
9. 474 × 15 =
10. 616 × 12 =
11. 467 × 12 =
12. 213 × 6 =
13. 237 × 9 =
14. 304 × 12 =
15. 472 × 16 =
16. 132 × 13 =
17. 322 × 12 =

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18.
$$\begin{array}{r} 431 \\ \times\ 22 \\ \hline \\ \hline \end{array}$$

19.
$$\begin{array}{r} 250 \\ \times\ 14 \\ \hline \\ \hline \end{array}$$

20.
$$\begin{array}{r} 342 \\ \times\ 24 \\ \hline \\ \hline \end{array}$$

21.
$$\begin{array}{r} 722 \\ \times\ 14 \\ \hline \\ \hline \end{array}$$

22. If a class has 53 pupils and the teacher gives 4 pencils to every student. What is the total number of pencils given to the pupils?

23. A cow produces 15 litres of milk each day. How many litres of milk will be produced in 100 days?

24. Magoma makes 220 cement bricks a day. Find the number of cement bricks that he will make in 11 days.

25. A loaf of bread is sold at 800 shillings. If Johari buys 46 loaves of bread, how much money will she pay?

26. Furaha sold 26 bags of oranges. If the price of one bag of oranges is 950 shillings, how much money did he get?

27. If 685 cement bricks are required to build a chicken coop, how many cement bricks are required to build 11 chicken coops?

28. Find the product of 117 and 33.

29. If 134 mangoes are harvested every day, how many mangoes will be harvested in 70 days?

30. A tree plantation has 287 rows of trees. If each row has 66 trees, how many trees are there in the farm?

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31. A soap factory manufactures 825 soaps in one hour. If each soap is sold at 50 shillings, how much money will the factory get per hour?

Multiplication of a number by a multiplier having up to two digits

In multiplying a number by the multiplier, consider the place values of the digits in the multiplier. Start by multiplying the number by the ones, followed by the tens, the hundreds, the thousands, the ten thousands and finally by the hundred thousands.

Multiplication of a number having up to four digits by a multiplier with up to two digits

Example 1

278 × 13 =

Solution

The answer can be obtained by horizontal arrangement of the numbers:
Multiply 278 by 3 ones: 278 × 3 = 834.
Multiply 278 by 1 tens: 278 × 10 = 2 780.
Add the two results obtained; that is, 834 + 2 780 = 3 614.

Therefore, 278 × 13 = 3 614.

The answer for this example can also be obtained by vertical arrangement of the numbers as follows:

	Thousands	Hundreds	Tens	Ones
		2	7	8
		×	1	3
3 × 8			2	4
3 × 70		2	1	0
3 × 200		6	0	0
10 × 8			8	0
10 × 70		7	0	0
10 × 200	+ 2	0	0	0
	3	6	1	4

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This equals to

$$\begin{array}{rr} & 2\,7\,8 \\ \times & 1\,3 \\ \hline & 8\,3\,4 \\ + & 2\,7\,8\,0 \\ \hline & 3\,6\,1\,4 \end{array}$$

Therefore, 278 × 13 = 3 614.

Example 2

2 165 × 3 =

Solution

	Thousands	Hundreds	Tens	Ones
	2	1	6	5
	×			3
3 × 5			1	5
3 × 60		1	8	0
3 × 100		3	0	0
3 × 2 000	+ 6	0	0	0
	6	4	9	5

The answer for this example can also be obtained directly as follows:

$$\begin{array}{rrrrr} & 2 & 1 & 6 & 5 \\ \times & & & & 3 \\ \hline & 6 & 4 & 9 & 5 \end{array}$$

Therefore, 2 165 × 3 = 6 495.

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Exercise 2

Answer the following questions:

1. 497 × 3 =
2. 3 237 × 4 =
3. 1 220 × 8 =
4. 306 × 12 =
5. 511 × 15 =
6. 432 × 22 =
7. 281 × 59 =
8. 374 × 62 =
9. 721 × 28 =
10. 189 × 84 =
11. 4 156 × 78 =
12. 2 213 × 23 =
13. 1 332 × 21 =
14. 2 113 × 22 =
15. 3 122 × 13 =
16. 2 346 × 14 =
17. 3 334 × 25 =
18. 4 167 × 17 =
19. 1 324 × 18 =
20. 2 415 × 16 =
21. 3 217 × 23 =
22. 1 433 × 14 =
23. 2 246 × 27 =
24. 3 417 × 32 =
25. 1 619 × 43 =

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Multiplication of a number having up to five digits by a multiplier with up to two digits

Example 1

24 615 × 5 =

Solution

	Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Ones
		2	4	6	1	5
	×					5
5 × 5					2	5
5 × 10					5	0
5 × 600			3	0	0	0
5 × 4 000		2	0	0	0	0
5 × 20 000	+ 1	0	0	0	0	0
	1	2	3	0	7	5

Therefore, 24 615 × 5 = 123 075.

The answer can also be obtained directly as follows:

2	4	6	1	5	
×				5	
1	2	3	0	7	5

Example 2

10 308
× 28

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Solution

$$\begin{array}{r} 10\,308 \\ \times \quad 28 \\ \hline 82\,464 \\ +\,206\,160 \\ \hline 288\,624 \end{array}$$

Exercise 3

Answer the following questions:

1. 42 983 × 20 =

2. 53 490 × 14 =

3. 71 762 × 12 =

4. 33 768 × 24 =

5. 432 10 × 2 =

6. 63 281 × 15 =

7. 53 249 × 13 =

8. 30 167 × 20 =

9. 20 070 × 28 =

10. 10 101 × 99 =

11. 90 909 × 11 =

12. 261 40 × 3 =

13. 33 004 × 2 =

14. 30 874 × 3 =

15.
$$\begin{array}{r} 21\,423 \\ \times \quad 23 \\ \hline \\ \hline \end{array}$$

16.
$$\begin{array}{r} 32\,247 \\ \times \quad 12 \\ \hline \\ \hline \end{array}$$

17.
$$\begin{array}{r} 41\,165 \\ \times \quad 21 \\ \hline \\ \hline \end{array}$$

18.
$$\begin{array}{r} 36\,792 \\ \times \quad 11 \\ \hline \\ \hline \end{array}$$

19.
$$\begin{array}{r} 20\,081 \\ \times \quad 24 \\ \hline \\ \hline \end{array}$$

20.
$$\begin{array}{r} 23\,414 \\ \times \quad 32 \\ \hline \\ \hline \end{array}$$

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Multiplication of a number by a multiplier having up to three digits

Example 1

452 × 56 =

Solution

		Ten thousands	Thousands	Hundreds	Tens	Ones
				4	5	2
			×		5	6
6 × 2					1	2
6 × 50				3	0	0
6 × 400			2	4	0	0
50 × 2				1	0	0
50 × 50			2	5	0	0
50 × 400	+	2	0	0	0	0
		2	5	3	1	2

Altenatively,

				4	5	2
			×		5	6
			2	7	1	2
	+	2	2	6	0	0
		2	5	3	1	2

Therefore, 452 × 56 = 25 312.

Example 2

$$\begin{array}{r} 276 \\ \times\ 123 \\ \hline \\ \hline \end{array}$$

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Solution

$$\begin{array}{r} 276 \\ \times \quad 123 \\ \hline 828 \\ 5\,520 \\ +\ 27\,600 \\ \hline 33\,948 \\ \hline \end{array}$$

Therefore, the answer is 33 948.

Exercise 4

Answer the following questions:

1. 109 × 125 =

2. 159 × 145 =

3. 255 × 204 =

4. 202 × 200 =

5. 227 × 200 =

6. 384 × 400 =

7. 608 × 32 =

8. 509 × 64 =

9. 919 × 251 =

10. 231 × 213 =

11. 411 × 124 =

12. 322 × 213 =

13.
$$\begin{array}{r} 109 \\ \times \quad 241 \\ \hline \\ \hline \end{array}$$

14.
$$\begin{array}{r} 413 \\ \times \quad 142 \\ \hline \\ \hline \end{array}$$

15.
$$\begin{array}{r} 521 \\ \times \quad 132 \\ \hline \\ \hline \end{array}$$

16.
$$\begin{array}{r} 236 \\ \times \quad 242 \\ \hline \\ \hline \end{array}$$

17.
$$\begin{array}{r} 346 \\ \times \quad 244 \\ \hline \\ \hline \end{array}$$

18.
$$\begin{array}{r} 422 \\ \times \quad 142 \\ \hline \\ \hline \end{array}$$

19.
$$\begin{array}{r} 714 \\ \times \quad 102 \\ \hline \\ \hline \end{array}$$

20.
$$\begin{array}{r} 812 \\ \times \quad 242 \\ \hline \\ \hline \end{array}$$

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Word problems involving multiplication

Example

One crate contains 24 bottles of soft drinks. How many bottles of soft drinks will be in 5 624 crates?

Solution

The number of crates = 5 624

Number of bottles in one crate = 24

$$\begin{array}{r} 5\,624 \\ \times \quad 24 \\ \hline 22\,496 \\ +\,112\,480 \\ \hline 134\,976 \end{array}$$

Therefore, there will be 134 976 bottles in 5 624 crates.

Exercise 5

Answer the following questions:

1. A garment manufacturing company produces 654 metres of cloth per day. How many metres of cloth will be produced in 23 days?

2. A pair of kitenge costs 30 500 shillings. What is the cost of 8 pairs of kitenge?

3. A lorry can transport 629 sacks of cement in one trip. If the lorry makes 65 trips, how many bags of cement will be transported?

4. A certain book has 6 285 lines of text. If each line has 14 words, how many words does the book contain?

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5. Which product is larger than the other between 531 × 6 and 351 × 7?

6. A teacher instructed each of his 258 pupils to collect 122 counters. How many counters were collected by pupils?

7. Maria sold 66 chickens at 15 000 shillings each. How much money did she get for selling all the chickens?

8. Each of 136 bricklayers made 40 concrete bricks. Find the number of concrete bricks made by all the bricklayers?

9. Baraka sells 2 560 kilograms of meat a day. How many kilograms of meat will he sell in 31 days?

10. A water tank has a capacity of 2 500 liters of water. What is the capacity of 83 water tanks of the same capacity?

11. One compartment of a passenger train can carry 98 passengers. What will be the number of passengers in 35 compartments of the same capacity?

12. Juhudi Primary school has 1 260 pupils. If each pupil was given 35 tree seedlings to plant, how many tree seedlings were planted by all the pupils?

Exercise 6

Answer all the following questions:

1. 234 × 5 =
2. 528 × 7 =
3. 28 987 × 6 =

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4. 133 × 10 =

5. 265 × 60 =

6. 741 × 100 =

7. 327 381 × 3 =

8. 33 333 × 3 =

9. 9 605 × 9 =

10. 624 × 531 =

11. 750 × 750 =

12.
$$\begin{array}{r} 308 \\ \times\ 11 \\ \hline \\ \hline \end{array}$$

13.
$$\begin{array}{r} 407 \\ \times\ 206 \\ \hline \\ \hline \end{array}$$

14.
$$\begin{array}{r} 615 \\ \times\ 33 \\ \hline \\ \hline \end{array}$$

15.
$$\begin{array}{r} 3\,434 \\ \times\ 25 \\ \hline \\ \hline \end{array}$$

16.
$$\begin{array}{r} 2\,131 \\ \times\ 22 \\ \hline \\ \hline \end{array}$$

17.
$$\begin{array}{r} 114 \\ \times\ 142 \\ \hline \\ \hline \end{array}$$

18.
$$\begin{array}{r} 2\,005 \\ \times\ 23 \\ \hline \\ \hline \end{array}$$

19.
$$\begin{array}{r} 1\,623 \\ \times\ 22 \\ \hline \\ \hline \end{array}$$

20.
$$\begin{array}{r} 723 \\ \times\ 6 \\ \hline \\ \hline \end{array}$$

21.
$$\begin{array}{r} 33\,407 \\ \times\ 28 \\ \hline \\ \hline \end{array}$$

22.
$$\begin{array}{r} 52\,743 \\ \times\ 13 \\ \hline \\ \hline \end{array}$$

23.
$$\begin{array}{r} 34\,752 \\ \times\ 11 \\ \hline \\ \hline \end{array}$$

24. Which product is greater than the other between 587 × 23 and 416 × 29?

25. One match box has 50 sticks. How many sticks are there in 167 match boxes of the same capacity?

Summary

1. In multiplication, consider the place value of the digit of the multiplier. Always start to multiply the ones, followed by the tens, hundreds, thousands, ten thousands, and finally the hundred thousands.
2. In solving word problems involving multiplication, you have to identify the numbers to be multiplied from the word problem.
3. The product of any number and zero is zero.

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Chapter Five

Division of numbers

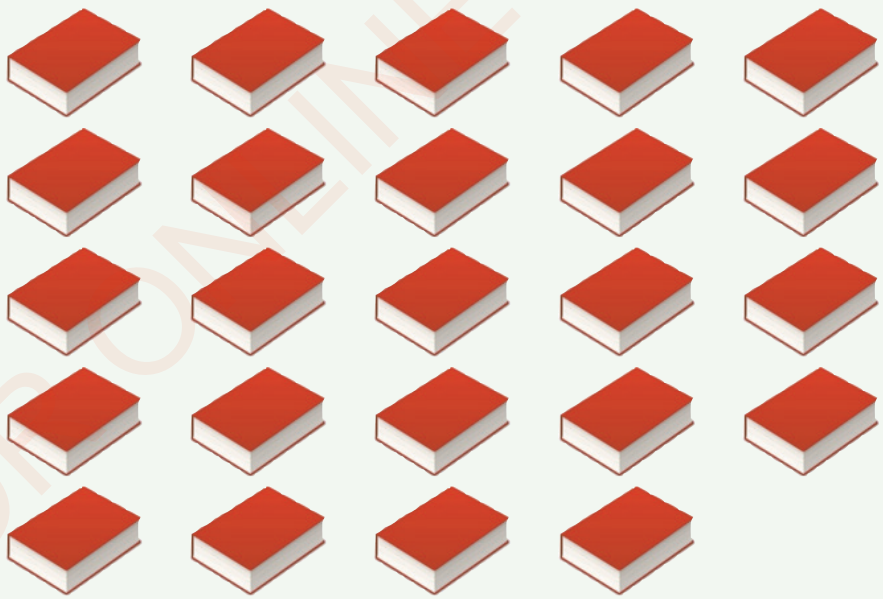
Introduction

Division is a mathematical process of distributing things or a group of things into a specified number of parts. In Standard Four, you learnt about division of numbers having a maximum of three digits by a divisor having a maximum of two digits. In this chapter, you will learn how to divide a number not exceeding one million by a divisor having up to three digits, with and without a remainder. A knowledge of division will help you in budgeting, making decisions concerning living expenses on a monthly or daily basis, distribution of resources and so on.

Exercise 1: Revision

Answer the following questions:

1. Arrange the following books into six groups with equal number of books in each group.



How many books does each group have?

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2. Eighteen sweets were divided equally among 3 children. How many sweets did each child get?

3. If 28 avocados are divided equally to 14 groups, how many avocados will each group get?

4. 125 ÷ 5 =

5. 96 ÷ 3 =

6. $7\overline{)532}$

7. $85\overline{)850}$

8. $27\overline{)243}$

9. A primary school has 240 pupils and 12 classrooms. If the number of pupils in each class is the same, how many pupils are in each class?

10. If the cost of 15 sweets is 300 shillings, what is the cost of one such sweet?

11. Use the method of repeated subtraction to answer the following questions:

(a) 20 ÷ 4 =

(b) 50 ÷ 10 =

Dividing a number without a remainder

In division, the number being divided is called the dividend. The number which divides the dividend is called the divisor. The answer is called the quotient. For example;

2522 ÷ 97 = 26.

In this example, 2 522 is the dividend, 97 is the divisor, and 26 is the quotient.

Long division method

In long division, the dividend, divisor and the quotient are arranged as follows:

$$\text{Divisor}\overline{)\text{Dividend}}$$ Quotient

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Example 1

$32\overline{)14496}$

Solution

Steps:

1.	Divide 14 by 32. This is not sufficient. Shift to the next digit, which is 4, to the right to get 144. Divide 144 by 32. The answer is 4 with a remainder. Write 4 in the quotient position.	$\begin{array}{r} 4 \\ 32\overline{)14496} \end{array}$
2.	Multiply 32 by 4 to get 128. Write 128 below 144 and subtract to get 16.	$\begin{array}{r} 4 \\ 32\overline{)14496} \\ -\,128 \\ \hline 16 \end{array}$
3.	Bring down the digit 9 to the right of 16 to get 169. Divide 169 by 32 to obtain 5 and a remainder. Write 5 in the quotient position, at the right of 4.	$\begin{array}{r} 45 \\ 32\overline{)14496} \\ -\,128\downarrow \\ \hline 169 \end{array}$
4.	Multiply 32 by 5, to get 160. Write 160 below 169 and subtract 160 from 169 to get 9.	$\begin{array}{r} 45 \\ 32\overline{)14496} \\ -\,128 \\ \hline 169 \\ -\,160 \\ \hline 9 \end{array}$
5.	Bring down the digit 6 to the right of 9 to get 96. Divide 96 by 32 to get 3 without a remainder. Write 3 in the quotient position at the right of 5.	$\begin{array}{r} 453 \\ 32\overline{)14496} \\ -\,128 \\ \hline 169 \\ -\,160\downarrow \\ \hline 96 \end{array}$

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6.	Multiply 32 by 3 to get 96. Write 96 below 96 and subtract to get 0.	$\begin{array}{r} 453 \\ 32\overline{)14496} \\ -\ 128 \\ \hline 169 \\ -\ 160 \\ \hline 96 \\ -\ 96 \\ \hline 0 \end{array}$

Therefore, $32\overline{)14496}$ is equal to 453.

Example 2

$696\overline{)561672}$

Solution

Steps:

1.	Divide 561 by 696. This is not sufficient. Shift to the next digit, which is 6, to get 5616. Divide 5616 by 696. The answer is 8 with a remainder. Write 8 in the quotient position.	$\begin{array}{r} 8 \\ 696\overline{)561672} \end{array}$
2.	Multiply 696 by 8 to get 5568. Write 5568 below 5616 and subtract to get 48.	$\begin{array}{r} 8 \\ 696\overline{)561672} \\ -\ 5568 \\ \hline 48 \end{array}$
3.	Bring down the digit 7 to the right of the remainder 48 to get 487. Divide 487 by 696. This is not sufficient. Write 0 in the quotient position at the right of 8.	$\begin{array}{r} 80 \\ 696\overline{)561672} \\ -\ 5568 \downarrow \\ \hline 487 \end{array}$

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4.	Multiply 696 by 0 to obtain 0. Write 0 below 487 and then subtract 0 from 487. This leaves 487 unchanged.	80 696 ⟌ 561672 – 5568 487 – 000 487
5.	Bring down the digit 2 to the right of 487 to get 4872. Divide 4872 by 696 to get exactly 7. Write 7 in the quotient position at the right of 0.	807 696 ⟌ 561672 – 5568 487 – 000 4872
6.	Multiply 696 by 7 to get 4872. Write 4872 below 4872 and subtract to get 0.	807 696 ⟌ 561672 – 5568 487 – 000 4872 – 4872 0

Therefore, 696 ⟌ 561672 is equal to 807.

Example 3

980 ⟌ 978040

Solution

998
980 ⟌ 978040
– 8820
9604
– 8820
7840
– 7840
0

Therefore, 980 ⟌ 978040 = 998.

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Exercise 2

Answer the following questions:

1.	$7\overline{)49000}$	2.	$10\overline{)29190}$	3.	$25\overline{)505000}$
4.	$909\overline{)32724}$	5.	$43\overline{)26789}$	6.	$364\overline{)22932}$
7.	$791\overline{)88592}$	8.	$75\overline{)28950}$	9.	$200\overline{)980000}$
10.	$33\overline{)110979}$	11.	$20\overline{)81520}$	12.	$36\overline{)726984}$
13.	$364\overline{)942032}$	14.	$800\overline{)100000}$	15.	$623\overline{)26789}$
16.	$781\overline{)82005}$	17.	$63\overline{)204687}$	18.	$303\overline{)188163}$
19.	$99\overline{)678249}$	20.	$444\overline{)447996}$		

Short division method

In the short division method, the arrangement of the dividend, divisor and quotient is as follows:

$$\text{Divisor}\overline{)\text{Divident}}$$
$$\text{Quotient}$$

Example 1

$2\overline{)84620}$

Steps:

1.	Start by dividing the dividend from left to right. 8 ten thousands divided by 2 gives 4 ten thousands. Write 4 under the ten thousands position.	$2\overline{)84620}$ 4

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2.	Divide the 4 thousands by 2 to get 2. Write 2 under the thousands position.	$2\overline{)84620}$ 42
3.	Divide the 6 hundreds by 2 to get 3. Write 3 under the hundreds position.	$2\overline{)84620}$ 423
4.	Divide the 2 tens by 2 to get 1. Write 1 under the tens position.	$2\overline{)84620}$ 4231
5.	Divide the 0 ones by 2 to get 0. Write 0 under the ones position.	$2\overline{)84620}$ 42310

Therefore, $2\overline{)84620} = 42310$.

Example 2

$23\overline{)14260}$

Steps:

1.	Divide 14 by 23. This is not sufficient. Hence, take 142 and divide it by 23. One gets 6 but with some remainder. Write 6 under the hundreds position. Multiply 23 by 6 to get 138. Subtract 138 from 142 to get 4 hundreds.	$23\overline{)14260}$ 6 Remainder is 4
2.	The 4 hundreds and the 6 tens give 46 tens. Divide 46 by 23 to get 2. Write 2 under the tens position.	$23\overline{)14260}$ 62
3.	Divide 0 ones 23 to get 0. Write 0 under the ones position.	$23\overline{)14260}$ 620

Therefore, $23\overline{)14260} = 620$.

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Example 3

312 500 ÷ 125 = 2500.

Exercise 3

Answer the following questions:

1.	$2\overline{)8640}$	**2.**	$9\overline{)36927}$	**3.**	$7\overline{)56574}$
4.	$100\overline{)89400}$	**5.**	$25\overline{)10000}$	**6.**	$60\overline{)66000}$
7.	$13\overline{)15613}$	**8.**	$605\overline{)55055}$	**9.**	$101\overline{)26765}$
10.	$10\overline{)356250}$	**11.**	$956\overline{)203628}$	**12.**	$213\overline{)202776}$
13.	$543\overline{)29865}$	**14.**	$150\overline{)354000}$	**15.**	$78\overline{)23400}$
16.	$26\overline{)118586}$	**17.**	$926\overline{)77784}$	**18.**	$87\overline{)82389}$
19.	$164\overline{)513648}$	**20.**	$442\overline{)195364}$		

Use the short division method to find the quotient in problems 21 to 32.

21.	22033 ÷ 11 =	**22.**	48800 ÷ 61 =
23.	307350 ÷ 45 =	**24.**	164000 ÷ 820 =
25.	89089 ÷ 89 =	**26.**	730800 ÷ 812 =
27.	380324 ÷ 476 =	**28.**	156400 ÷ 230 =
29.	755480 ÷ 85 =	**30.**	360000 ÷ 600 =
31.	331920 ÷ 922 =	**32.**	32220 ÷ 45 =

Division of a number and getting a remainder

In some cases, the dividend may not be an exact multiple of the divisor. In such cases, division gives a quotient and a remainder.

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Long division method

Example 1

$27\overline{)866}$

Solution

Steps:

1.	Divide 86 by 27 to get 3. Write 3 above the tens position.	$\begin{array}{r} \quad 3 \\ 27\overline{)866} \end{array}$
2.	Multiply 27 by 3 to get 81. Write 81 under 86 and subtract to get 5.	$\begin{array}{r} \quad 3 \\ 27\overline{)866} \\ -\,81 \\ \hline \quad 5 \end{array}$
3.	Drop the 6 ones to the 5 tens to get 56. Divide 56 by 27 to get 2. Write 2 above the ones position.	$\begin{array}{r} \quad 32 \\ 27\overline{)866} \\ -\,81 \\ \hline \quad 56 \end{array}$
4.	Multiply 27 by 2 to get 54. Write 54 below 56 and subtract 56 from 54 to get 2.	$\begin{array}{r} \quad 32 \\ 27\overline{)866} \\ -\,81 \\ \hline \quad 56 \\ -\,54 \\ \hline \quad 2 \end{array}$

Therefore, $27\overline{)866}$ = 32 remainder 2.

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Example 2

$7\overline{)148}$

Solution

Steps:

1.	Divide 14 by 7. The answer is 2. Write 2 above the tens position.	$\begin{array}{r} 2 \\ 7\overline{)148} \end{array}$
2.	Multiply 7 by 2 to get 14. Write 14 under 14 and subtract: 14 – 14 = 0.	$\begin{array}{r} 2 \\ 7\overline{)148} \\ -\ 14 \\ \hline \end{array}$
3.	Drop the 8 ones to the 0 tens to get 8 ones. Divide 8 by 7 to get 1. Write 1 above the ones position.	$\begin{array}{r} 21 \\ 7\overline{)148} \\ -\ 14 \\ \hline 8 \end{array}$
4.	Multiply 7 by 1 to get 7. Write 7 below 8 and subtract: 8 – 7 = 1. The number 1 is the remainder.	$\begin{array}{r} 21 \\ 7\overline{)148} \\ -\ 14 \\ \hline 8 \\ -\ 7 \\ \hline 1 \end{array}$

Therefore, $7\overline{)148}$ = 21 remainder 1.

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Exercise 4

Answer the following questions:

1.	$6\overline{)467}$	**2.**	$8\overline{)891}$	**3.**	$5\overline{)327}$
4.	$25\overline{)815}$	**5.**	$90\overline{)405}$	**6.**	$77\overline{)620}$
7.	$88\overline{)220}$	**8.**	$43\overline{)267}$	**9.**	$11\overline{)241}$
10.	$58\overline{)494}$	**11.**	$84\overline{)847}$	**12.**	$34\overline{)120}$
13.	$25\overline{)555}$	**14.**	$60\overline{)786}$	**15.**	$15\overline{)148}$
16.	$11\overline{)139}$	**17.**	$32\overline{)347}$	**18.**	$14\overline{)535}$
19.	$28\overline{)234}$	**20.**	$38\overline{)234}$		

Short division method

Example 1

$6\overline{)82}$

Steps:

1.	Divide 8 by 6. The answer is 1 with remainder 2.	$6\overline{)82}$
2.	Write 1 under 8 in the tens position. Combine the 2 tens that remained and the 2 ones to make 22.	$6\overline{)82}$ 1
3.	Divide 22 by 6. The answer is 3 with remainder 4. Write 3 under the 2 ones.	$6\overline{)82}$ 13 remainder 4
Therefore, $6\overline{)82}$ = 13 remainder 4.		

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Example 2

$12\overline{)573}$

Solution

Steps:

1.	Divide 5 by 12. This is not sufficient. Divide 57 by 12. The answer is 4 with 9 as remainder. Write 4 below 7.	$12\overline{)573}$ 4
2.	Add the 3 ones to the 9 tens remainder to get 93. Divide 93 by 12 to get 7 and 9 as remainder. Write 7 below 3.	$12\overline{)573}$ 47 remainder 9

Therefore, $12\overline{)573}$ = 47 remainder 9.

Example 3

$10\overline{)678}$

Solution

$10\overline{)678}$

67 remainder 8.

Exercise 5

Answer the following questions:

1.	$3\overline{)457}$	2.	$5\overline{)99}$	3.	$9\overline{)68}$
4.	$22\overline{)938}$	5.	$12\overline{)405}$	6.	$10\overline{)644}$
7.	$31\overline{)125}$	8.	$70\overline{)982}$	9.	$10\overline{)831}$
10.	$16\overline{)401}$	11.	$18\overline{)233}$	12.	$30\overline{)857}$
13.	$15\overline{)286}$	14.	$80\overline{)751}$	15.	$9\overline{)489}$
16.	$11\overline{)383}$	17.	$13\overline{)252}$	18.	$24\overline{)457}$
19.	$17\overline{)500}$	20.	$65\overline{)536}$		

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Word problems involving division

Example 1

Thirteen poultry farmers divided 1 625 chickens equally among themselves. How many chickens did each farmer get?

Solution

Number of poultry farmers: 13

Number of chickens: 1 625

Divide 1 625 by 13:

$$
\begin{array}{r}
125 \\
13\overline{)\,1625} \\
-13 \\
\hline
32 \\
-26 \\
\hline
65 \\
-\ 65 \\
\hline
0
\end{array}
$$

Therefore, each poultry farmer got 125 chickens.

Example 2

A class teacher gave her 35 pupils an equal number of oranges. If she had a total of 305 oranges, how many oranges did each pupil get and how many oranges did the teacher remain with?

Solution

Number of oranges = 305

Number of students = 35

Divide 305 by 35:

305 ÷ 35 = 8 remainder 25

Therefore, each pupil got 8 oranges and the teacher remained with 25 oranges.

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Exercise 6

Answer the following questions:

1. An equal distribution of 133 700 kilograms of rice was done to 50 families that were affected by floods. How many kilograms of rice did each family receive?

2. Twenty-four goats were bought for 446 400 shillings. What was the price of one goat if the price was the same for all 24 goats?

3. A teacher gave an equal number of sheets of paper to 60 students. If the teacher had 414 sheets of paper, how many sheets of paper did each student get? How many sheets of paper remained with the teacher?

4. A standard five class having 50 pupils was awarded a prize of 80 000 shillings for being the best in the school's competition. If the money was divided equally among the pupils, how much money did each pupil get?

5. An equal number of bags of maize was distributed to 40 villages. If there were 955 bags of maize, how many bags of maize did each village get, and how many bags of maize remained?

6. A businessman earned 492 000 shillings by selling 41 pairs of shoes. If the cost of each pair of shoes was the same, what was the selling price for a pair of shoes?

7. Juliana earned 720 000 shillings by selling oranges. If the price of one orange was 150 shillings, how many oranges did Juliana sell?

8. An equal distribution of 99 000 books was done among 200 schools. How many books did each school get?

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9. A total of 100 800 pieces of chalk are packaged equally into 700 boxes. How many pieces of chalk does each box contain?

10. Twenty-four members of a cooperative society harvested 986 pineapples. If the pineapples were equally shared among the members, how many pineapples remained?

11. Some villagers contributed 325 000 shillings to build a school toilet. If each villager contributed 500 shillings, how many villagers made the contribution?

12. An equal distribution of 136 890 pens was done to 30 pupils. How many pens did each pupil get?

Exercise 7

Answer the following questions:

1. 32352 ÷ 16 =
2. 170 ÷ 17 =
3. 3069 ÷ 99 =
4. 363600 ÷ 300 =
5. $31\overline{)165}$
6. $760\overline{)174800}$
7. $90\overline{)405000}$
8. $998\overline{)558880}$
9. $95\overline{)344}$
10. $44\overline{)935}$
11. $55\overline{)868230}$

12. Bakari earned 984 000 shillings from selling pineapples. If the price of each pineapple was 820 shillings, how many pineapples did Bakari sell?

13. Teacher Sara received 508 exercise books for her 95 Standard One pupils. If she distributed an equal number of exercise books to her pupils, how many exercise books did each pupil get, and how many exercise books remained?

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14. Using the following table, write all numbers which are divisible by 8.

560	360	124	270	600
94	70	80	208	40
12	63	30	188	120
54	190	49	250	72

Summary

1. The number to be divided is called the dividend. The number used to divide is called the divisor. The result obtained by dividing a number by another number is called the quotient.
2. The quotient may be with a remainder or without a remainder.
3. In dividing a number, divide the digits of the dividend starting from the left most digits of the dividend and move towards the right.
4. In dividing a number, the divisor may be an exact multiple of the dividend, or there may be a remainder.

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Chapter Six

Roman numbers

Introduction

In Standard Four, you learnt about reading and writing Roman numbers starting from 1 – 50, that is, I up to L. In this chapter, you will learn more on how to read and write Roman numbers starting from L up to M, which correspond to the Arabic numbers (numerals) 50 up to 1 000. In real life situation, Roman numbers are used to show the hours on some analogue clocks and watches, listing items and rankings sucha as I, II, III and so on. They are also used in naming classrooms, class levels, reading time and when writing preliminaries.

Exercise 1: Revision

Answer the following questions:

1. Write the following numbers in words:

(a) X (b) XII (c) IV
(d) III (e) IX (f) XLIX
(g) XXIX (h) XIII (i) XXXVIII
(j) XXX (k) XXXIII (l) XXIV
(m) XIX (n) VI (o) XXXIII

2. Write the following numbers in Roman:

(a) Twenty (b) Eighteen
(c) Twenty-seven (d) Forty-seven
(e) Fifty (f) Sixteen
(g) Twenty-nine (h) Thirty-one

3. Write the following numbers in Roman:

(a) 12 (b) 46 (c) 37 (d) 40
(e) 50 (f) 18 (g) 47 (h) 21
(i) 34 (j) 43 (k) 26 (l) 32

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The Roman numbers L up to C

Read the following numbers:

Numbers in numerals	50	60	70	80	90	100
Roman numbers	L	LX	LXX	LXXX	XC	C
Numbers in words	Fifty	Sixty	Seventy	Eighty	Ninety	One hundred

The Roman numbers I, X, and C correspond to the numbers 1, 10, and 100. These three Roman numbers are the key in writing other Roman numbers. They have the following properties:

(a) When written to the left of a larger number, they are subtracted and when written to the right of a larger number, they are added.

(b) Cannot be repeated when written to the left of a greater number.

(c) Cannot be repeated more than three times when written to the right of a greater number.

Example 1

Read and write the following numbers in words:

(a) LXV

(b) LXXVI

Solution

(a) LXV: 50 + 10 + 5 = 65

Therefore, LXV is sixty-five.

(b) LXXVI: 50 + 20 + 6 = 76

Therefore, LXXVI is seventy-six.

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The numbers IV and IX are the ones. Therefore, if they are written to the right of a larger number, they are added to that number.

Example 2

Read the following numbers:
(a) XCIX : (100 – 10) + 9 = 90 + 9 = 99
Therefore, the number XCIX is ninety-nine.

(b) LIV : 50 + 4 = 54
Therefore, the number LIV is fifty-four.

Example 3

Read the numbers in the following table:

	Roman number	Number in words	Number in numerals
1.	LV	Fifty-five	55
2.	LIX	Fifty-nine	59
3.	LXXXIX	Eighty-nine	89
4.	LXXII	Seventy-two	72
5.	XCV	Ninety-five	95
6.	LXIV	Sixty-four	64
7.	LVIII	Fifty-eight	58
8.	LXI	Sixty-one	61
9.	LXXIII	Seventy-three	73
10.	LXXXV	Eighty-five	85

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Exercise 2

Answer the following questions:

1. Read and write the following Roman numbers in words:

(a) LXVII (b) LII (c) LXIV (d) XCVI
(e) XCVIII (f) LXXVII (g) LXXXVII (h) LXXXII
(i) LXXIV (j) LXIII

2. Write the following numbers in Roman:

(a) 52 (b) 66
(c) 70 (d) 81
(e) 93 (f) Fifty-one
(g) Sixty-three (h) Seventy-five
(i) Eighty-four (j) Ninety-two

3. Arrange the following Roman numbers in ascending order:

C, I, X, L, V, LXV, LXXXV, XCV, LV, LXXV.

4. Write the missing Roman numbers in the following number pattern:

LXXX, _____, LXXXII, _____, LXXXIV, _____.

Roman numbers C up to D

Read the following numbers:

Numbers in numerals	100	200	300	400	500
Roman numbers	C	CC	CCC	CD	D
Numbers in words	One hundred	Two hundred	Three hundred	Four hundred	Five hundred

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Example 1

Write the following numbers in Roman:

(a) 205

(b) 362

Solution

(a) 205 = 200 + 5

But 200 = CC and 5 = V.

Therefore, 205 in Roman numbers is CCV.

(b) 362 = 300 + 60 + 2

But 300 = CCC, 60 = LX and 2 = II.

Therefore, 362 in Roman numbers is CCCLXII.

Example 2

Read and write the following Roman numbers in words:

(a) CXVII

(b) CDXLVI

Solution

(a) CXVII: 100 + 10 + 5 + 2 = 117

Therefore, CXVII is one hundred and seventeen.

(b) CDXLVI: (500 – 100) + (50 – 10) + 6 =

400 + 40 + 6 = 446

Therefore, CDXLVI is four hundred and forty-six.

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Example 3

Read and write the following numbers:

	Roman number	Number in words	Number in numerals
1.	CIV	One hundred and four	104
2.	CXIX	One hundred and nineteen	119
3.	CLXXVI	One hundred and seventy-six	176
4.	CCXXII	Two hundred and twenty-two	222
5.	CCCXLIII	Three hundred and forty-three	343
6.	CCXXV	Two hundred and twenty-five	225
7.	CCCXXXVIII	Three hundred and thirty-eight	338
8.	CDXVII	Four hundred and seventeen	417
9.	CCLIV	Two hundred and fifty-four	254
10.	CDXXXI	Four hundred and thirty-one	431

Exercise 3

Answer the following questions:

1. Read and write the following Roman numbers in words:

(a) CCCXXX (b) CCXIX (c) CCXCII

(d) CLXIX (e) CDXLVII

2. Write the following numbers in Roman:

(a) Four hundred and forty-four

(b) Five hundred

(c) One hundred

(d) Two hundred and nine

(e) Three hundred and fifty

(f) One hundred and fifteen

(g) Two hundred and eight

(h) Three hundred and twenty-seven

(i) Four hundred and fifty-four

(j) Four hundred and six

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3. Write the following numbers in Roman:

(a) 108 (b) 211

(c) 374 (d) 435

(e) 442

The Roman numbers D up to M

Read the following numbers:

Numbers in numerals	Roman numbers	Numbers in words
500	D	Five hundred
600	DC	Six hundred
700	DCC	Seven hundred
800	DCCC	Eight hundred
900	CM	Nine hundred
1000	M	One thousand

Example 1

Write the following Roman numbers in numerals:

(a) CMIX (b) DCCLXXIV

Solution

(a) CM = 900 and IX = 9.

CMIX = 900 + 9 = 999.

Therefore, CMIX = 909.

(b) DCCLXXIV: 500 + 200 = 700; LXX = 50 + 20 = 70 and IV = 4.

DCCLXXIV = 700 + 70 + 4 = 774

Therefore, DCCLXXIV = 774.

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Example 2

Read the following numbers:

	Roman number	Number in words	Number in numerals
1.	DXI	Five hundred and eleven	511
2.	DCCXCIX	Seven hundred and ninety-nine	799
3.	DCLXXIV	Six hundred and seventy-four	674
4.	DCCC	Eight hundred	800
5.	CMXXVII	Nine hundred and twenty-seven	927
6.	CMLXXXIV	Nine hundred and eighty-four	984
7.	CMXXXI	Nine hundred and thirty-one	931
8.	DL	Five hundred and fifty	550
9.	DCCXVI	Seven hundred and sixteen	716
10.	DCCXXVIII	Seven hundred and twenty-eight	728

Exercise 4

Answer the following questions:

1. Read and write the following Roman numbers in words:

(a) CMXC (b) DCCL
(c) CMXCVI (d) DLXXXIX
(e) DLXXVIII (f) DLXIV
(g) CMLXVIII (h) CMLXXI
(i) DCCLXV (j) CMLXX
(k) DCXCVII (l) CMXCVIII

2. Write the following numbers in Roman:

(a) Three hundred and twenty-one
(b) Seven hundred and nine
(c) Five hundred and fifty-eight
(d) Eight hundred and eighteen

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(e) Nine hundred and seventy-six
(f) Eight hundred and fifty-five
(g) Nine hundred and eighty-seven
(h) Seven hundred and seventy-seven
(i) Nine hundred and fifty
(j) Five hundred and fifty-five

Exercise 5

Answer the following questions:

1. Write the following Roman numbers in words:

(a)	CCCXIV	(b)	XCI
(c)	CCXCII	(d)	CCXXIV
(e)	DCCI	(f)	DCCCIX
(g)	DCCCLXXI	(h)	CMXCV
(i)	DXLVI	(j)	XCIII

2. Karol was given a card with the number XLV and Anna was given a card with the number LXX.
(a) Who was given a card with a bigger number?
(b) Write the number on each card in numerals.

3. Two numbers were written on two cards. The first card had the number DCVI and the second card had the number CDXI.
(a) Which card had the bigger number?
(b) Write the number of the card which had smaller number in numerals.

4. Write the following numbers in Roman:
(a) Seven hundred
(b) Seventy-one
(c) Ninety-three
(d) Two hundred and fifty-eight

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(e) Five hundred and thirty-three
(f) Six hundred and ninety-six
(g) Three hundred and eighty-two
(h) Eight hundred and twenty-eight
(i) Nine hundred and ninety-six
(j) Two hundred and ninety-nine

5. Write the following numbers in Roman:

(a) 21	(b) 12	(c) 32
(d) 700	(e) 66	(f) 311
(g) 435	(h) 660	(i) 808
(j) 934		

Summary

1. The basic Roman numbers are I, V, X, L, C, D and M.
2. The numbers V, L and D cannot be subtracted from a larger number.
3. The numbers I, X and C may be subtracted from a larger number as follows:
   (a) I may be subtracted only from V and X as in IV and IX.
   (b) X may be subtracted only from L and C as in XL and XC.
   (c) C may be subtracted only from D and M as in CD and CM.
4. The numbers I, X and C may individually be repeated only up to three times, as in III, XXX and CCC.
5. There is no Roman symbol for number 0.

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Chapter Seven

Types of numbers, factors and multiples of numbers

Introduction

In this chapter, you will learn about types of whole numbers, namely, even numbers, odd numbers and prime numbers. You will also learn about factors and multiples of numbers. You will be able to use factors and multiples in finding the Greatest Common Factor (GCF) and the Lowest Common Multiple (LCM) of whole numbers. This competence will help you in comparing prices, exchanging money, dividing things into equal parts, understanding time and measuring quantities of different items.

Types of numbers

Counting numbers

In our daily life, we normally count things. In counting, we start with 1 followed by 2, 3, 4, and so on. The numbers 1, 2, 3, 4, … are known as counting numbers. They are also called natural numbers.

Example 1

List all the counting numbers between 8 and 20.

Solution

The counting numbers between 8 and 20 are 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, and 19.

Whole numbers

If 0 is included in the set of counting numbers, then we get whole numbers. Therefore, the list of whole numbers is 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, ...

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Example 2

List the first nine whole numbers.

Solution

The first nine whole numbers are:
0, 1, 2, 3, 4, 5, 6, 7 and 8.

Even numbers

Even numbers are whole numbers which are exactly divisible by 2. That is, when this number is divided by 2, the remainder is 0. The last digit of an even number is either 0, 2, 4, 6 or 8. Zero is an even number.

Activity 1: Identification of even numbers

Steps:

1. List the counting numbers from 1 up to 12. The numbers are 1, 2, 3,4,5,6, 7,8,9,10,11, 12.
2. Represent the numbers by counters as shown in the following table.

Numbers	1	2	3	4	5	6	7	8	9	10	11	12
Counter												

3. Collect the counters in groups of two and use a line to connect each group.

Numbers	1	2	3	4	5	6	7	8	9	10	11	12
Counter												

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4. The numbers which have an exact number of groups of two without a remainder are: 2, 4, 6, 8, 10 and 12.

These numbers are even numbers.

Example 1

List all even numbers between 17 and 33.

Solution

The even numbers between 17 and 33 are 18, 20, 22, 24, 26, 28, 30 and 32.

Example 2

Fill in the blanks with four even numbers that follow in the following pattern of numbers: 574, 572, 570, ____, ____, ____, ____

Solution

Since the pattern is decreasing by 2 at each stage, the next four even numbers are 568, 566, 564 and 562.

Exercise 1

Answer the following questions:

1. List all the even numbers between:
   (a) 25 and 35.
   (b) 50 and 60.
   (c) 81 and 99.

2. Identify and write the even numbers in the following numbers:
   (a) 43, 52, 56, 59, 60.
   (b) 71, 78, 82, 83, 87.
   (c) 92, 97, 96, 98, 99.

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3. Which among the following numbers are not even numbers?
   (a) 52, 55, 56, 57, 59, 60, 62.
   (b) 18, 33, 36, 37, 40, 58, 70.

4. Write the missing even numbers in the following pattern:
   22, 24, 26, _____, _____, _____.

5. How many even numbers are there between 45 and 63?

6. Write all even numbers between 73 and 93 which are exactly divisible by 4.

7. Write the missing even numbers in the following pattern:
   30, ____, 34, 36, ____, ____, 42, ____, 46.

Odd numbers

Odd numbers are whole numbers which are not divisible by 2.

Activity 2: Identification of odd numbers

Steps:

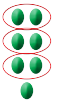
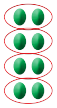
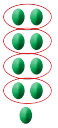
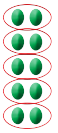
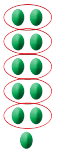
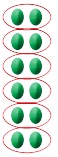
1. List the counting numbers from 1 to 12.
   The numbers are: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12.
2. Represent the numbers by counters.

Numbers	1	2	3	4	5	6	7	8	9	10	11	12
Counter												

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3. Collect counters in groups of two and use a line to connect each group.

Numbers	1	2	3	4	5	6	7	8	9	10	11	12
Counter												

4. In step 3, you observe that some numbers have an exact number of groups of two while others have 1 as remainder. The numbers which have 1 as a remainder are: 1, 3, 5, 7, 9 and 11. These are the odd numbers.

Example 1

Write all odd numbers among the following numbers 38, 49, 87, 96, 105, 254 and 281.

Solution

The odd numbers among the given numbers are:
49, 87, 105 and 281.

Example 2

Write the three missing odd numbers in the following pattern:
1003, 1005, 1007, _____, _____, _____.

Solution

The missing odd numbers are:
1009, 1011 and 1013.

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Exercise 2

Answer the following questions:

1. Given the following list of numbers:
   4, 5, 8, 11, 13, 14, 16, 19, 21, 22, 25, 27, 29, 31, 32, 34, 35
   (a) Write all odd numbers in the list.
   (b) Write all odd numbers in the list lying between 8 and 22.

2. Write down the missing odd numbers in the following pattern:
   9, 11, 13, ____, 17, ____, ____, ____, 25, 27, ____, ____

3. How many odd numbers are there among the first 10 counting numbers?

4. Answer with 'YES' or 'NO':
   (a) 243 is an odd number. _____
   (b) The sum of any two odd numbers is an even number. _____
   (c) 2 018 is an odd number. _____
   (d) 999 997 is an odd number. _____

5. List all odd numbers between 31 and 50 that are exactly divisible by 5.

Prime numbers

A prime number is a whole number that is divisible by 1 and itself. It has exactly two factors, that is, one and itself.

One (1) is not a prime number because it has a single factor which is itself.

Activity 3: Identification of prime numbers

Prime numbers can be identified using factors.
Use the following steps to identify prime numbers.

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Steps:

1. List the counting numbers from 1 up to 100.
   The counting numbers from 1 up to 100 are:
   1, 2, 3, 4, 5, 6, 7, 8, 9, 10,
   11, 12, 13, 14, 15, 16, 17, 18, 19, 20,
   21, 22, 23, 24, 25, 26, 27, 28, 29, 30,
   31, 32, 33, 34, 35, 36, …100.

2. Encircle 2, then mark all numbers divisible by 2 with ×.
3. Encircle 3, then mark all numbers divisible by 3 with ×.
4. Encircle 5, then mark all numbers divisible by 5 and have not been marked with ×.
5. Encircle 7, then mark all numbers divisible by 7 and have not been marked with ×.
6. Encircle 11, then mark all numbers divisible by 11 and have not been marked with ×.
7. Except for the number 1, write all the numbers which have been encircled and those which have not been marked with x. There are twenty-five (25) such numbers. Those numbers are the prime numbers and they are listed below:
   2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89 and 97.

Example 1

List all the prime numbers less than 20.

Solution

The prime numbers less than 20 are:
2, 3, 5, 7, 11, 13, 17 and 19.

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Example 2

Write all the prime numbers between 101 and 120.

Steps:

1. List all numbers between 101 and 120. The numbers are:
   102, 103, 104, 105, 106, 107, 108, 109, 110,
   111, 112, 113, 114, 115, 116, 117, 118, 119.
2. Mark all numbers that are divisible by 2 with x. This leaves the numbers
   103, 105, 107, 109, 111, 113, 115, 117 and 119 unmarked.
3. Mark all numbers listed in Step 2 that are divisible by 3 with x. This leaves the numbers 103, 107, 109, 113, 115 and 119 unmarked.
4. Mark all numbers listed in Step 3 that are divisible by 5 with x. This leaves the numbers 103, 107, 109, 113 and 119 unmarked.
5. Mark all numbers listed in Step 4 that are divisible by 7 with x. This leaves the numbers 103, 107, 109 and 113 unmarked.

Thus, the prime numbers between 101 and 120 are:
103, 107, 109 and 113.

Example 3

Write the prime numbers among the following numbers:
19, 21, 29, 37, 44, 45, 49, 51, 55, 57 and 59.

Solution

The prime numbers among the given numbers are:
19, 29, 37 and 59.

Exercise 3

Answer the following questions:

1. Write all the prime numbers among the following numbers:
   4, 7, 10, 12, 13, 15, 16, 17.

2. List three prime numbers between 14 and 25.

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3. Identify and write all prime numbers among the following numbers: 123, 125, 127, 128, 130, 131, 135, 137, 138, 139, 142.

4. Write a prime number which is also an even number.

5. How many prime numbers are there between 10 and 20?

6. Think of a prime number such that if you subtract a certain even number from it, the answer is zero. What number is that?

7. Find the sum of prime numbers between 1 and 20.

8. Write the missing prime numbers in the following pattern of prime numbers: 31, _____, _____, _____, 47.

9. Write all the prime numbers from the following list of numbers:
80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95.

10. Write 'TRUE' or 'FALSE' against each of the following statements:
(a) All odd numbers are prime numbers. _____
(b) 2 is the smallest prime number. _____
(c) 1, 2, 3, 4, 5 is a list of prime numbers. _____
(d) 15 is not a prime number. _____
(e) 1 is a prime number. _____

Factors of a number

A factor of a given number is any number which divides that number without a remainder. The plural of a factor is factors.

Example 1

Find all the factors of 6.

Solution

Divide 6 by 1, 2, 3, 4, 5 and 6.

6 ÷ 1= 6, 6 ÷ 4 = 1 with remainder 2,
6 ÷ 2 = 3, 6 ÷ 5 = 1 with remainder 1,
6 ÷ 3 = 2, 6 ÷ 6 = 1.

The numbers which divide 6 without remainder are 1, 2, 3 and 6.
Therefore, the factors of 6 are 1, 2, 3 and 6.

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Example 2

List all factors of 36 which are divisible by 2.

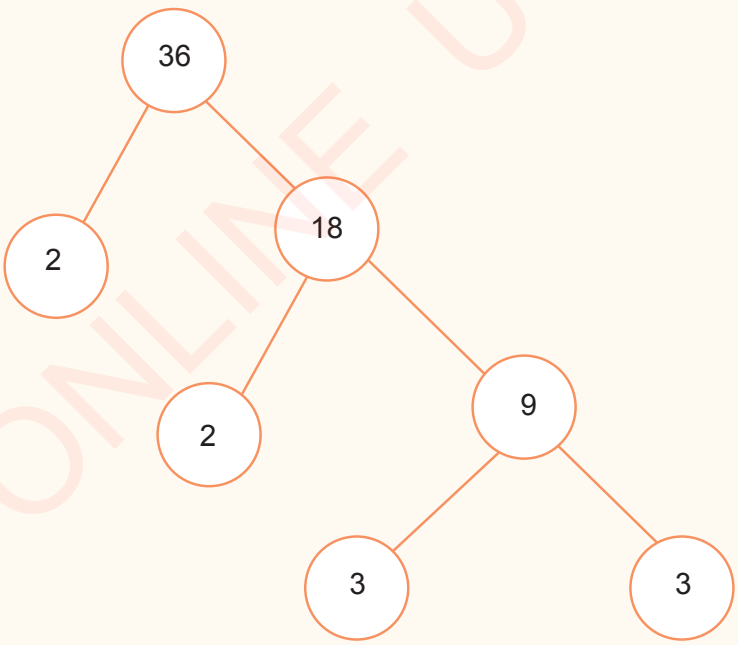
Solution

Find all the factors of 36. Divide 36 by 1, 2, 3, 4, 6, 9, 12, 18 and 36:

36 ÷ 1 = 36,
36 ÷ 2 = 18,
36 ÷ 3 = 12,
36 ÷ 4 = 9,
36 ÷ 6 = 6,
36 ÷ 9 = 4,
36 ÷ 12 = 3,
36 ÷ 18 = 2,
36 ÷ 36 = 1.

The factors of 36 are: 1, 2, 3, 4, 6, 9, 12, 18 and 36.
The factors which are divisible by 2 are: 2, 4, 6, 12, 18 and 36.

Remark: A number can be written as a product of more than two factors. For example:



In order to express 36 as a product of prime numbers, multiply all the prime numbers from the tree diagram.
That is, 36 = 2 × 2 × 3 × 3.

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Example 3

Find all the factors of 45.

Solution

Express 45 as a product of two numbers in different ways.

1 × 45 = 45. Therefore, 1 and 45 are factors of 45.

3 × 15 = 45. Therefore, 3 and 15 are factors of 45.

5 × 9 = 45. Therefore, 5 and 9 are factors of 45.

Therefore, the factors of 45 are 1, 3, 5, 9, 15, and 45.

Exercise 4

Answer the following questions:

1. Write all the factors of the following numbers:

(a) 20 (b) 7

(c) 12 (d) 5

2. Find all the factors of the following numbers:

(a) 8 (b) 16

(c) 24 (d) 49

(e) 10 (f) 81

3. Fill in the boxes with the missing factors:

(a) 40 = 2 × ☐ × 5

(b) 72 = 1 × 2 × 3 × ☐

(c) 100 = 2 × ☐ × 10

(d) 90 = 3 × ☐ × 6

(e) 56 = ☐ × 4 × 7

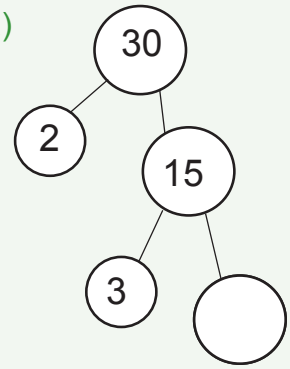
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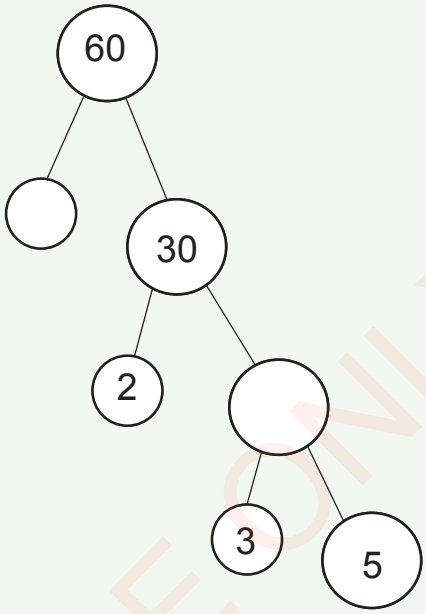
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4. Fill the missing factors in the following tree diagrams:

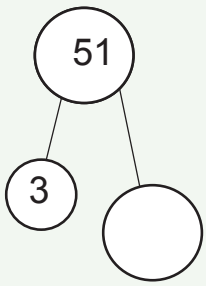
(a)



(b)



(c)



Finding factors of a number by using prime numbers

Prime numbers can also be identified by using tree diagrams.

Activity 4: Identification of prime numbers

Steps:

1. List all counting numbers from 1 to 15 and encircle them as follows:

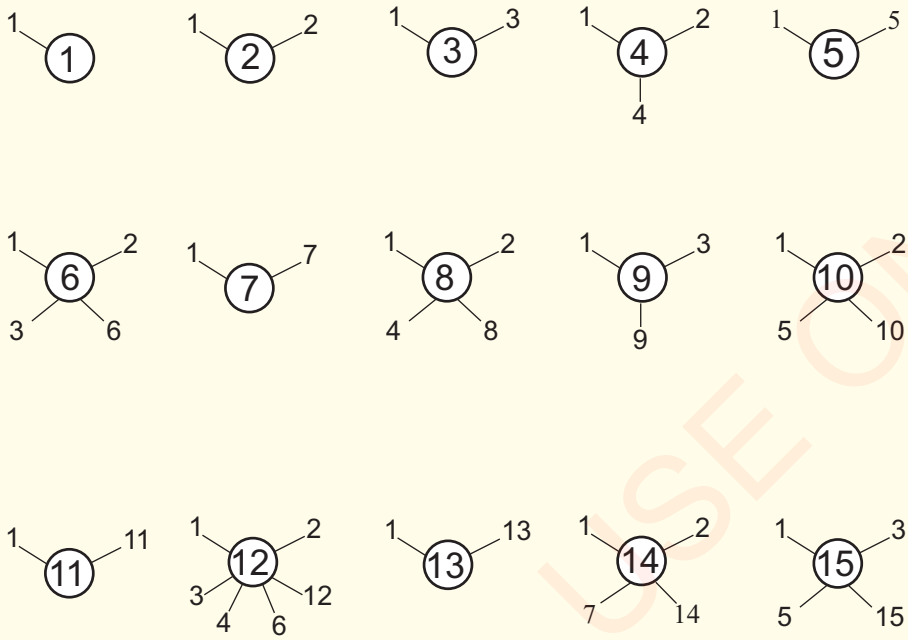
(1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11)
(12) (13) (14) (15)

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2. Write factors of each number and represent them using branches as shown below:



3. List all the numbers in step 2 which have only two factors, that is, numbers with only two branches.

The numbers with two branches are 2, 3, 5, 7, 11 and 13. These numbers have only two factors which are 1 and the number itself. Thus, these are the prime numbers.

Exercise 5

Find the prime factors of each of the following numbers:

(a) 12 (b) 28 (c) 15

(d) 24 (e) 14

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Greatest common factor

The Greatest Common Factor (GCF) is the largest number which divides two or more numbers without a remainder. In other words, the GCF is the largest factor of two or more numbers.

Example 1

Find the common factors of 6 and 8.

Solution

List the factors of 6 and 8:
The factors of 6 are 1, 2, 3 and 6.
The factors of 8 are 1, 2, 4 and 8.
Therefore, the common factors of 6 and 8 are 1 and 2.

Example 2

Find the GCF of 30 and 42.

Solution

The factors of 30 are 1, 2, 3, 5, 6, 10, 15, and 30.
The factors of 42 are 1, 2, 3, 6, 7, 14, 21, and 42.
The common factors of 30 and 42 are 1, 2, 3 and 6.
The greatest common factor (GCF) of 30 and 42 is 6.

Example 3

Find the GCF of 12 and 18 by using prime factors.

Solution

Recall that a prime number is one among the numbers.

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2, 3, 5, 7, 11, 13, 17…, whose factors are 1 and the number itself.

Express 12 as a product of prime numbers: $12 = 2 \times 2 \times 3$.

Express 18 as a product of prime numbers: $18 = 2 \times 3 \times 3$.

The common prime factors of both numbers are 2 and 3.

The product of 2 and 3 is 6.

Therefore, the GCF of 12 and 18 is 6.

Example 4

Find the GCF of 24 and 60 by prime factors.

Solution

2	24	60	24 and 60 are divisible by 2
2	12	30	12 and 30 are divisible by 2
2	6	15	2 is a factor of 6 but not of 15
3	3	15	3 and 15 are divisible by 3
5	1	5	5 is divisible by 5
	1	1	When 1 is reached, the process ends

The common prime factors of 24 and 60 are 2, 2 and 3. Their product is $2 \times 2 \times 3 = 12$.

Therefore, the GCF of 24 and 60 is 12.

Exercise 6

Answer the following questions:

1. Use listing method to find the common factors of the following pairs of numbers:

(a) 10 and 12 (b) 8 and 16 (c) 15 and 27
(d) 96 and 36 (e) 42 and 72 (f) 7 and 15
(g) 20 and 21 (h) 18 and 45 (i) 3 and 7

2. Use prime factors to find the GCF of the following pairs of numbers:

(a) 11 and 42 (b) 15 and 20 (c) 30 and 90
(d) 8 and 24 (e) 4 and 8 (f) 16 and 24
(g) 12 and 16

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3. Use the method of tree diagram to find the GCF of the following pairs of numbers:

(a) 42 and 48 (b) 33 and 72
(c) 72 and 144 (d) 75 and 80

4. Use common prime factors to find the GCF of the following pairs of numbers:

(a) 23 and 5 (b) 24 and 156 (c) 24 and 180
(d) 35 and 245 (e) 36 and 162

Multiples of numbers

If any counting number is multiplied by another counting number, then the result is called a multiple. The plural of multiple is multiples.

$12 \times 1 = 12$; 12 is a multiple of 1 and 12.

$12 \times 2 = 24$; 24 is a multiple of 2, 12, and 24.

$12 \times 3 = 36$; 36 is a multiple of 3, 12, and 36.

Multiples of a number can be listed although the list has no end unless a limit is given.

Example 1

Write the first five multiples of 2.

Solution

In order to get the first five multiples of 2, multiply 2 by 1, then by 2, 3, 4 and 5 as follows:

$2 \times 1 = 2$,
$2 \times 2 = 4$,
$2 \times 3 = 6$,
$2 \times 4 = 8$,
$2 \times 5 = 10$.

Therefore, the first five multiples of 2 are 2, 4, 6, 8 and 10.

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Example 2

Write the multiples of 5.

Solution

The multiples of 5 are obtained by multiplying 5 by 1, then by 2, 3, 4 and so on as follows:

$5 \times 1 = 5$, $5 \times 4 = 20$,

$5 \times 2 = 10$, $5 \times 5 = 25$,

$5 \times 3 = 15$, $5 \times 6 = 30$.and so on.

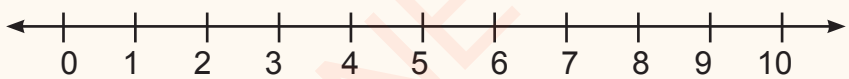
Therefore, the multiples of 5 are 5, 10, 15, 20, 25…

Example 3

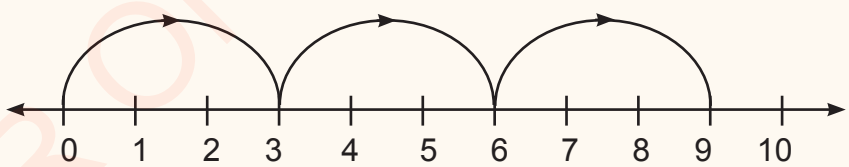
Use a number line to show the multiples of 3.

Solution

1. Draw a number line as shown below:



2. Starting from 0 move three successive steps to the right to get 3, 6, 9 and so on.



Therefore, the multiples of 3 are 3, 6, 9, 12, 15 and so on.

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Exercise 7

Answer the following questions:

1. Write all the multiples of 4 between 2 and 30.

2. Write all the multiples of 11 between 9 and 45.

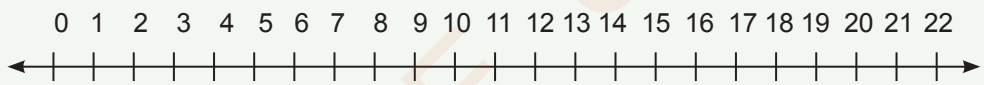
3. List the first ten multiples of 9.

4. Write all the multiples of 7 between 45 and 100.

5. List all the multiples of the following numbers which do not exceed 60:
   (a) 5 (b) 8 (c) 10 (d) 17

6. List all multiples of 6 between 5 and 62.

7. Use the following number line to answer the questions that follow:



   (a) Circle the multiples of 5.
   (b) Mark all multiples of 2 by x.
   (c) List the first 5 multiples of 1.

Lowest common multiple

The Lowest Common Multiple (LCM) of two or more numbers is the smallest whole number which is a multiple of those numbers. It is the smallest common multiple of the given numbers.

Example 1

List the common multiples of 3 and 6.

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Solution

Write the multiples of 3.

The multiples of 3 are 3, 6, 9, 12, 15, 18, 21, 24, …

Write the multiples of 6.

The multiples of 6 are 6, 12, 18, 24, 30, 36, 42, 48, …

Find the multiples of 3 that are also multiples of 6.

The common multiples of 3 and 6 are 6, 12, 18, 24, …

Therefore, the common multiples of 3 and 6 are: 6, 12, 18, 24, …

Example 2

Find the lowest common multiple (LCM) of 3 and 4.

Solution

1. Write the multiples of 3.
   The multiples of 3 are 3, 6, 9, 12, 15, 18, 21, 24, 27, …
2. Write the multiples of 4.
   The multiples of 4 are 4, 8, 12, 16, 20, 24, 28, …
3. The common multiples of 3 and 4 are 12, 24, …

Therefore, the LCM of 3 and 4 is 12.

When finding the LCM by using the method of prime factor divisors, all the prime factor divisors are multiplied.

Example 3

Use the method of common divisors to find the LCM of 12 and 20.

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Solution

2	12	20	12 and 20 are divisible by 2
2	6	10	6 and 10 are divisible by 2
3	3	5	3 divides only 3 but not 5
5	1	5	5 divides 5
	1	1	When 1 is reached, the process ends

The lowest common multiple of 12 and 20 is the product of
$2 \times 2 \times 3 \times 5 = 60$.

Therefore, the LCM of 12 and 20 is 60.

Example 4

Find the LCM of 8 and 30 using the method of prime factor divisors.

Solution

2	8	30
2	4	15
2	2	15
3	1	15
5	1	5
	1	1

The lowest common multiple of 8 and 30 is the product of
$2 \times 2 \times 2 \times 3 \times 5 = 120$.

Therefore, the LCM of 8 and 30 is 120.

Exercise 8

Answer the following questions:

1. List all multiples of 9 between 20 and 60.

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2. Write all multiples of 5 between 30 and 47.

3. List all common multiples of 5, 8, and 20 between 10 and 100.

4. List the first 5 multiples of each of the following numbers:
   (a) 6 (b) 35
   (c) 13 (d) 24

5. Find the LCM of the following pairs of numbers:
   (a) 5 and 7 (b) 12 and 40
   (c) 8 and 12 (d) 6 and 13

6. Find the LCM of the following pairs of numbers using product of prime numbers:
   (a) 18 and 30 (b) 45 and 60 (c) 23 and 46
   (d) 25 and 85 (e) 150 and 225 (f) 96 and 128

Exercise 9

Answer the following questions:

1. List all the factors for each of the following numbers:
   (a) 70 (b) 95 (c) 224
   (d) 250 (e) 729

2. Write the prime factors for each of the following numbers:
   (a) 108 (b) 120
   (c) 840

3. Write the common factors of each of the following pairs of numbers
   (a) 9 and 15 (b) 12 and 72
   (c) 8 and 32

4. Find the common factors of each of the following pairs of numbers.
   (a) 60 and 200 (b) 28 and 32

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5. List the first 8 multiples for each of the following numbers:

(a) 7 (b) 9 (c) 13

(d) 20 (e) 34

6. Find the LCM of 24 and 27 by using prime factors.

7. List all prime numbers between 30 and 40.

8. Write the type of a number which results from adding:

(a) Two even numbers

(b) An odd number and an even number

(c) Two odd numbers

9. Find the GCF of each of the following pairs of numbers:

(a) 8 and 12 (b) 6 and 18 (c) 14 and 28

(d) 15 and 30

10. Find the LCM of each of the following pairs of numbers:

(a) 2 and 3 (b) 4 and 6 (c) 7 and 4

(d) 5 and 7

11. Draw a chart of numbers from 1 to 100 and use it to answer the following questions:

(a) Write the first five multiples for each of the following numbers:

(i) 11

(ii) 29

(iii) 33

(b) Write all even numbers between 70 and 83.

(c) Write all prime numbers between 50 and 99.

(d) List all odd numbers between 85 and 100.

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Summary

1. A prime number is a number with only two factors, which are 1 and the number itself.
2. Factors are numbers which divide a given number without a remainder.
3. Multiples are numbers which are divisible by the given number without a remainder.
4. 2 is the only number which is both even and prime.
5. Even numbers are numbers that are divisible by 2.
6. Odd numbers are numbers that are not divisible by 2.

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Chapter Eight

Fractions

Introduction

In Standard Four, you learnt about addition and subtraction of fractions with the same denominator. In this chapter, you will learn about types of fractions, comparison of fractions, addition and subtraction of fractions with different denominators. You will also learn how to solve word problems involving the concept of fraction. The competence on fractions will help you in measuring time, budgeting, medical prescriptions, assessing progress, preparing meals and the like.

Exercise 1: Revision

Answer the following questions:

1. $\frac{1}{3} + \frac{1}{3} =$
2. $\frac{6}{12} + \frac{5}{12} =$
3. $\frac{3}{8} + \frac{4}{8} =$
4. $\frac{5}{20} + \frac{11}{20} =$
5. $\frac{13}{17} + \frac{4}{17} =$
6. $\frac{4}{10} + \frac{1}{10} =$
7. $\frac{15}{35} - \frac{8}{35} =$
8. $\frac{9}{36} + \frac{12}{36} =$
9. $\frac{11}{53} + \frac{30}{53} =$
10. $\frac{5}{22} + \frac{9}{22} =$
11. $\frac{6}{20} - \frac{5}{20} =$
12. $\frac{25}{48} - \frac{13}{48} =$
13. $\frac{7}{13} - \frac{4}{13} =$
14. $\frac{30}{60} - \frac{20}{60} =$
15. $\frac{5}{7} - \frac{2}{7} =$

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16. $\frac{15}{40} - \frac{8}{40} =$ **17.** $\frac{9}{19} - \frac{5}{19} =$

18. Half of the farm was planted with maize. What part of the farm was not planted with maize?

19. Pupils planted seedlings of fruit trees. If $\frac{1}{4}$ of the seedlings dried up, what fraction of the seedlings survived?

20. Zawadi walked $\frac{4}{5}$ of her journey. What fraction of her journey remained?

21. The villagers sold $\frac{3}{9}$ of their cotton to a certain cooperative union and $\frac{4}{9}$ to another cooperative union. What fraction of cotton did they sell?

22. Maua ate $\frac{1}{12}$ of bread and Amani ate $\frac{3}{12}$ of the same bread. What fraction of the bread was eaten by Maua and Amani?

Types of fractions

There are three types of fractions, proper fractions, improper fractions and mixed fractions.

(i) A proper fraction is a fraction in which the numerator is smaller than the denominator. The following are examples of proper fractions:

$\frac{1}{4}, \frac{2}{4}, \frac{1}{9}, \frac{3}{8}, \frac{10}{12}, \frac{15}{40}$.

(ii) An improper fraction is a fraction where the numerator is bigger than the denominator. The following are examples of improper fractions:

$\frac{6}{5}, \frac{9}{4}, \frac{10}{7}, \frac{11}{9}, \frac{12}{11}$.

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(iii) A mixed fraction or mixed numbers is a fraction which consists of a whole number and a proper fraction. This type of fraction is obtained when an improper fraction is simplified. The following are examples of mixed numbers:

$3\frac{1}{2}$, $4\frac{1}{2}$, $5\frac{3}{4}$, $15\frac{1}{4}$, $22\frac{1}{3}$.

Example

Which of the following are (a) proper fractions? (b) improper fractions?

$\frac{6}{9}$, $\frac{2}{3}$, $\frac{7}{2}$, $\frac{1}{3}$ and $\frac{9}{4}$.

Answer

(a) Proper fractions are $\frac{6}{9}$, $\frac{2}{3}$ and $\frac{1}{3}$.

(b) Improper fractions are $\frac{7}{2}$ and $\frac{9}{4}$.

Exercise 2

Answer the following questions:

1. Which of the following are improper fractions?

   $\frac{3}{4}$, $\frac{10}{8}$, $\frac{1}{4}$, $\frac{9}{15}$, $\frac{20}{18}$ and $\frac{16}{9}$.

2. Which of the following are proper fractions?

   $\frac{1}{6}$, $\frac{1}{7}$, $\frac{11}{6}$, $\frac{5}{4}$ and $\frac{9}{10}$.

3. What is the difference between a proper fraction and an improper fraction?

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Equivalent fractions

Any fraction whose numerator is the same as the denominator has a value of 1.

Example 1

$\frac{2}{2} = \frac{3}{3} = \frac{4}{4} = \frac{5}{5} = \frac{6}{6} = 1.$

If a fraction is multiplied by 1 its value remains unchanged.

Example 2

Write four fractions which are equivalent to $\frac{1}{2}$.

Solution

Multiply the numerator and the denominator by the same number.

$\frac{1}{2} = \frac{1 \times 2}{2 \times 2} = \frac{2}{4}$

$\frac{1}{2} = \frac{1 \times 3}{2 \times 3} = \frac{3}{6}$

$\frac{1}{2} = \frac{1 \times 4}{2 \times 4} = \frac{4}{8}$

$\frac{1}{2} = \frac{1 \times 5}{2 \times 5} = \frac{5}{10}$.

Therefore, $\frac{1}{2} = \frac{2}{4} = \frac{3}{6} = \frac{4}{8} = \frac{5}{10}$.

Example 3

Write four fractions which are equivalent to $\frac{3}{4}$.

Solution

Multiply the numerator and the denominator by the same number.

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$\frac{3}{4} = \frac{3}{4} \times \frac{2}{2} = \frac{6}{8}$

$\frac{3}{4} = \frac{3}{4} \times \frac{3}{3} = \frac{9}{12}$

$\frac{3}{4} = \frac{3}{4} \times \frac{4}{4} = \frac{12}{16}$

$\frac{3}{4} = \frac{3}{4} \times \frac{5}{5} = \frac{15}{20}$.

Therefore, four fractions which are equivalent to

$\frac{3}{4}$ are $\frac{6}{8}$, $\frac{9}{12}$, $\frac{12}{16}$ and $\frac{15}{20}$.

Exercise 3

Answer the following questions:

1. For each of the following fractions, list any three fractions that are equal to the given fractions:

(a) $\frac{1}{7}$ (b) $\frac{1}{11}$ (c) $\frac{1}{9}$ (d) $\frac{1}{15}$ (e) $\frac{1}{4}$

2. Fill in the blanks with the missing fractions:

(a) $\frac{1}{4}, \frac{2}{8}, ____, \frac{4}{16}$.

(b) $\frac{1}{8}, \frac{2}{16}, ____, ____, \frac{5}{40}$.

(c) $\frac{3}{5}, ____, \frac{9}{15}, ____$.

(d) $\frac{3}{16}, ____, \frac{9}{48}$.

3. Which among the following fractions are equivalent?

$\frac{1}{4}, \frac{1}{6}, \frac{1}{8}, \frac{25}{100}, \frac{2}{16}, \frac{3}{18}$.

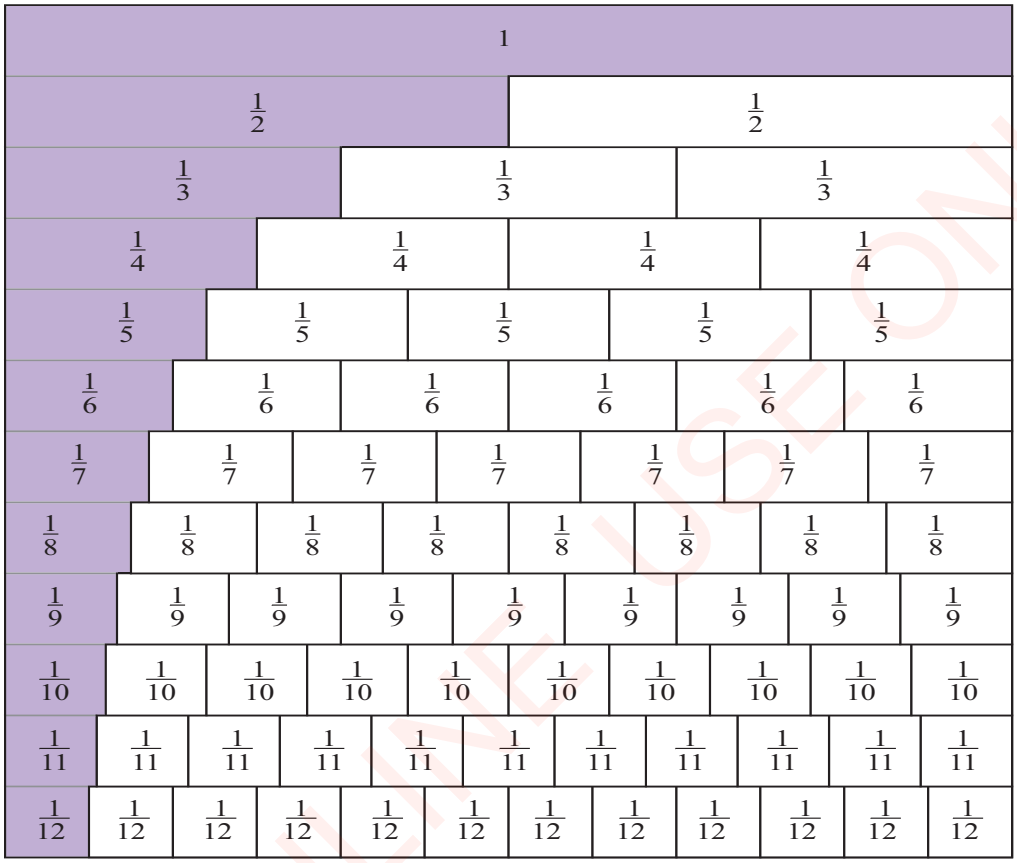
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Comparing fractions

Fractions with different values may be illustrated using a table showing different fractions. Study carefully the following table:

Table of fractions



In the table of fractions, the length of a shaded part represents the size or value of the particular fraction.

Example 1

Of the two fractions, $\frac{1}{2}$ and $\frac{1}{4}$, which one is greater than the other?

The table of fractions shows that the shaded part representing $\frac{1}{2}$ is longer than the shaded part representing $\frac{1}{4}$. Therefore, $\frac{1}{2}$ is greater than $\frac{1}{4}$.

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Example 2

Of the two fractions, $\frac{2}{6}$ and $\frac{2}{5}$, which one is smaller than the other?

The table shows that the shaded part representing $\frac{2}{6}$ is shorter than the shaded part representing $\frac{2}{5}$. Therefore, $\frac{2}{6}$ is smaller than $\frac{2}{5}$.

Exercise 4

Use the table of fractions to answer the following questions:

1. For each of the following pair of fractions, identify which one is greater than the other.
   (i) $\frac{2}{3}$ and $\frac{5}{6}$ (ii) $\frac{1}{8}$ and $\frac{1}{9}$ (iii) $\frac{4}{5}$ and $\frac{2}{10}$

2. For each of the following pairs of fractions identify which one is smaller than the other.
   (i) $\frac{5}{11}$ and $\frac{2}{3}$ (ii) $\frac{4}{12}$ and $\frac{6}{10}$ (iii) $\frac{6}{7}$ and $\frac{3}{9}$

3. Write the following fractions in ascending order:
   (i) $\frac{1}{3}, \frac{5}{6}, \frac{1}{2}$ (ii) $\frac{3}{4}, \frac{7}{12}, \frac{2}{3}$ (iii) $\frac{7}{8}, \frac{5}{6}, \frac{3}{4}$

4. Write the following fractions in descending order:
   (i) $\frac{5}{6}, \frac{3}{4}, \frac{2}{3}$ (ii) $\frac{7}{12}, \frac{5}{8}, \frac{3}{7}$ (iii) $\frac{7}{10}, \frac{1}{2}, \frac{3}{5}$

Adding fractions with different denominators

Example 1

$\frac{1}{2} + \frac{1}{4} =$

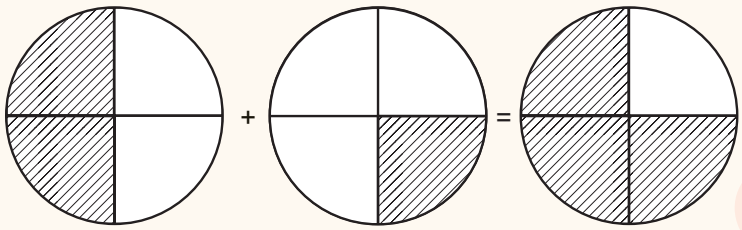
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Solution

Write $\frac{1}{2}$ and $\frac{1}{4}$ as fractions with the same denominator by multiplying $\frac{1}{2}$ by $\frac{2}{2}$.

That is, $\frac{1}{2} = \frac{1 \times 2}{2 \times 2} = \frac{2}{4}$.



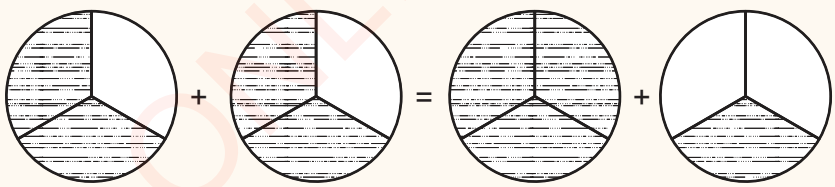
$\frac{2}{4} + \frac{1}{4} = \frac{3}{4}$.

Therefore, $\frac{1}{2} + \frac{1}{4} = \frac{2}{4} + \frac{1}{4} = \frac{2+1}{4} = \frac{3}{4}$.

Example 2

$\frac{2}{3} + \frac{2}{3} =$

Solution



$\frac{2}{3} + \frac{2}{3} = \frac{3}{3} + \frac{1}{3} = \frac{4}{3}$.

Therefore, $\frac{2}{3} + \frac{2}{3} = \frac{4}{3} = 1\frac{1}{3}$.

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Example 3

$\frac{2}{5} + \frac{3}{9} =$

Solution

Since 5 × 9 = 45, multiply each fraction by $\frac{45}{45}$ to obtain a common denominator.

$$\frac{2}{5} \times \frac{45}{45} + \frac{3}{9} \times \frac{45}{45} = \frac{2 \times 9}{45} + \frac{3 \times 5}{45}$$

$$= \frac{18}{45} + \frac{15}{45}$$

$$= \frac{33}{45} \text{ or } \frac{11}{15}.$$

Therefore, $\frac{2}{5} + \frac{3}{9} = \frac{33}{45}$ or $\frac{11}{15}$.

Example 4

$\frac{4}{15} + \frac{3}{5} + \frac{1}{30} =$

Solution

Since 15 and 5 are factors of 30, we proceed as follows:

$$\frac{4}{15} = \frac{4}{15} \times \frac{2}{2} = \frac{8}{30}; \qquad \frac{3}{5} = \frac{3}{5} \times \frac{6}{6} = \frac{18}{30}$$

It follows that;

$$\frac{4}{15} + \frac{3}{5} + \frac{1}{30} = \frac{8}{30} + \frac{18}{30} + \frac{1}{30}$$

$$= \frac{27}{30} \text{ or } \frac{9}{10}.$$

Therefore, $\frac{4}{15} + \frac{3}{5} + \frac{1}{30} = \frac{27}{30}$ or $\frac{9}{10}$.

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Exercise 5

Answer the following questions:

1. $\frac{3}{5}+\frac{1}{6}=$
2. $\frac{3}{4}+\frac{1}{5}=$
3. $\frac{3}{7}+\frac{4}{21}=$
4. $\frac{30}{36}+\frac{1}{18}=$
5. $\frac{1}{5}+\frac{5}{7}=$
6. $\frac{1}{2}+\frac{1}{4}+\frac{1}{5}=$
7. $\frac{5}{20}+\frac{7}{60}=$
8. $\frac{2}{3}+\frac{5}{9}=$
9. $\frac{1}{7}+\frac{2}{5}=$
10. $\frac{8}{20}+\frac{24}{40}=$
11. $\frac{5}{65}+\frac{1}{13}=$
12. $\frac{1}{2}+\frac{1}{3}+\frac{1}{8}=$
13. $\frac{3}{8}+\frac{2}{6}=$
14. $\frac{2}{3}+\frac{1}{9}+\frac{1}{18}=$
15. $\frac{2}{15}+\frac{9}{10}=$
16. $\frac{20}{50}+\frac{3}{25}=$
17. $\frac{3}{4}+\frac{1}{7}+\frac{1}{4}=$
18. $\frac{7}{9}+\frac{10}{27}=$
19. $\frac{12}{25}+\frac{13}{100}=$
20. $\frac{15}{30}+\frac{45}{90}=$

Subtraction of fractions with different denominators

Example 1

$\frac{3}{4}-\frac{1}{2}=$

Solution

Multiply $\frac{1}{2}$ by $\frac{2}{2}$ so as to obtain fractions with the same denominator.

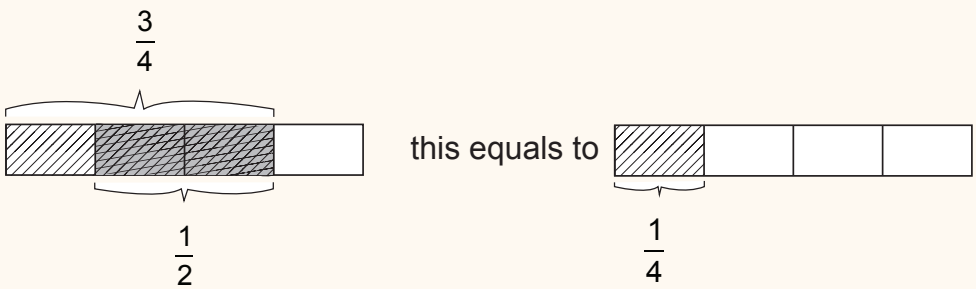
That is, $\frac{1}{2} = \frac{1}{2}\times\frac{2}{2} = \frac{2}{4}$

$\frac{3}{4}-\frac{1}{2} = \frac{3}{4}-\frac{2}{4} = \frac{3-2}{4}=\frac{1}{4}$.

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Alternatively, using diagram;



Or

$$\frac{3}{4} - \frac{1}{2} = \frac{3}{4} - \frac{2}{4}$$

$$= \frac{3-2}{4}$$

$$= \frac{1}{4}.$$

Therefore, $\frac{3}{4} - \frac{1}{2} = \frac{1}{4}$.

Example 2

$\frac{3}{5} - \frac{1}{4} =$

Solution

$$\frac{3}{5} - \frac{1}{4} = \frac{3}{5} \times \frac{4}{4} - \frac{1}{4} \times \frac{5}{5}$$

$$= \frac{(3 \times 4) - (1 \times 5)}{20}$$

$$= \frac{12-5}{20} = \frac{7}{20}.$$

Therefore, $\frac{3}{5} - \frac{1}{4} = \frac{7}{20}$.

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Example 3

$\frac{5}{6} - \frac{4}{7} =$

Solution

$$\frac{5}{6} - \frac{4}{7} = \frac{5}{6} \times \frac{7}{7} - \frac{4}{7} \times \frac{6}{6}$$

$$= \frac{(5 \times 7) - (4 \times 6)}{42}$$

$$= \frac{35 - 24}{42} = \frac{11}{42}.$$

Therefore, $\frac{5}{6} - \frac{4}{7} = \frac{11}{42}$.

Exercise 6

Answer the following questions:

1. $\frac{8}{9} - \frac{2}{6} =$
2. $\frac{4}{8} - \frac{2}{10} =$
3. $\frac{1}{2} - \frac{1}{3} =$
4. $\frac{15}{20} - \frac{14}{40} =$
5. $\frac{25}{30} - \frac{13}{90} =$
6. $\frac{3}{7} - \frac{2}{14} =$
7. $\frac{3}{4} - \frac{4}{9} =$
8. $\frac{6}{8} - \frac{2}{5} =$
9. $\frac{54}{60} - \frac{9}{20} =$
10. $\frac{5}{9} - \frac{2}{4} =$
11. $\frac{8}{15} - \frac{10}{30} =$
12. $\frac{6}{7} - \frac{4}{14} =$
13. $\frac{9}{20} - \frac{3}{10} =$
14. $\frac{8}{12} - \frac{1}{5} =$
15. $\frac{3}{5} - \frac{3}{8} =$
16. $\frac{20}{22} - \frac{8}{11} =$
17. $\frac{24}{28} - \frac{19}{56} =$
18. $\frac{10}{13} - \frac{5}{39} =$
19. $\frac{46}{50} - \frac{40}{100} =$
20. $\frac{18}{30} - \frac{7}{60} =$

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Multiplication of fractions with different denominators

Example 1

(a) $\frac{1}{3} \times \frac{1}{4} =$ (b) $\frac{3}{4} \times \frac{2}{3} =$

Solution

The solution is the fraction whose numerator is the product of the two numerators and denominator is the product of the two denominators.

(a) $\frac{1}{3} \times \frac{1}{4} = \frac{1 \times 1}{3 \times 4} = \frac{1}{12}$.

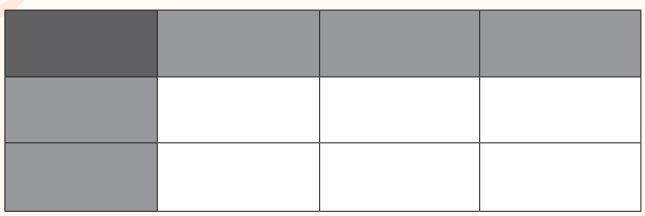
Therefore, $\frac{1}{3} \times \frac{1}{4} = \frac{1}{12}$.

Altenatively,

$\frac{1}{3} \times \frac{1}{4} =$

Steps:

1. Construct a rectangle and subdivide it into 3 horizontal rectangles and 4 vertical rectangles.
2. Shade the first vertical rectangle representing $\frac{1}{4}$ and the first horizontal rectangle representing $\frac{1}{3}$.
3. Count the number of small rectangles which have been shaded twice. There is only one such rectangle. This is the numerator.
4. The total number of all small rectangles is 12. This is the denominator.



Therefore, $\frac{1}{3} \times \frac{1}{4} = \frac{1}{12}$.

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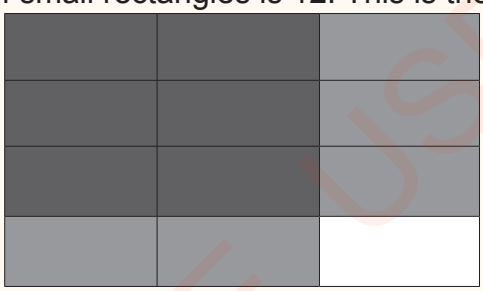
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(b) $\frac{3}{4} \times \frac{2}{3} =$

Steps:

1. Subdivide a rectangle into 4 horizontal and 3 vertical rectangles using equally spaced lines.
2. Shade 3 out of 4 horizontal rectangles which represent $\frac{3}{4}$. Also, shade 2 out of the 3 vertical rectangles which represent $\frac{2}{3}$.
3. Count the number of small rectangles that have been shaded twice. There are 6 such small rectangles. This is the numerator.

The total number of small rectangles is 12. This is the denominator.



Therefore, $\frac{3}{4} \times \frac{2}{3} = \frac{6}{12}$ or $\frac{1}{2}$.

Example 2

$\frac{5}{8} \times \frac{3}{4} =$

Solution

Steps:

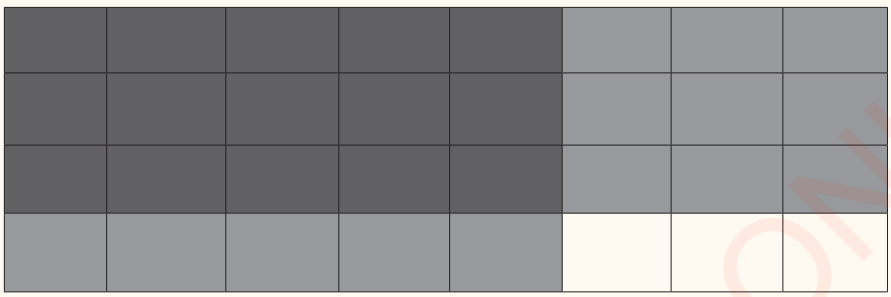
1. Subdivide a rectangle into 4 horizontal and 8 vertical rectangles using equally spaced lines.
2. Shade 5 of the 8 vertical rectangles. This represents $\frac{5}{8}$.
3. Shade 3 of the 4 horizontal rectangles. This represents $\frac{3}{4}$.

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4. Count the number of small rectangles that have been shaded twice, once horizontally and once vertically. There are 15 such small rectangles. This is the numerator.

The total number of small rectangles is 32. This is the denominator.



Therefore, $\frac{5}{8} \times \frac{3}{4} = \frac{15}{32}$.

Exercise 7

Answer the following questions:

1. $\frac{2}{5} \times \frac{3}{7} =$
2. $\frac{6}{9} \times \frac{1}{7} =$
3. $\frac{2}{4} \times \frac{3}{5} =$
4. $\frac{3}{8} \times \frac{5}{10} =$
5. $\frac{13}{15} \times \frac{2}{4} =$
6. $\frac{7}{12} \times \frac{1}{6} =$
7. $\frac{4}{5} \times \frac{6}{11} =$
8. $\frac{1}{4} \times \frac{2}{7} =$
9. $\frac{2}{3} \times \frac{7}{10} =$
10. $\frac{8}{9} \times \frac{1}{3} =$
11. $\frac{2}{4} \times \frac{3}{4} =$
12. $\frac{11}{13} \times \frac{1}{5} =$
13. $\frac{3}{14} \times \frac{1}{2} =$
14. $\frac{5}{9} \times \frac{4}{6} =$
15. $\frac{7}{8} \times \frac{1}{5} =$
16. $\frac{2}{17} \times \frac{5}{7} =$
17. $\frac{3}{5} \times \frac{5}{9} =$
18. $\frac{3}{4} \times \frac{6}{10} =$
19. $\frac{1}{4} \times \frac{4}{5} =$
20. $\frac{17}{19} \times \frac{1}{2} =$

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Multiplication of fractions by a whole number

Example 1

$4 \times \frac{1}{5} =$

Solution

When a fraction is multiplied by a whole number, write the whole number over one.

In this example, $4 = \frac{4}{1}$.

Thereafter, multiply numerator by numerator and denominator by denominator:

$$4 \times \frac{1}{5} = \frac{4}{1} \times \frac{1}{5}$$

$$= \frac{4}{5}.$$

Therefore, $4 \times \frac{1}{5} = \frac{4}{5}$.

Example 2

$\frac{2}{3} \times 12 =$

Solution

$$\frac{2}{3} \times 12 = \frac{2}{3} \times \frac{12}{1}$$

$$= \frac{24}{3}$$

$$= 8.$$

Therefore, $\frac{2}{3} \times 12 = 8$.

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Exercise 8

Answer the following questions:

1. $6 \times \frac{3}{4} =$
2. $\frac{2}{3} \times 9 =$
3. $\frac{5}{6} \times 30 =$
4. $\frac{1}{2} \times 24 =$
5. $27 \times \frac{1}{9} =$
6. $15 \times \frac{2}{5} =$
7. $12 \times \frac{1}{6} =$
8. $\frac{2}{10} \times 4 =$
9. $\frac{5}{9} \times 18 =$
10. $21 \times \frac{1}{7} =$
11. $\frac{1}{3} \times 36 =$
12. $\frac{1}{8} \times 32 =$
13. $5 \times \frac{1}{6} =$
14. $20 \times \frac{1}{4} =$
15. $\frac{1}{10} \times 50 =$
16. $3 \times \frac{3}{11} =$
17. $13 \times \frac{1}{13} =$
18. $40 \times \frac{1}{20} =$
19. $\frac{7}{10} \times 10 =$
20. $\frac{2}{5} \times 25 =$

Word problems involving fractions

Example 1

A household had one bag of sugar. If Anna used $\frac{5}{6}$ of the sugar in the bag and Magoma used $\frac{1}{8}$ of the sugar in the bag, what fraction of the sugar was used by both Anna and Magoma?

Solution

Anna used $\frac{5}{6}$ of the sugar and Magoma used $\frac{1}{8}$ of the sugar.

Add the two fractions:

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$\frac{5}{6} + \frac{1}{8} = \frac{20+3}{24} = \frac{23}{24}$

$= \frac{23}{24}$.

Therefore, Anna and Magoma used $\frac{23}{24}$ of the sugar.

Example 2

Ali harvested $\frac{6}{7}$ of the onions grown in a certain farm, and Zaituni harvested $\frac{1}{9}$ of the onions from the same farm. What is the difference between the fraction of onions harvested by Ali and the fraction harvested by Zaituni?

Solution

Ali harvested $\frac{6}{7}$ and Zaituni harvested $\frac{1}{9}$ of onions.

Subtract the two fractions: $\frac{6}{7} - \frac{1}{9} = \frac{54-7}{63} = \frac{47}{63}$.

Therefore, the difference between the two fractions is $\frac{47}{63}$.

Example 3

Grandmother drinks $\frac{3}{4}$ of a litre of milk per day. How many litres of milk will she drink in 6 days?

Solution

$\frac{3}{4} \times 6 = \frac{3}{4} \times \frac{6}{1}$

$= \frac{3 \times 6}{4 \times 1} = \frac{18}{4}$

$= \frac{9}{2}$

$= 4\frac{1}{2}$.

Therefore, the grandmother will drink $4\frac{1}{2}$ litres of milk in 6 days.

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Exercise 9

Answer the following questions:

1. A teacher spent $\frac{1}{3}$ of her salary to pay school fees for her daughter and $\frac{2}{5}$ for domestic expenses. What fraction of her salary was used for both expenses?

2. Half of the garden was planted with okra and $\frac{3}{8}$ was planted with green vegetables. What fraction of the garden was planted with okra and green vegetables?

3. John eats $\frac{3}{5}$ of bread and Elizabeth eats $\frac{2}{7}$ of the same bread. What fraction of bread is eaten by both?

4. On the first day, a mother cooked $\frac{1}{2}$ kilogram of rice. The second day she cooked $\frac{1}{3}$ kilogram of rice. What fraction of a kilogram of rice was cooked in both days?

5. During the holidays, $\frac{1}{4}$ of the students travelled by bus and $\frac{1}{3}$ of the students travelled by train. What fraction of the students travelled by both bus and train?

6. Baraka took $\frac{3}{5}$ of the bags of beans and Asha took $\frac{1}{10}$ of the same bags of beans. What fraction of the bags of beans was not taken?

7. Muungano Primary School has 80 cattle. The school decided to sell $\frac{2}{5}$ of the cattle. How many cattle remained at the school?

8. Amina took $\frac{2}{5}$ of a piece of cloth to make a gown. Anna took $\frac{1}{10}$ of the same piece of cloth. What fraction of the piece of cloth was taken by both?

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9. Juma drew a line segment of length 9 centimetres. Then, he drew another line segment whose length is $\frac{1}{3}$ of the length of the first line segment. What is the length of the second line segment?

10. One day, my brother, sister and uncle helped my mother to cultivate her garden. My brother cultivated $\frac{1}{5}$ of the garden, my sister cultivated $\frac{3}{10}$ of the garden and my uncle cultivated $\frac{2}{5}$ of the garden. What fraction of the garden was cultivated by all three?

11. Eliudi had 20 bags of sorghum. He gave $\frac{1}{2}$ of the bags to his brother. How many bags of sorghum did the brother get?

12. A hospital has 48 beds. If $\frac{1}{12}$ of the beds are made of iron, how many beds at the hospital are made of iron?

13. A Kangaroo ran $\frac{1}{3}$ of a distance of 15 kilometres. What distance did the Kangaroo run?

14. Mwembechai primary school enrolled 30 pupils in kindergarten. If $\frac{1}{6}$ of the enrolled pupils did not turn up, how many pupils did not turn up?

15. A technical school has 80 teachers. If $\frac{3}{4}$ are female teachers, what is the number of male teachers?

Exercise 10

Answer the following questions:

1. Which of the fractions $\frac{7}{8}$ and $\frac{8}{9}$ is greater than the other?

2. What is the difference between $\frac{3}{5}$ and $\frac{1}{6}$?

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3. $\frac{6}{10} + \frac{7}{9} =$

4. $10 \times \frac{3}{4} =$

5. $\frac{54}{60} \times \frac{3}{4} =$

6. Subtract $\frac{3}{7}$ from $\frac{11}{12}$

7. $\frac{13}{15} \times \frac{9}{10} =$

8. $\frac{5}{7} \times 28 =$

9. Find $\frac{2}{5}$ of 200 people.

10. Multiply $\frac{1}{8}$ by 8

11. Multiply 24 by $\frac{3}{12}$

12. $\frac{17}{34} - \frac{19}{68} =$

13. $\frac{1}{10} + \frac{2}{20} + \frac{15}{40} =$

14. $\frac{38}{40} - \frac{52}{80} =$

15. $\frac{2}{4} + \frac{2}{3} + \frac{2}{6} =$

16. $\frac{2}{5} + \frac{1}{3} + \frac{1}{5} =$

17. $\frac{4}{6} - \frac{5}{9} =$

18. Find the difference between $\frac{8}{9}$ and $\frac{9}{27}$.

19. Masalu had 88 mangoes. If he sold $\frac{1}{8}$ of the mangoes, how many mangoes were sold?

20. Furaha cultivated $\frac{5}{7}$ of his farm and his friend cultivated $\frac{1}{8}$ of the same farm. What fraction of the farm was not cultivated?

Summary

1. In multiplying a fraction by another fraction, multiply numerator by numerator, and denominator by denominator.
2. In multiplying a whole number by a fraction, the whole number is first expressed as a fraction.
3. When an improper fraction is simplified, it gives a mixed number.

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Chapter Nine

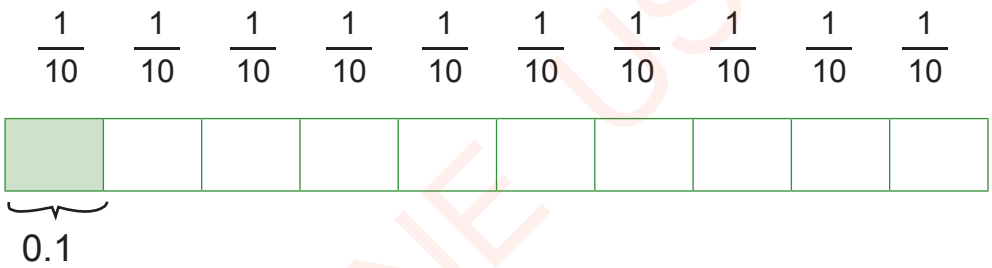
Decimals

Introduction

The concept of decimals is new to you since it has not been taught or learnt before. However, it is very closely connected to the concept of fractions that you have learnt in Chapter Eight. The competence of decimals will help you to deal with money accurately. For example, conversion of money. Also, it will provide you with the ability to measure mass, length, volume and other quantities accurately.

Meaning of a decimal

Study the following rectangle:



A rectangle sub divided into 10 equal parts.

A rectangle is subdivided into 10 equal parts. The shaded part is $\frac{1}{10}$ of the original rectangle. In decimal notation, the fraction $\frac{1}{10}$ is written as 0.1, which is obtained by dividing 1 by 10. It is one-tenth of the rectangle.

Place value of decimals

You have already learnt how to determine the place values of digits in whole numbers. In decimals, the place values of digits to the left of the decimal point are determined as in whole numbers. The place values of the digits to the right of the decimal point are tenth, followed by hundredth, thousandth, and so on depending on the number of decimal places.

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Example

Write the place value of each of the digits in the following decimals:

(a) 8.1 (b) 0.1 (c) 12.34 (d) 27.312

Solution

(a) 8 .1
- 1 — Tenth
- 8 — Ones

(b) 0 . 1
- 1 — Tenth
- 0 — Ones

(c) 1 2 . 3 4
- 4 — Hundredth
- 3 — Tenth
- 2 — Ones
- 1 — Tens

(d) 2 7 . 3 1 2
- 2 — Thousandth
- 1 — Hundredth
- 3 — Tenth
- 7 — Ones
- 2 — Tens

Exercise 1

1. Write down the place value of each of the digits in the following decimals:

(a) 32.03 (b) 0.05
(c) 1.37 (d) 146.02
(e) 48.22 (f) 1.16

2. Write down the following decimals in numerals:

(a) Four tens, zero ones, zero tenth, nine hundredth
(b) Five ones, two tenth, three hundredth
(c) One hundreds, zero tens, four ones, four tenth

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There are many types of decimals. The following are some decimals based on a number divided by 10:

(a) $\frac{2}{10} = 0.2$ (b) $\frac{4}{10} = 0.4$ (c) $\frac{9}{10} = 0.9$

In the decimals 0.2, 0.4 and 0.9, the point separates a whole number, which is 0, and a number, which is a fraction of 10.

A decimal has two parts:

(a) A whole number

(b) A decimal part (which represents a fraction).

These parts are separated by a dot (.) called a decimal point.

For example;

(a) In 0.8, a whole number is 0 and a decimal part is 8.

(b) In 3.15, a whole number is 3 and a decimal part is 15.

Reading decimal numbers

Reading numbers with one decimal place

Decimal numbers are read from left to right as shown in the following example.

Example

Decimal number	How the number is read
0.7	Zero point seven
1.8	One point eight
25.6	Twenty-five point six
250.1	Two hundred fifty point one

Reading decimal numbers with two decimal places

Use the following table to study decimal numbers:

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$\frac{1}{100}$									

The shaded area is $\frac{1}{100}$ of the whole drawing and it is written as 0.01. The number 0.01 is obtained by dividing 1 by 100.

Using the drawing, you can get different decimal numbers. For example;

(a) $\frac{3}{100} = 0.03$ (b) $\frac{12}{100} = 0.12$ (c) $\frac{94}{100} = 0.94$

The digits to the left of the point are read like whole numbers. The digits to the right of the point are read one after the other, starting from the tenth, followed by hundredth, thousandth and so on. For example:

Decimal number	How the number is read
0.05	Zero point zero five
0.13	Zero point one three
15.34	Fifteen point three four
525.25	Five hundred twenty-five point two five

Exercise 2

Read the following decimals:

1. (a) 0.4 (b) 1.7

(c) 18.9 (d) 28.2

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2. (a) 43.5 (b) 132.5 (c) 631.8 (d) 0.1

3. (a) 0.01 (b) 1.23 (c) 2.07 (d) 0.25

4. (a) 18.15 (b) 84.72 (c) 24.99 (d) 72.75

5. (a) 113.04 (b) 583.94 (c) 716.88 (d) 2.04

Writing decimals in numerals and in words

Example 1

Write the following decimals in words:

Decimals in numerals	Decimals in words
0.4	Zero point four
2.1	Two point one
0.08	Zero point zero eight
13.26	Thirteen point two six

Example 2

Write the following decimals in numerals:

Decimals in words	Decimal numbers in numerals
Zero point five	0.5
Eleven point six	11.6
Zero point zero nine	0.09
Twenty-three point three seven	23.37

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Exercise 3

Answer the following questions:

1. Write the following decimals in words:

(a) 0.6	(b) 0.1	(c) 0.3	(d) 2.4
(e) 6.7	(f) 12.8	(g) 0.02	(h) 0.29
(i) 48.65	(j) 93.07	(k) 68.31	

2. Write the following decimals in numerals:

(a) Zero point five three.
(b) Eight point seven five.
(c) Ten point nine.
(d) Zero point zero two.
(e) Eleven point eight two.
(f) Thirteen point zero one.
(g) Fifty-six point two five.
(h) Twenty-eight point one eight.

Changing a fraction into a decimal number

Decimals are obtained by dividing a numerator by a denominator.

Example 1

Change $\frac{6}{10}$ into decimal.

Solution

Steps:

1. Divide the numerator 6 by the denominator 10. This is denoted by $10\overline{)6}$ The division is not sufficient. Write 0 in the answer's position above the digit 6 followed by a decimal point as shown in Step 2.
2. Put a zero to the right of 6 to get 60. Divide 60 by 10 to get 6. Write 6 after the decimal point.

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$$
\begin{array}{r}
0.6 \\
10\overline{)\ 60} \\
-\ 60 \\
\hline
0
\end{array}
$$

Therefore, $\frac{6}{10} = 0.6$.

Example 2

Change $\frac{1}{2}$ into decimal.

Solution

Steps:

1. Divide 1 by 2. This is denoted by $2\overline{)1}$. The division is not sufficient. Write 0 in the answer's position followed by a decimal point.	$\begin{array}{r} 0. \\ 2\overline{)\ 1} \end{array}$
2. Put a zero to the right of 1 to get 10. Divide 10 by 2 to get 5. Write 5 in the answer's position. Multiply 5 by 2 to get 10. Subtract to get 0.	$\begin{array}{r} 0.5 \\ 2\overline{)\ 10} \\ -10 \\ \hline 0 \end{array}$

Therefore, $\frac{1}{2} = 0.5$.

Example 3

Change $\frac{1}{100}$ into decimal.

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Solution

Steps:

1. Divide 1 by 100.	$100\overline{)1}$
2. The division in step 1 is not sufficient. Write 0 above the digit 1 followed by a decimal point. Put a zero to the right of 1 to get 10.	$100\overline{)10}$ 0.
3. Divide 10 by 100. The division is still not sufficient. Write 0 in the tenth position in the answer's position, then put 0 to the right of 10 to get 100.	$100\overline{)100}$ 0.0
4. Divide 100 by 100 to get 1. Write 1 in the hundredth position in the answer's position.	$100\overline{)100}$ 0.01 −100 0

Therefore, $\frac{1}{100} = 0.01$.

Example 4

Convert $\frac{5}{2}$ into a decimal number.

Solution

$$2\overline{)5} \quad 2.5$$
$$-4$$
$$10$$
$$-10$$
$$0$$

Therefore, $\frac{5}{2} = 2.5$.

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Exercise 4

Change the following into decimals:

1. (a) $\frac{3}{10}$ (b) $\frac{8}{10}$ (c) $\frac{7}{10}$ (d) $\frac{12}{10}$

2. (a) $\frac{1}{5}$ (b) $\frac{2}{5}$ (c) $\frac{3}{2}$ (d) $\frac{7}{5}$

3. (a) $\frac{3}{100}$ (b) $\frac{15}{100}$ (c) $\frac{76}{100}$ (d) $\frac{83}{100}$

4. (a) $\frac{1}{25}$ (b) $\frac{1}{4}$ (c) $\frac{3}{4}$ (d) $\frac{5}{4}$

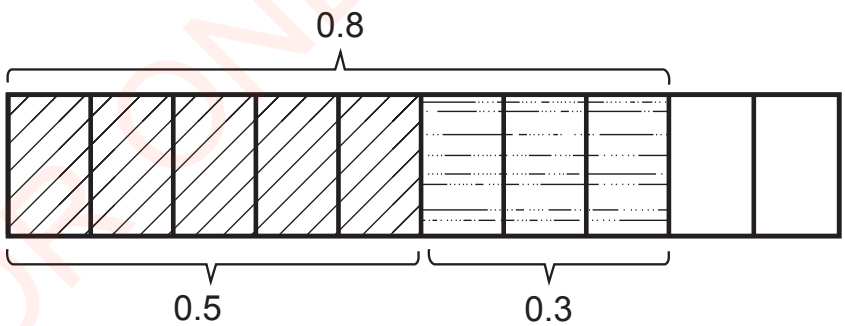
5. (a) $\frac{6}{100}$ (b) $\frac{108}{100}$ (c) $\frac{176}{100}$ (d) $\frac{27}{100}$

Addition of decimals

Addition of decimals with only one decimal place

Use the following figure to find the value of 0.5 + 0.3.

Key: One box represents zero point one.



Using the figure, we conclude that: 0.5 + 0.3 = 0.8.

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Example 1

0.5 + 0.2 =

Solution

Steps:

1. Arrange the two numbers in a vertical position in such a way that the zero digits before the decimal points are in the same vertical position.	0.5 + 0.2 _____
2. Add the tenth: 5 + 2 = 7. Write 7 in the decimal position. Add the ones: 0 + 0 = 0. Write 0 in the ones position. 3. Put a decimal point after the ones digit to separate the tenth digit.	0.5 + 0.2 0.7

Therefore, 0.5 + 0.2 = 0.7.

Example 2

1.7
+ 2.6
_____

Solution

Steps:

1. Add the tenth: 7 + 6 = 13. Write 3 in the tenth position and take 1 to the ones digits.
2. Add the ones: 1 + 2 + 1 = 4. Write 4 in the ones position.
3. Put a decimal point after the ones digit to separate the tenth digit.

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Therefore,
$$\begin{array}{r} 1.7 \\ +\ 2.6 \\ \hline 4.3 \\ \hline \end{array}$$

Example 3

22.5 + 30.2 =

Solution

In order to find the answer, arrange the numbers vertically as shown:

$$\begin{array}{r} 22.5 \\ +\ 30.2 \\ \hline 52.7 \\ \hline \end{array}$$

Therefore, 22.5 + 30.2 = 52.7.

Exercise 5

Answer the following questions:

1. 0.4 + 0.7 =
2. 0.6 + 0.3 =
3. 126.7 + 2.1 =
4. 6.4 + 7.9 =
5. 23.4 + 5.2 =
6. 36.7 + 5.4 =
7. 34.9 + 98.5 =
8. 86.5 + 12.2 =
9. 137.1 + 28.7 =
10. 250.8 + 22.4 =
11. 324.4 + 86.8 =
12. 58 + 2.6 =
13. 224.2 + 4.5 =
14. 79.3 + 46.1 =
15. 188.3 + 15.9 =

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Addition of decimal numbers with two decimal places

Example 1

2.45 + 0.31 =

Solution

Steps:

1. Arrange the two numbers in vertical position corresponding to their place values.	2.45 + 0.31
2. Add the decimal digits: 45 + 31 = 76. Write 76 in the two decimal positions.	2.45 + 0.31 76
3. Add the ones: 2 + 0 = 2. Write 2 in the ones position.	2.45 + 0.31 2 76
4. Put a decimal point after the ones digits to separate the decimal digits.	2.45 + 0.31 2.76
Therefore, 2.45 + 0.31 = 2.76.	

Example 2

2.98 + 2.65 =

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Solution

Steps:

1. Arrange the digits vertically corresponding to their positions.	2.98 + 2.65
2. Add the decimal digits: 98 + 65 = 163. Write 63 in the two decimal places, carry 1 and take it to the ones.	2.98 + 2.65 63
3. Add the ones: 2 + 2 + 1 = 5. Write 5 in the ones position.	2.98 + 2.65 5 63
4. Put a decimal point after the ones digit to separate the decimal digits.	2.98 + 2.65 5.63
Therefore, 2.98 + 2.65 = 5.63.	

Example 3

32.25 + 14.27 =

Solution

32.25
+ 14.27
46.52

Therefore, 32.25 + 14.27 = 46.52.

Exercise 6

Answer the following questions:

1. 0.35 + 0.24 = **2.** 1.56 + 0.33 = **3.** 2.36 + 1.22 =

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4. 21.57 + 9.24 =	**5.** 38.64 + 6.27 =	**6.** 26.72 + 3.18 =
7. 37.26 + 2.83 =	**8.** 4.85 + 43.37 =	**9.** 3.68 + 72.44 =
10. 95.25 + 6.76 =	**11.** 33.75 + 12.26 =	**12.** 94.18 + 24.32 =
13. 84.34 + 13.88 =	**14.** 76.09 + 21.05 =	**15.** 86.45 + 3.79 =

Subtraction of decimals

Subtraction of decimals with one decimal place

Subtraction of decimals is done using the same procedure as subtraction of whole numbers. Arrange the digits in their place values followed by subtraction from the right to the left.

Example 1

5.3 – 3.2 =

Solution

Steps:

1. Start by subtracting the tenth as you subtract whole numbers:
   3 – 2 = 1. Write 1 in the tenth position.
2. Subtract the ones: 5 – 3 = 2. Write 2 in the ones position to the left of the decimal point.

Therefore, 5.3 – 3.2 = 2.1.

Example 2

13.6 – 4.9 =

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Solution

Steps:

1. Start by subtracting the tenth: 6 – 9. This is not sufficient. Take 1 from the 3 ones and change it to get 10 tenth. Add 10 tenth to the 6 tenth to get 16 tenth. Now, subtract the tenth: 16 – 9 = 7. Write 7 in the tenth position.
2. Subtract the whole numbers: 12 – 4 = 8. Write 8 in the ones position to the left of the decimal point.

Therefore, 13.6 – 4.9 = 8.7.

Example 3

26.5 – 18.6 =

Solution

$$\begin{array}{r} 26.5 \\ -\ 18.6 \\ \hline 7.9 \end{array}$$

Therefore, 26.5 – 18.6 = 7.9.

Exercise 7

Answer the following questions:

1. 0.8 – 0.2 =
2. 0.9 – 0.7 =
3. 2.4 – 0.8 =
4. 3.6 – 2.8 =
5. 4.7 – 0.9 =
6. 22.7 – 4 =
7. 35.6 – 24.2 =
8. 64.5 – 34.8 =
9. 125.2 – 0.7 =
10. 226.4 – 22.5 =
11. 27.4 – 13.3 =
12. 12.6 – 1.4 =
13. 17.8 – 9.7 =
14. 45.1 – 22.8 =
15. 125.2 – 94.8 =

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16. 0.6 – 0.3 = **17.** 30.8 – 15.3 = **18.** 120.2 – 98.7 =

19. 55.1 – 54.9 = **20.** 235.9 – 0.7 =

Subtraction of numbers with two decimal places

Example 1

0.84 – 0.21 =

Solution

Steps:

1. Arrange the numbers vertically corresponding to their place values.	0.84 – 0.21 _____
2. Start by subtracting the decimal digits: 84 − 21 = 63. Write 63 in the two decimal positions.	0.84 –0.21 63
3. Subtract the ones: 0 – 0 = 0. Write 0 in the ones position.	0.84 –0.21 0.63
Therefore, 0 . 84 − 0 . 21 = 0 . 63.	

Example 2

2.45 – 1.64 =

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Solution

Steps:

1. Arrange the numbers vertically corresponding to their place values.	2.45 – 1.64 _____
2. Subtract the hundredth: 5 – 4 = 1. Write 1 in the hundredth position.	2.45 – 1.64 1
3. Subtract the tenth: 4 – 6. This is not sufficient. Take 1 from the two ones. Change it to get 10 tenth. Add the 10 tenth to the 4 tenth to obtain 14 tenth. Now, subtract the tenth: 14 – 6 = 8. Write 8 in the tenth position. The decimal digits become 81.	2.45 – 1.64 81
4. Subtract the ones: 1 – 1 = 0. Write 0 in the ones position.	2.45 – 1.64 0.81
Therefore, 2.45 – 1.64 = 0.81.	

Example 3

12.46 – 8.64 =

Solution

Arrange the decimal numbers vertically as shown below:

12.46
– 8.64
3.82

Therefore, 12.46 – 8.64 = 3.82.

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Exercise 8

Answer the following questions:

1.	0.62 – 0.21 =	**2.**	0.25 – 0.12 =
3.	0.86 – 0.34 =	**4.**	0.82 – 0.36 =
5.	0.67 – 0.48 =	**6.**	0.33 – 0.29 =
7.	2.45 – 0.26 =	**8.**	3.68 – 1.23 =
9.	5.27 – 4.25 =	**10.**	12.54 – 6.71 =
11.	47.76 – 34.25 =	**12.**	42.26 – 13.47 =
13.	126.57 – 52.36 =	**14.**	364.20 – 72.66 =
15.	96.31 – 28.29 =	**16.**	422.04 – 260.06 =
17.	10.14 – 3.05 =	**18.**	0.05 – 0.03 =
19.	3.05 – 2.45 =	**20.**	530.05 – 490.75 =

Multiplication of decimals

Multiplication of a number with one decimal place by a whole number

Multiplication of a number with one decimal place by a whole number is done using the same procedure used in multiplying whole numbers. Once the result is obtained, insert a decimal point before the last digit of the product to get the digit in the tenth position.

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Example 1

$$\begin{array}{r} 4.1 \\ \times \quad 2 \\ \hline \\ \hline \end{array}$$

Solution

Steps:

1. Multiply just like in whole numbers: 41 × 2 = 82.
2. Insert a decimal point between 8 and 2.
   Therefore, the answer is 8.2.

Example 2

8.3 × 12 =

Solution

8.3 × 12 = 99.6

Example 3

$$\begin{array}{r} 219.8 \\ \times \quad 23 \\ \hline \\ \hline \end{array}$$

Solution

$$\begin{array}{r} 219.8 \\ \times \quad 23 \\ \hline 6594 \\ +\ 4\,396 \\ \hline 5\,055.4 \\ \hline \end{array}$$

Therefore, the answer is 5 055.4.

Exercise 9

Answer the following questions:

1. 0.6 × 4 =
2. 2.3 × 3 =
3. 3.1 × 4 =
4. 4.7 × 21 =
5. 18.9 × 34 =
6. 112.6 × 11 =

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7. 64.5 × 72 =

8. 6.2 × 7 =

9. 136.2 × 34 =

10. 22.6 × 84 =

11. 0.2 × 92 =

12. 126.2 × 15 =

13. 98.7 × 29 =

14. 8.4 × 52 =

15.
$$\begin{array}{r} 1.2 \\ \times\ 6 \\ \hline \\ \hline \end{array}$$

16.
$$\begin{array}{r} 6.8 \\ \times\ 5 \\ \hline \\ \hline \end{array}$$

17.
$$\begin{array}{r} 21.4 \\ \times\ 8 \\ \hline \\ \hline \end{array}$$

18.
$$\begin{array}{r} 699.7 \\ \times\ 2 \\ \hline \\ \hline \end{array}$$

19.
$$\begin{array}{r} 324.2 \\ \times\ 14 \\ \hline \\ \hline \end{array}$$

20.
$$\begin{array}{r} 5.6 \\ \times\ 6 \\ \hline \\ \hline \end{array}$$

Multiplication of a number with two decimal places by a whole number

Multiplication of a number with two decimal places by a whole number is done using the same procedure used in multiplying whole numbers. Once the result is obtained, insert a decimal point before the second right most digit of the product to get the digits in the tenth position and hundredth position.

Example 1

$$\begin{array}{r} 1.02 \\ \times\ 3 \\ \hline \\ \hline \end{array}$$

Solution

Steps:

1. Multiply just like in whole numbers as follows:
   102 × 3 = 306.
2. Insert a decimal point to the left of the second rightmost digit of the product, that is 3.06.

Therefore, the answer is 3.06.

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Example 2

$$\begin{array}{r} 31.25 \\ \times \quad 26 \\ \hline \\ \hline \end{array}$$

Solution

Steps:

1. Multiply just like in whole numbers as follows:
   3125 × 26 = 81250.
2. Insert a decimal point just to the left of the second rightmost digit, that is, 812.50.

Therefore, the answer is 812.50.

Example 3

$$\begin{array}{r} 212.5 \\ \times \quad 27 \\ \hline 14875 \\ + \ 4250 \\ \hline 5737.5 \\ \hline \end{array}$$

Therefore, the answer is 5 737.5.

Exercise 10

Answer the following questions:

1. 0.02 × 3 =

2. 1.13 × 2 =

3. 4.15 × 6 =

4. 2.38 × 7 =

5. 216.45 × 8 =

6. 1.83 × 4 =

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7. 531.03 × 11 =

8. 342.35 × 15 =

9. 418.62 × 13 =

10. 274.24 × 17 =

11. 135.71 × 32 =

12. 386.08 × 22 =

13. 0.08 × 29 =

14. 25.02 × 16 =

15. 336.01 × 4 =

16. 442.07 × 12 =

17. 38.27 × 12 =

18.
$$\begin{array}{r} 506.35 \\ \times \quad 28 \\ \hline \\ \hline \end{array}$$

19.
$$\begin{array}{r} 3.49 \\ \times \quad 38 \\ \hline \\ \hline \end{array}$$

20.
$$\begin{array}{r} 180.57 \\ \times \quad 19 \\ \hline \\ \hline \end{array}$$

Exercise 11

Answer the following questions:

1. Write the following decimals in numerals:

(a) One point two
(b) Zero point four
(c) Zero point seven
(d) Three point six eight
(e) Twenty five point two eight

2. Write the following decimals in words:

(a) 4.6
(b) 33.5
(c) 51.8
(d) 0.08
(e) 91.66
(f) 16.49

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3. Change the following fractions into decimals:

(a) $\frac{6}{10}$ (b) $\frac{17}{10}$ (c) $\frac{2}{10}$

(d) $\frac{83}{100}$ (e) $\frac{5}{100}$ (f) $\frac{108}{100}$

(g) $\frac{365}{100}$

4. 23.2 + 0.8 =

5. 0.5 + 3.6 =

6. 0.23 + 8.52 =

7.
$$\begin{array}{r} 38.5 \\ \times \quad 8 \\ \hline \\ \hline \end{array}$$

8.
$$\begin{array}{r} 12.9 \\ \times \quad 44 \\ \hline \\ \hline \end{array}$$

9.
$$\begin{array}{r} 180.57 \\ \times \quad 19 \\ \hline \\ \hline \end{array}$$

10.
$$\begin{array}{r} 99.15 \\ \times \quad 86 \\ \hline \\ \hline \end{array}$$

11. 19.9 – 14.5 =

12. 0.8 – 0.3 =

13. 12.1 – 9.8 =

14. 13.07 – 5.04 =

15. 87.25 – 64.96 =

16. 35.34 – 26.45 =

17. 2.3 × 22 =

18. 0.4 × 15 =

19. 0.45 × 13 =

20. 6.08 × 11 =

21. 30.25 × 14 =

22. 1.16 × 9 =

23. 5.02 × 6 =

24. 85.18 × 8 =

25. 27.58 × 31 =

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Summary

1. Decimal numbers are read from left to right. Digits to the left of a decimal point are read as whole numbers, while digits to the right of a decimal point are read one after the other.
2. In adding and subtracting decimals, one must take note of the place value of digits on both sides of the decimal point.
3. Multiplication of decimals by whole numbers is done as follows:
   Multiply the numbers as whole numbers and then put a decimal point. If the decimal number being multiplied has one decimal place, put a decimal point to the left of the rightmost first digit. If the decimal number being multiplied has two decimal places, put a decimal point to the left of the rightmost second digit.

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Chapter Ten

Square numbers and square roots

Introduction

In this chapter, you will learn how to calculate square numbers not exceeding 10 000. You will also learn how to find the square root of square numbers of up to three digits, and to solve word problems involving square numbers and square roots. This competence will help you when dealing with large or small numbers, taking measurements, when describing computer's memory, dealing with growth of different things such as bacteria, finance, interests and so on.

Square numbers

A square number is a number which is obtained by multiplying a number by itself. That is, a square of a number is the product of the given number and itself.

Finding square numbers by counting dots

Example 1

Study carefully the arrangement of dots in the following table:

(a) Write the number of dots in each set.

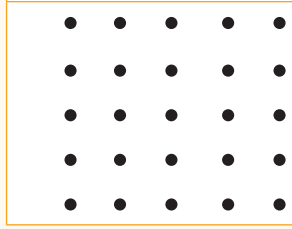
(b) Multiply the number of horizontal and vertical dots.

(c) Write the product obtained after multiplying the horizontal and vertical dots.

Arrangement of dots	Multiply the number of horizontal and vertical dots	Product
•	1 × 1	1
• • • •	2 × 2	4

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	3 × 3	9
	5 × 5	25

In this example, the square numbers are 1, 4, 9 and 25.

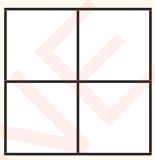
Finding square numbers using geometrical squares

Example 2

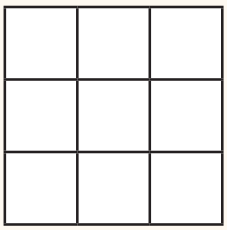
Study carefully the number of small squares in each of the following large squares, and then, find a relationship between the number of small squares and square numbers.



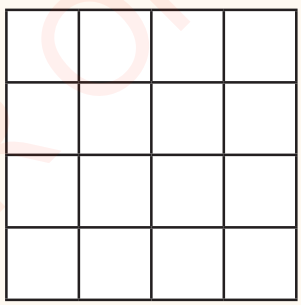
1 × 1 = 1



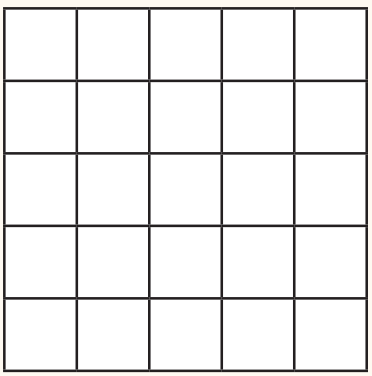
2 × 2 = 4



3 × 3 = 9



4 × 4 = 16



5 × 5 = 25

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The number of small squares in each large square is a square number. Therefore, the square numbers are 1, 4, 9, 16, and 25.

A number being multiplied by itself is said to be squared.

For example, $5 \times 5 = 5^2$ is five squared, $3 \times 3 = 3^2$ is three squared, $4 \times 4 = 4^2$ is four squared and so on.

Example 3

Write the square number of each of the following numbers:

(a) 7 (b) 10 (c) 11

Solution

(a) $7 \times 7 = 49$. Therefore, 49 is the square number of 7.

(b) $10 \times 10 = 100$. Therefore, 100 is the square number of 10.

(c) $11 \times 11 = 121$. Therefore, 121 is the square number of 11.

Exercise 1

Answer the following questions:

1. Find the product of each of the following numbers to obtain square numbers:
   (a) 20×20 (b) 21×21 (c) 8×8
   (d) 14×14 (e) 13×13

2. Write the square number of each of the following numbers:
   (a) 6 (b) 15 (c) 73
   (d) 9 (e) 31

3. Fill in the blanks in each of the following:
   (a) $81 = 9 \times$ _____
   (b) $144 =$ _____ $\times 12$
   (c) $625 = 25 \times$ _____
   (d) _____ $= 16 \times 16$
   (e) $961 = 31 \times$ _____

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4. Write the two missing square numbers in each of the following number patterns:

(a) 1, 4, 9, 16, 25, _____, _____.

(b) 1, 9, 25, 49, _____, _____.

5. Multiply each of the following numbers by itself and interpret the obtained product:

(a) 53, 55, 57, 58 (b) 30, 33, 35 (c) 88, 89, 91

6. List all the square numbers between 70 and 150.

7. Write TRUE or FALSE against each of the following statements:

(a) All square numbers are divisible by 6. _____

(b) The product of any counting number by itself is a square number. _____

A number raised to two

A square number can be written as a number raised to two as follows:

(a) $9 = 3 \times 3 = 3^2$ is read as three squared or three raised to two.

(b) $4 = 2 \times 2 = 2^2$ is read as two squared or two raised to two.

(c) $16 = 4 \times 4 = 4^2$ is read as four squared or four raised to two.

(d) $49 = 7 \times 7 = 7^2$ is read as seven squared or seven raised to two.

Therefore, a number raised to two shows that it has been multiplied by itself.

Example

Write each of the following numbers as a number raised to two:

(a) 144 (b) 81

(c) 121

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Solution

(a) $144 = 12 \times 12$
$= 12^2$

(b) $81 = 9 \times 9$
$= 9^2$

(c) $121 = 11 \times 11$
$= 11^2$

Exercise 2

Answer the following questions:

1. Write the following products as a number raised to two:
(a) 6×6 (b) 9×9 (c) 15×15

2. Write each of the following numbers as a number raised to two:
(a) 225 (b) 256 (c) 121 (d) 289

3. Use the multiplication sign to represent each of the following numbers. The first item is given as an example.
(a) $14^2 = 14 \times 14$ (b) $10^2 =$ (c) $37^2 =$
(d) $18^2 =$ (e) $26^2 =$

4. Write each of the following numbers without finding the product:
(a) Twenty-three raised to two.
(b) Thirty-five raised to two.
(c) Seventeen raised to two.
(d) Forty-eight raised to two.

5. Fill the blanks with the missing numbers:
(a) $2 \times 2 =$ _____ $= 4$.
(b) _____ $\times$ _____ = _____ $= 49$.
(c) _____ $\times$ _____ $= 5^2 =$ _____.
(d) _____ $\times$ _____ $= 16^2 =$ _____.

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6. Complete the following Table:

Number	6		9		1
Number raised to two	6^2	11^2			
Square number	36			169	

7. Find the products of the following:

(a) 19^2 (b) 36^2 (c) 81^2

Square root of a number

The square root of a given number is a number which when multiplied by itself gives a square number. The symbol $\sqrt{\ }$ is called the square root and is used for finding the square root of a square number. For example; $\sqrt{49}$ means square root of 49.

$\sqrt{49} = \sqrt{7 \times 7} = 7$.

Therefore, $\sqrt{49} = 7$. That is, the square root of 49 is 7.

Example 1

Find the square root of each of the following numbers:

(a) 25 (b) 9 (c) 100

Solution

(a) $\sqrt{25} = \sqrt{5 \times 5} = 5$.

Therefore, 5 is the square root of 25 or 5^2.

(b) $\sqrt{9} = \sqrt{3 \times 3} = 3$.

Therefore, 3 is the square root of 9 or 3^2.

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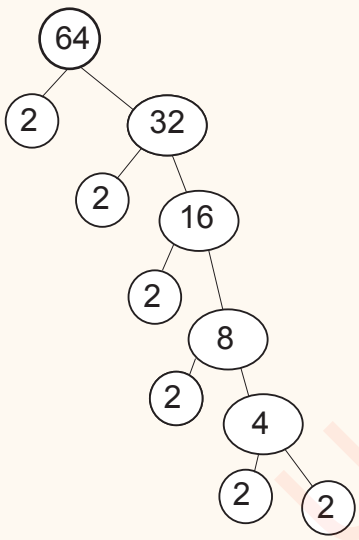
(c) $\sqrt{100} = \sqrt{10 \times 10} = 10$.

Therefore, 10 is the square root of 100 or 10^2.

Example 2

Use a tree diagram to find the square root of 64.

Solution



Steps:

1. Write the square root of 64: That is, $\sqrt{64}$
2. The product of the prime factors of 64: $\sqrt{64} = \sqrt{2 \times 2 \times 2 \times 2 \times 2 \times 2}$
3. Arrange the like factors in groups of two:
   $\sqrt{64} = \sqrt{(2 \times 2) \times (2 \times 2) \times (2 \times 2)}$
   $= \sqrt{2 \times 2} \times \sqrt{2 \times 2} \times \sqrt{2 \times 2}$
4. Since $\sqrt{2 \times 2} = 2$, it follows that,
   $\sqrt{64} = \sqrt{2 \times 2} \times \sqrt{2 \times 2} \times \sqrt{2 \times 2}$
   $= 2 \times 2 \times 2$
   $= 8.$
   Therefore, $\sqrt{64} = 8$.

Example 3

Find $\sqrt{676}$

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Solution

Steps:

1. Find the prime factors of 676 by division:

$$\begin{array}{r|l} 2 & 676 \\ 2 & 338 \\ 13 & 169 \\ 13 & 13 \\ & 1 \end{array}$$

2. Express 676 as a product of its prime factors, that is, $676 = 2 \times 2 \times 13 \times 13$
3. The product of the prime factors of 676 is: $\sqrt{676} = \sqrt{2 \times 2 \times 13 \times 13}$
4. Arrange the factors into two equal groups: $\sqrt{676} = \sqrt{(2 \times 2) \times (13 \times 13)}$
$= (\sqrt{2 \times 2}) \times (\sqrt{13 \times 13})$
5. Since $\sqrt{2 \times 2} = 2$ and $\sqrt{13 \times 13} = 13$, it follows that;
$\sqrt{(2 \times 2) \times (13 \times 13)} = 2 \times 13 = 26$

Therefore, $\sqrt{676} = 26$.

Exercise 3

Answer the following questions:

1. Find the square root of each of the following numbers:

(a) 196 (b) 400
(c) 121 (d) 324

2. Find the square root of each of the following numbers:

(a) 51×51 (b) 15×15
(c) 73×73 (d) 99×99

3. Find the square root of each of the following numbers by using prime factors:

(a) 729 (b) 529
(c) 625 (d) 784

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4. Use a tree diagram to find the square root of each of the following numbers:
   (a) 81 (b) 676 (c) 961

5. Find each of the following:
   (a) $\sqrt{256}$ (b) $\sqrt{361}$

Word problems involving square number and square root of numbers

Example

A lorry can carry 576 crates of soda. The crates are arranged in the lorry in such a way that there are equal rows and equal columns. How many crates of soda will each row or each column have?

Solution

Each row and each column has the same number of crates of soda. In order to get the number of crates in each row and column, you have to find $\sqrt{576}$. That is,

$\sqrt{576} = \sqrt{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3}$

$= \sqrt{(2 \times 2)\ (2 \times 2)\ (2 \times 2)\ (3 \times 3)}$

$= 2 \times 2 \times 2 \times 3$

$= 24.$

Therefore, each row and each column will have 24 crates of soda.

Exercise 4

Answer the following questions:

1. Find the number which is 13 raised to two.

2. Kambi, Maria and Shelembi were required to write the number 25 in different ways. Kambi wrote 5^2, Maria wrote 5×5 and Shelembi wrote $\sqrt{625}$. Were their answers correct? Give reasons.

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3. John's age is the same as the square root of 100. What is the age of John in years?

4. Teacher Christina has 17 raised to 2 chickens. How many chickens does she have?

5. The age of a certain child multiplied by itself is the same as the age of the father. If the age of the father is 49 years, find the age of the child?

Exercise 5

Answer the following questions:

1. Fill in the blanks.
   (a) 25, 36, 49, 64, _____, _____.
   (b) 121, 169, 225, 289, 361, _____, _____.

2. Copy the following table and fill numbers in the blank spaces

Number	3			23		31
Number raised to two	3^2	18^2		23^2		31^2
Square number	9		441		625	

3. Find the square roots of the following numbers:
   (a) 1 (b) 49 (c) 225 (d) 400

4. List all the square numbers between 2 and 98.

5. Fill in the blanks in each of the following:
   (a) 400 = 20 × _____.
   (b) _____ = 15 × 15.
   (c) 169 = _____ × 13.

6. Fill in the blanks in each of the following:
   (a) 16, 25, 36, 49, 64, _____, _____.
   (b) 64, 100, 144, _____, _____.
   (c) 25, 49, 81, _____, _____.
   (d) 225, 289, 361, 441, 529, _____, _____.

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7. Find the square root of 841.

8. (a) Find the value of each of the following: $\sqrt{625}$, $\sqrt{576}$, $\sqrt{961}$ and $\sqrt{729}$.
(b) Arrange the answers in part (a) from the smallest to the largest.

9. Use a tree diagram to find the square root of each of the following numbers:
(a) 196 (b) 225 (c) 441
(d) 841 (e) 900

10. Find the square root of each of the following numbers by the prime factors method:
(a) 81 (b) 169 (c) 289
(d) 256 (e) 576

11. Which number when squared the result is two hundred and eighty nine?

12. The age of Tumaini is the same as the square root of one hundred and forty four. What is the age of Tumaini in years?

Summary

1. The number obtained by multiplying a number by itself is called a square number.
2. The square root of a given number is a number which when multiplied by itself gives a square number.
3. The symbol $\sqrt{\ }$ represent the "square root" of a number.

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Chapter Eleven

Time

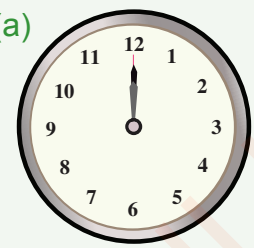
Introduction

In Standard Four, you learnt how to read, write, add and subtract time in terms of hours and minutes. In this chapter, you will learn to change, multiply and divide time measurements. You will also learn to construct a calendar. This competence will help you in scheduling and controlling your time when performing different activities. For example, it will help you adhere to school time table, transport time table, appointments and general proper time management.

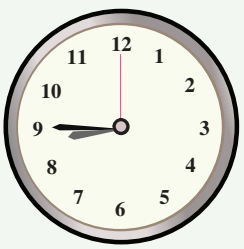
Exercise 1: Revision

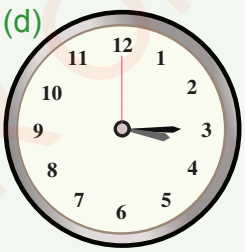
Answer the following questions:

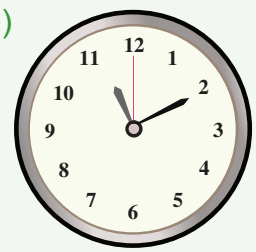
1. Write the time in words and numerals for each of the following clocks:

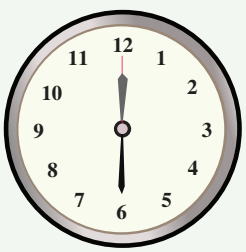
(a) 

(b) 

(c) 

(d) 

(e) 

(f) 

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2. For each of the following questions, draw a clock face with the hour and minute hands showing the following times:

(a) Quarter past twelve (12:15)

(b) Four o'clock (4:00)

(c) Half past eight (8:30)

(d) Quarter to ten (9:45)

(e) Five minutes past eleven (11:05)

3. Write the following times in words:

(a) 2:15 (b) 7:20

(c) 5:30 (d) 8:45

4.

	hours	minutes
	2	10
+	4	25

5.

	hours	minutes
	9	44
+	1	10

6.

	hours	minutes
	3	10
+	5	50

7.

	hours	minutes
	4	30
–	2	20

8.

	hours	minutes
	8	48
–	3	40

9.

	hours	minutes
	6	30
+	4	40

10.

	hours	minutes
	3	32
–	2	05

11.

	hours	minutes
	9	00
–	5	30

12.

	hours	minutes
	7	46
–	1	22

13.

	hours	minutes
	5	12
+	1	49

14. The candidates started the examination at 9:15 in the morning and finished at 10.45 in the morning. What time did the candidates use for the examination?

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15. An athlete sprinter started to run at 8.55 in the morning. If he used one hour and forty minutes to finish, at what time did he finish running?

Constructing an annual calendar

An annual calendar displays dates, weeks, months and year. It also indicates dates for national and international public holidays. Carefully study the following calendar, then identify the features you have observed.

2019 CALENDAR

JANUARY

Monday	Tuesday	Wes-day	Thursday	Friday	Saturday	Sunday
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

FEBRUARY

Monday	Tuesday	Wes-day	Thursday	Friday	Saturday	Sunday
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28			

MARCH

Monday	Tuesday	Wes-day	Thursday	Friday	Saturday	Sunday
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

APRIL

Monday	Tuesday	Wes-day	Thursday	Friday	Saturday	Sunday
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

MAY

Monday	Tuesday	Wes-day	Thursday	Friday	Saturday	Sunday
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

JUNE

Monday	Tuesday	Wes-day	Thursday	Friday	Saturday	Sunday
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

JULY

Monday	Tuesday	Wes-day	Thursday	Friday	Saturday	Sunday
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

AUGUST

Monday	Tuesday	Wes-day	Thursday	Friday	Saturday	Sunday
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

SEPTEMBER

Monday	Tuesday	Wes-day	Thursday	Friday	Saturday	Sunday
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

OCTOBER

Monday	Tuesday	Wes-day	Thursday	Friday	Saturday	Sunday
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

NOVEMBER

Monday	Tuesday	Wes-day	Thursday	Friday	Saturday	Sunday
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

DECEMBER

Monday	Tuesday	Wes-day	Thursday	Friday	Saturday	Sunday
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

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1. An annual calendar displays twelve months.
2. The names of the twelve months are: January, February, March, April, May, June, July, August, September, October, November and December.
3. There are months with 31, 30, 28 or 29 days.

There are two types of years; a short year and a leap year. A short year is the year with 28 days in February, and a leap year is the year with 29 days in February. A leap year is divisible by 4, whereas, a short year is not divisible by 4. For example, the year 2016 was a leap year because it is divisible by 4 (2016 ÷ 4 = 504), but the year 2017 was a short year because the number 2017 is not divisible by 4, that is, 2017 ÷ 4 = 504 remainder 1.

Reading an annual calendar and writing dates

Reading a calendar

Example 1

Write the names of the months with 30 days.

Answer

The names of the months with 30 days are; April, June, September and November.

Example 2

Write the names of the days of a week.

Answer

The names of the days in the week are; Monday, Tuesday, Wednesday, Thursday, Friday, Saturday and Sunday.

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Writing dates

A date is written using either words or by separating the numbers which represent the day, month and year with a full stop (.), a forward slash (/) or a horizontal dash (-) and other recognized formats.

Example 1

Write the date 1/1/2018 in words.

Answer: First of January two thousand and eighteen.

Example 2

Write the date: 20th February, 2018 by separating numbers using full stops.

Answer: 20.2.2018.

Example 3

Write the date 20.2.2018 using forward slashes.

Answer: 20/2/2018.

Example 4

Write the following date using dashes: Third of May, two thousand and nineteen.

Answer: 3 – 5 – 2019.

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Exercise 2

Answer the following questions:

1. Write down the names of the months with 31 days.
2. How many Sundays does the current year have?
3. Write in words the date of the first Monday of the month of July of the current year.
4. Use dashes to write the date of the last Wednesday of the month of January of the current year.
5. Which day is the date 28/2 of this year?

Constructing and reading a monthly calendar

Of all months of a year, February has exactly 4 weeks in a short year. The other months have 4 weeks and few days. Each week has 7 days. The days of a week are: Monday, Tuesday, Wednesday, Thursday, Friday, Saturday and Sunday. These days of a week form a calendar for one month.
Use the following steps to construct a one month calendar.

Steps:

1. Draw a rectangle.
2. Inside the rectangle, draw seven vertical and six horizontal lines. These divide the rectangle into a number of smaller rectangles.
3. Write along the first row of small rectangles from left to right, the names of days, starting from Monday to Sunday.
4. Find out on what day of the week was the last date of the previous month.
5. Start by writing the digit 1 for the first day of the current month.
6. Continue writing the day numbers up to the last day of the month.

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The following table illustrates a monthly calendar:

Monday	Tuesday	Wesnesday	Thursday	Friday	Saturday	Sunday
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

Exercise 3

Answer the following questions:

1. Construct a Calendar for the month of November this year and use it to answer the following questions:
   (a) Which day is 30th of the month?
   (b) What is the date of the first Sunday of the month?

2. Construct a calendar for the month of March this year and use it to answer the following questions:
   (a) Which day is 28th of the month?
   (b) Write the date for the second Friday of the month.

3. Lilian is a nurse at a Mawenzi hospital. She started her annual leave on 28/5/2018 and returned to work on 25/6/2018. How many days was her annual leave?

4. For the years, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, and 2004:
   (a) What were the leap years?
   (b) What were the short years?

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5. Adamu attended a six months training programme on environmental care. If the training started on 1/2/2015, on what date did he finish the training programme?

Converting time measurements

In time measurement conversions, you must consider the relationship between time measurements.

Relationship between different time measurements:

1 Hour	=	60 minutes
1 Day	=	24 hours
1 Week	=	7 days
1 Month	=	28 days for February of the short year, 29 days for February of the leap year and 30 or 31 days for the other months.
1 Year	=	12 months
1 Leap year	=	366 days
1 Short year	=	365 days

Remark: The relationship between months and weeks vary depending on the given month.

Example 1

How many days are there in 72 hours?

Solution

1 day has 24 hours

72 hours = 72 ÷ 24 = 3 days.

Therefore, there are 3 days in 72 hours.

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Example 2

How many weeks are there in 91 days?

Solution

1 week has 7 days.

91 days = 91 ÷ 7 = 13 weeks.

Therefore, there are 13 weeks in 91 days.

Example 3

How many days are there in 3 leap years?

Solution

1 leap year has 366 days.

3 leap years have 3 × 366 = 1 098 days.

Therefore, 3 leap years have 1 098 days.

Example 4

Juma walked 1000 metres in 15 minutes. Convert the minutes into hours.

Solution

60 minutes are the same as 1 hour.

15 minutes are the same as $15 \div 60 = \frac{15}{60}$ hour.

Simplification gives $\frac{15}{60} = \frac{1}{4}$.

Therefore, 15 minutes are the same as $\frac{1}{4}$ of an hour.

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Exercise 4

Answer the following questions:

1. How many weeks and days are there in the following number of days?
   (a) 48 (b) 60 (c) 19 (d) 112 (e) 705

2. Convert each of the following time into days:
   (a) 12 weeks and 1 day (b) 36 weeks and 6 days
   (c) 72 weeks and 4 days (d) 80 weeks

3. A bridge was constructed in 34 days. How many weeks and days did it take to construct the bridge?

4. If it takes 72 hours for a bus to travel from one city to another. How many days does this bus take to travel to its destination?

5. The green vegetables in the garden took 30 days to mature. Convert this time into weeks and days.

6. Change 360 minutes into hours.

7. How many minutes are there in one day?

8. Convert 28 hours into days.

9. Convert 70 hours into minutes.

10. How many hours are there in 10 days?

Multiplication of time measurements

When multiplying time measurement by the given number, start by multiplying the smaller time measurement followed by the larger time measurement.

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Multiplication of hours and minutes

When multiplying hours and minutes, remember that 1 hour = 60 minutes. Start by multiplying minutes followed by hours.

Example 1

hours	minutes
2	10
×	3

Solution

Steps:

1. Multiply minutes: 3 × 10 = 30 minutes. Write 30 in the minutes position.	hours minutes 2 10 × 3 30
2. Multiply hours: 3 × 2 = 6 hours. Write 6 in the hours position.	hours minutes 2 10 × 3 6 30

Therefore, the answer is 6 hours and 30 minutes.

Example 2

hours	minutes
7	21
×	4

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Solution

Steps:

1. Multiply minutes: 4 × 21 = 84 minutes. 1 hour = 60 minutes. Therefore, 84 minutes = 1 hour and 24 minutes. Write 24 in the minutes position and add 1 hour to the product of hours.	hours minutes 7 21 × 4 24
2. Multiply hours: 4 × 7 = 28 hours. Add 1 hour to the product of 28 hours to get 29 hours. Write 29 in the hours position.	hours minutes 7 21 × 4 29 24

Therefore, the answer is 29 hours and 24 minutes.

Example 3

hours minutes

5 16

× 6

Solution

hours minutes

5 16

× 6

31 36

Therefore, the answer is 31 hours and 36 minutes.

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Exercise 5

Answer the following questions:

1.

hours	minutes
4	10
×	2

2.

hours	minutes
3	15
×	3

3.

hours	minutes
6	13
×	5

4.

hours	minutes
7	23
×	4

5.

hours	minutes
4	16
×	6

6.

hours	minutes
1	05
×	8

7.

hours	minutes
6	20
×	3

8.

hours	minutes
2	12
×	9

9.

hours	minutes
7	05
×	3

10.

hours	minutes
10	00
×	2

Multiplication of days and hours

When multiplying days and hours, you have to remember that 1 day = 24 hours. Start by multiplying hours followed by days.

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Example 1

	days	hours
	4	3
×		7

Solution

Steps:

1. Multiply hours: 7 × 3 = 21 hours. Write 21 in the hours position.	days hours 4 3 × 7 21
2. Multiply days: 7 × 4 = 28 days. Write 28 in the days position.	days hours 4 3 × 7 28 21

Therefore, the answer is 28 days and 21 hours.

Example 2

	days	hours
	6	12
×		4

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1. Multiply hours: 4 × 12 = 48 hours. But 1 day = 24 hours. Therefore, 48 hours = 2 days. Write 0 in the hours position, and add 2 days to the product of days.	days hours 6 12 × 4 0
2. Multiply days, 4 × 6 = 24 days. Add the 2 days converted from hours to 24 days to get 26 days. Write 26 in the days position.	days hours 6 12 × 4 26 0

Therefore, the answer is 26 days.

Example 3

days hours
8 20
× 2

Solution

days hours
8 20
× 2
17 16

Therefore, the answer is 17 days and 16 hours.

Exercise 6

Answer the following questions:

1. days hours
5 10
× 2

2. days hours
11 9
× 3

3. days hours
8 11
× 5

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4.

days	hours
24	5
×	4

5.

days	hours
15	15
×	3

6.

days	hours
10	10
×	6

7.

days	hours
8	22
×	10

8.

days	hours
7	7
×	7

9.

days	hours
11	1
×	15

10.

days	hours
20	4
×	9

Multiplication of weeks and days

When multiplying weeks and days, you have to remember that, 1 week = 7 days. Start by multiplying days followed by weeks.

Example 1

weeks	days
2	2
×	3

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Solution

Steps:

1. Multiply days: 3 × 2 = 6 days. Write 6 in the days' position.	weeks days 2 2 × 3 6
2. Multiply weeks: 3 × 2 = 6 weeks. Write 6 in the weeks' position.	weeks days 2 2 × 3 6 6

Therefore, the answer is 6 weeks and 6 days.

Example 2

weeks	days
5	3
×	4

Solution

Steps:

1. Multiply days: 4 × 3 = 12 days. But 1 week = 7 days. Therefore, 12 days = 1 week and 5 days. Write 5 in the days position, and then add 1 week to the product of weeks.	weeks days 5 3 × 4 5

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2. Multiply weeks: 4 × 5 = 20 weeks.
Add 1 week converted from days to 20 weeks to get 21 weeks.
Write 21 in the weeks' position.

weeks	days
5	3
×	4
21	5

Therefore, the answer is 21 weeks and 5 days.

Example 3

weeks	days
10	6
×	6

Solution

weeks	days
10	6
×	6
65	1

Exercise 7

Answer the following questions:

1.
weeks	days
7	1
×	6

2.
weeks	days
3	3
×	3

3.
weeks	days
5	4
×	7

4.
weeks	days
11	6
×	2

5.
weeks	days
17	2
×	3

6.
weeks	days
10	5
×	4

7.
weeks	days
7	4
×	6

8.
weeks	days
12	4
×	5

9.
weeks	days
2	2
×	9

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10.

weeks	days
1	5
×	5

Multiplication of years and weeks

When multiplying years and weeks, you have to remember that 1 year = 52 weeks. Start by multiplying weeks followed by years.

Example 1

years	weeks
8	6
×	5

Solution

Steps:

1. Multiply weeks: 5 × 6 = 30 weeks. Write 30 in the weeks position.	years 8 × 5 = 30 weeks
2. Multiply years: 5 × 8 = 40 years. Write 40 in the years position.	years 8 × 5 = 40 years 30 weeks

Therefore, the answer is 40 years and 30 weeks.

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Example 2

years	weeks
5	21
×	4

Solution

Steps:

1. Multiply weeks: 21 × 4 = 84 weeks. But 1 year = 52 weeks. So, 84 weeks = 1 year and 32 weeks. Write 32 in the weeks position, and add 1 year to the product of years.	years weeks 5 21 × 4 32
2. Multiply years: 5 × 4 = 20 years. Add the converted 1 year to the 20 years to get 21 years. Write 21 in the years position.	years weeks 5 21 × 4 21 32

Therefore, the answer is 21 years and 32 weeks.

Example 3

years	weeks
3	25
×	4

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Solution

	years	weeks
	3	25
×		4
	13	48

Therefore, the answer is 13 years and 48 weeks.

Exercise 8

Answer the following questions:

1.

	years	weeks
	10	10
×		5

2.

	years	weeks
	14	7
×		8

3.

	years	weeks
	34	5
×		5

4.

	years	weeks
	25	30
×		6

5.

	years	weeks
	35	4
×		8

6.

	years	weeks
	24	15
×		6

7.

	years	weeks
	15	15
×		5

8.

	years	weeks
	175	11
×		4

9.

	years	weeks
	50	0
×		4

10.

	years	weeks
	20	6
×		9

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Multiplication of years and months

When multiplying years and months, you have to remember that 1 year = 12 months. Start by multiplying months followed by years.

Example 1

years	months
1	4
×	2

Solution

Steps:

1. Multiply months: 2 × 4 = 8 months. Write 8 in the months position.	years 1 × months 4 2 8
2. Multiply years: 2 × 1 = 2 years. Write 2 years in the years position.	years 1 × months 4 2 2 8

Therefore, the answer is 2 years and 8 months.

Example 2

years	months
3	2
×	8

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Solution

Steps:

1. Multiply months: 8 × 2 = 16 months. But 1 year = 12 months. So, 16 months = 1 year and 4 months. Write 4 in the months position, and add 1 year to the product of years.	years months 3 2 × 8 4
2. Multiply years: 8 × 3 = 24 years. Add the converted 1 year to 24 years to get 25 years. Write 25 in the years position.	years months 3 2 × 8 25 4

Therefore, the answer is 25 years and 4 months.

Example 3

years months
6 5
× 6

Solution

years months
6 5
× 6
38 6

Therefore, the answer is 38 years and 6 months.

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Exercise 9

Answer the following questions:

1.

years	months
5	2
×	4

2.

years	months
11	8
×	2

3.

years	months
9	3
×	7

4.

years	months
15	10
×	6

5.

years	months
22	11
×	3

6.

years	months
18	8
×	8

7.

years	months
20	7
×	5

8.

years	months
16	4
×	4

9.

years	months
12	10
×	2

10.

years	months
30	1
×	6

Division of time measurements

Division of hours and minutes

In dividing hours and minutes, remember that 1 hour = 60 minutes. Start by dividing hours, then divide minutes.

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Example 1

3	hours	minutes
	12	45

1. Divide 12 hours by 3 to get 4 hours. Write 4 in the hours position.	3 | hours: 12, minutes: 45 4
2. Divide 45 minutes by 3 to get 15 minutes. Write 15 in the minutes position.	3 | hours: 12, minutes: 45 4 15
Therefore, the answer is 4 hours and 15 minutes.	

Example 2

3	hours	minutes
	22	24

Solution

Steps:

1. Divide 22 hours by 3 to get 7 hours and 1 hour remainder. Change the 1 hour remainder into minutes, that is, 1 hour = 60 minutes.	3 | hours: 22, minutes: 24 7
2. Add the minutes that is, 60 + 24 = 84 minutes.	3 | hours: 21, minutes: 84 7

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3. Divide 84 minutes by 3 to get 28 minutes. Write 28 in the minutes position.	3) hours 21 minutes 84 7 28
Therefore, the answer is 7 hours and 28 minutes.	

Example 3

7) hours 30 minutes 20

Solution

7) hours 30 minutes 20

4 20

Therefore, the answer is 4 hours and 20 minutes.

Exercise 10

Answer the following questions:

1. 5) hours 15 minutes 20

2. 3) hours 14 minutes 15

3. 12) hours 125 minutes 24

4. 5) hours 10 minutes 40

5. 4) hours 30 minutes 20

6. 5) hours 44 minutes 15

7. 7) hours 47 minutes 50

8. 5) hours 24 minutes 40

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Division of days and hours

In dividing days and hours, remember that 1 day = 24 hours. Start dividing the days followed by hours.

Example 1

	days	hours
5	15	20

Solution

Steps:

1. Divide 15 days by 5 to get 3 days. Write 3 in the days position.	5) days 15 hours 20 3
2. Divide 20 hours by 5 to get 4 hours. Write 4 in the hours position.	5) days 15 hours 20 3 4
Therefore, the answer is 3 days and 4 hours.	

Example 2

	days	hours
4	38	4

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Solution

Steps:

1. Divide 38 days by 4 to get 9 days and 2 days remainder. Write 9 in the days position. Change 2 days remainder into hours, that is, 1 day = 24 hours. Thus, 2 days = 2 x 24 hours = 48 hours.	4) days 38 hours 4 9
2. Add the hours, that is, 48 + 4 = 52 hours.	4) days 36 hours 52 9
3. Divide 52 hours by 4 to get 13 hours. Write 13 in the hours position.	4) days 36 hours 52 9 13
Therefore, the answer is 9 days and 13 hours.	

Example 3

5) days 85 hours 15

Solution

5) days 85 hours 15
17 3

Therefore, the answer is 17 days and 3 hours.

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Exercise 11

Answer the following questions:

1.

	days	hours
4	8	12

2.

	days	hours
5	10	5

3.

	days	hours
8	15	16

4.

	days	hours
5	14	9

5.

	days	hours
7	15	18

6.

	days	hours
13	18	10

7.

	days	hours
6	15	0

8.

	days	hours
10	24	4

9.

	days	hours
8	32	8

10.

	days	hours
7	18	9

Division of weeks and days

In dividing time involving weeks and days, remember that 1 week = 7 days.
Always start dividing weeks followed by days.

Example 1

	weeks	days
4	48	4

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Solution

Steps:

1. Divide 48 weeks by 4 to get 12 weeks. Write 12 in the weeks position.	4) weeks 48 days 4 12
2. Divide 4 days by 4 to get 1 day. Write 1 in the days position.	4) weeks 48 days 4 12 1
Therefore, the answer is 12 weeks and 1 day.	

Example 2

10) weeks 51 days 3

Solution

Steps:

1. Divide 51 weeks by 10. You will get 5 weeks and 1 week remainder. Write 5 in the weeks position. Change 1 week remainder into days, that is, 1 week = 7 days. Add 7 days to 3 days to get 10 days.	10) weeks 51 days 3 5
2. Divide 10 days by 10 to get 1 day. Write 1 in the days position.	10) weeks 50 days 10 5 1
Therefore, the answer is 5 weeks and 1 day.	

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Example 3

	weeks	days
5	16	13

Solution

	weeks	days
5	16	13
	3	4

Therefore, the answer is 3 weeks and 4 days.

Exercise 12

Answer the following questions:

1.

	weeks	days
3	33	3

2.

	weeks	day
5	45	5

3.

	weeks	days
17	72	6

4.

	weeks	days
9	16	5

5.

	weeks	days
8	35	3

6.

	weeks	days
6	13	5

7.

	weeks	days
9	28	2

8.

	weeks	days
4	30	6

9.

	weeks	days
15	240	0

10.

	weeks	days
20	142	6

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Division of years and weeks

In dividing time involving years and weeks, remember that 1 year = 52 weeks.
Always, start dividing years followed by weeks.

Example 1

	years	weeks
6	24	12

Solution

Steps:

1. Divide 24 years by 6. You will get 4 years. Write 4 in the years position.	6) years: 24, weeks: 12 4
2. Divide 12 weeks by 6. You will get 2 weeks. Write 2 in the weeks position.	6) years: 24, weeks: 12 4 2
Therefore, the answer is 4 years and 2 weeks.	

Example 2

	years	weeks
6	99	12

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Solution

Steps:

1. Divide 99 years by 6 to get 16 years and 3 years remainder. Write 16 in the years position. Change the 3 years remainder into weeks, that is, 3 × 52 = 156 weeks. Add weeks: 12 + 156 = 168 weeks.	6) years 99 weeks 12 16
2. Divide 168 weeks by 6 to get 28 weeks. Write 28 in the weeks position.	6) years 96 weeks 168 16 28
Therefore, the answer is 16 years and 28 weeks.	

Example 3

5) years 44 weeks 12

Solution

5) years 44 weeks 12

8 44

Therefore, the answer is 8 years and 44 weeks.

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Exercise 13

Answer the following questions:

1.
	years	weeks
2	74	42

2.
	years	weeks
6	480	18

3.
	years	weeks
4	17	8

4.
	years	weeks
52	104	0

5.
	years	weeks
47	124	38

6.
	years	weeks
8	60	0

7.
	years	weeks
5	54	12

8.
	years	weeks
11	670	30

9.
	years	weeks
12	125	4

10.
	years	weeks
17	365	9

Division of Years and months

In dividing time measurements that involve years and months, remember that, 1 year = 12 months. Always, start dividing years followed by months.

Example 1

	years	months
2	6	8

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Solution

Steps:

1. Divide 6 years by 2 to get 3 years. Write 3 in the years position.	2) years 6 months 8 3
2. Divide 8 years by 2 to get 4 months. Write 4 in the months position.	2) years 6 months 8 3 4
Therefore, the answer is 3 years and 4 months.	

Example 2

5) years 98 months 4

Solution

Steps:

1. Divide 98 years by 5 to get 19 years and 3 years remainder. Write 19 in the years position. Change the 3 years remainder into months, that is, 1 year = 12 months. Thus, 3 years = 3 x 12 months = 36 months. Add the obtained 36 months to the 4 months to get 40 months.	5) years 98 months 4 19

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2. Divide 40 months by 5 to get 8 months.
Write 8 in the months position.

	years	months
5	95	40
	19	8

Therefore, the answer is 19 years and 8 months.

Example 3

	years	months
9	98	3

Solution

	years	months
9	98	3
	10	11

Therefore, the answer is 10 years and 11 months.

Exercise 14

Work out the following questions:

1.

	years	months
7	98	7

2.

	years	months
8	87	4

3.

	years	months
5	98	9

4.

	years	months
10	105	10

5.

	years	months
15	51	3

6.

	years	months
11	115	6

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7.

	years	months
18	216	0

8.

	years	months
21	127	9

9.

	years	months
8	1866	8

10.

	years	months
11	440	0

Exercise 15

Answer the following questions:

1.

days	hours
4	2
×	4

2.

days	hours
10	15
×	2

3.

weeks	days
2	5
×	6

4.

weeks	days
12	14
×	5

5.

years	weeks
17	19
×	13

6.

years	weeks
20	40
×	10

7.

	days	hours
5	16	11

8. Change each of the following times into minutes:

(a) 7 hours (b) $4\frac{1}{2}$ hours (c) $2\frac{1}{2}$ hours

9. Which of the following years is a leap year: 2008, 2009, 2010 and 2011?

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10. Change 48 hours into days.

11. Change 124 hours into days and hours.

12. Lusia visited her sister Fausta. She stayed with her for 144 hours. How many days did she stay with her sister?

13. Write the total numbers of days for the months of June, July and August.

14. How many years and months are there in 65 months?

15. A student was required to study Mathematics at school for the whole year 2017. If the student was on leave in June and December, how many days was the student at school during that year?

16. A year in which February has 29 days is known as a _____ year.

17. In a normal cycle of one year, which months follow each other and have 31 days?

18. How many weeks and days are there in April?

19. Which among the two years, 2000 and 2006 had fewer days than the other?

20. A train left Dar es Salaam to Mwanza on Thursday afternoon at 2.00 p.m. If the train travelled for 58 hours, on which day did the train arrive in Mwanza?

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Summary

1. In multiplying time measurements by a number, start by multiplying the smaller measurement. When the product of the smaller unit is larger than 1 unit of the larger time measurement, convert it into the larger unit and write the remainder in the smaller time unit.
2. In dividing time measurements by a number, start by dividing the larger measurements, followed by smaller time measurements.
3. In multiplying or dividing time measurements by a number, take note of the relationship that exists between the given time measurement units.
4. A year which is divisible by 4 is known as a leap year. In a leap year, February has 29 days.
5. A year which is not divisible by 4 is known as a short year. In a short year, February has 28 days.

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Chapter Twelve

Metric units

Introduction

In Standard Four, you learnt how to convert metric units of length, mass and volume. In this chapter, you will learn how to convert, add and subtract metric units of length, mass and volume. This competence will help you to use proper metric units in different activities. For instance, cooking, tailoring, carpentry, construction of buildings, roads, bridges and the like. The knowledge on metric units is also important in business and agriculture.

Exercise 1: Revision

Answer the following questions:

1. Match the set of words in group A with those in group B such that they are meaningful.

	Group A	Group B
(a)	A metric unit for rice	Metric units
(b)	A metric unit for the length of a pencil	Mililitre
(c)	Metre, kilogram, litre	Centimetre
(d)	A metric unit for milk	Kilometre
(e)	A long metric unit of length	Weight

2. Convert the following into grams:

(a) 2 kg (b) 45 kg (c) 8 kg

3. Eliza walks 3 km and 500 m in the morning. In the afternoon, she walks 2 km and 500 m. What distance does Eliza walk daily?

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4. Convert the following grams into kilograms:
(a) 1 000 g (b) 40 g (c) 3 500 g

5. A bottle with volume 1 000 ml contains 750 ml of milk. How much more milk should be added into the bottle to fill it?

Metric units of length

Relationship between metric units of length

The relationship between metric units of length starts with the minimum metric unit, which is millimetre (mm) up to the maximum metric unit of length which is kilometre (km). Generally, there are seven metric units of length which are related as shown in the following table:

millimetre (mm)	centimetre (cm)	decimetre (dm)	metre (m)	decametre (dam)	hectometre (hm)	kilometre (km)
1						
10	1					
100	10	1				
1 000	100	10	1			
10 000	1 000	100	10	1		
100 000	10 000	1 000	100	10	1	
1 000 000	100 000	10 000	1 000	100	10	1

Using the above table of metric units of length, it is possible to find the relationship between any two different metric units of length. For example, from the table;
(a) 1 m = 1 000 mm
(b) 1 dm = 10 cm
(c) 1 dam = 10 m

Converting metric units of length

Converting large metric units of length into small metric units of length involves multiplication. Converting small metric units into large metric units involves division.

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Example 1

(a) Convert 13 kilometres into metres.

Solution

1 km = 1 000 m

13 km =?

Then, $13\,\text{km} = \frac{13\,\text{km} \times 1\,000\,\text{m}}{1\,\text{km}} = 13\,000\,\text{m}.$

Therefore, 13 kilometres equals to 13 000 metres.

(b) Convert 7 m into dm.

Solution

1 m = 10 dm

7m = ?

Then, $7\,\text{m} = \frac{10\,\text{dm} \times 7\,\text{m}}{1\,\text{m}} = 70\,\text{dm}.$

Therefore, 7 m equals to 70 dm.

Example 2

(a) Convert 300 cm into m.

Solution

1 m = 100 cm

? = 300 cm

Then, $300\,\text{cm} = \frac{300\,\text{cm} \times 1\,\text{m}}{100\,\text{cm}} = 3\,\text{m}.$

Therefore, 300 cm equals to 3 m.

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(b) Convert 500 mm into cm.

Solution

1 cm = 10 mm

? = 500 mm

Then, $500\,\text{mm} = \frac{500\,\text{mm} \times 1\,\text{cm}}{10\,\text{mm}} = 50\,\text{cm}.$

Therefore, 500 mm equals to 50 cm.

(c) Convert 3 250 metres into kilometres.

Solution

1 km = 1 000 m

? = 3 250 m

Then, $3\,250\,\text{m} = \frac{3\,250\,\text{m} \times 1\,\text{km}}{1\,000\,\text{m}}$

$= \frac{3\,250}{1\,000}\text{km}$

$= \left(3 + \frac{250}{1\,000}\right)\text{km}$

$= \left(3 + \frac{1}{4}\right)\text{km}$

$= 3\frac{1}{4}\text{km}.$

Therefore, 3 250 metres is the same as $3\frac{1}{4}$ kilometres.

Exercise 2

Answer the following questions:

1. Convert the following into metres:
   (a) 3 km (b) 9 hm (c) 7 dam (d) 4 km (e) 3 hm

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2. Convert the following into centimetres:

(a) 8 m (b) 7 dm (c) 6 dam

(d) 4 m (e) 5 hm

3. Convert the following into kilometres:

(a) 7 000 m (b) 12 000 dm

(c) 9 000 hm (d) 40 dam

4. Convert the following into metres:

(a) 6 000 mm (b) 4 000 dm (c) 7 000 cm

(d) 4 120 dm (e) 6 dam (f) 5 hm

5. Convert the following units as instructed:

(a) 10 mm into dm (b) 85 cm into dm and cm

(c) $1\frac{1}{2}$ km into m (d) $4\frac{1}{2}$ hm into m

(e) $4\frac{1}{2}$ dam into dm (f) 5 000 m into km

Addition of metric units of length

Metric units of length can be added together if they have the same units. Different metric units of length can be added together by considering the relationship between the given units.

Example 1

(a) 10 km + 3 km =

Solution

10 km + 3 km = 13 km

Therefore, 10 km + 3 km = 13 km.

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(b) 8 km 3 hm + 6 km 5 hm =

Solution

km	hm
8	3
+ 6	5
14	8

Therefore, 8 km 3 hm + 6 km 5 hm = 14 km 8 hm.

Example 2

(a) 7 km 5 hm + 4 km 8 hm =

Solution

Steps:

1. Add hectometres: 5 + 8 = 13 hm. But 1 km = 10 hm. Thus, 13 hm = 1 km + 3 hm. Write 3 in the hm column and take 1 km to the km column.	km hm 7 5 + 4 8 3
2. Add kilometres: 1 + 7 + 4 = 12 km . Write 12 in the km column.	km hm 7 5 + 4 8 12 3
Therefore, 7 km 5 hm + 4 km 8 hm = 12 km 3 hm.	

(b)

km	hm	dam
7	4	9
+ 6	6	3

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Solution

	km	hm	dam
	7	4	9
+	6	6	3
	14	1	2

Exercise 3

Answer the following questions:

1.

	cm	mm
	13	3
+	5	4

2.

	cm	mm
	3	4
+	1	8

3.

	cm	mm
	1	9
+	3	2

4.

	m	dm	mm
	3	6	7
+	7	5	9

5.

	m	dm	cm
	9	5	1
+	4	7	9

6.

	dm	cm	mm
	3	4	6
+	8	2	5

7.

	m	dm	mm
	4	7	9
+	3	8	4

8.

	m	cm	mm
	4	25	4
+	6	80	8

9.

	km	m
	9	56
+	6	48

10.

	km	m	cm
	4	40	26
	3	22	68
+	5	71	23

11.

	dm	cm	mm
	61	3	5
	8	3	8
+	11	3	4

12.

	km	hm
	5	6
+	2	8

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13.

	km	m	cm
	5	70	81
	7	47	40
+	2	860	60

14.

	dm	cm	mm
	13	4	6
	35	8	4
+	30	0	3

15.

	dm	cm	mm
	14	0	3
	40	8	6
+	12	3	1

16.

	m	cm	mm
	4	45	2
+	8	45	6

17.

	km	dam	cm
	7	40	4
	3	54	2
+	11	30	4

18.

	m	cm	mm
	6	81	4
	3	40	2
+	0	25	3

19.

	m	cm	mm
	1	65	3
	4	60	4
+	5	14	1

20.

	m	cm
	4	45
+	8	45

Subtraction of metric units of length

Metric units of length can be subtracted if they have the same unit. Different metric units of length can be subtracted by considering the relationship between the given units.

Example 1

	m	cm
	4	45
–	2	20

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Solution

Steps:

1. Subtract centimetres: 45 – 20 = 25 cm. Write 25 in the cm column.	m cm 4 45 – 2 20 25
2. Subtract the units in the metres column: 4 – 2 = 2 m. Write 2 in the metres column.	m cm 4 45 – 2 20 2 25
Therefore, the answer is 2 m and 25 cm.	

Example 2

km	m	cm
10	160	55
– 4	580	76

Solution

Steps:

1. Subtract centimetres: 55 – 76. This is not sufficient. Take 1 m from the 160 m and change it into cm. That is, 1 m = 100 cm. Add the obtained 100 cm to 55 cm to get 155 cm. Now, subtract centimetres: 155 – 76 = 79 cm. Write 79 in the cm column.	km m cm 10 160 55 – 4 580 76 79

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2. Remember in the metres column, there remained 159 m. Subtract meters: 159 – 580. This is not sufficient. Take 1 km from the 10 km and change it into metres. That is, 1 km = 1000 m.
Add the obtained 1000 m to 159 m to get 1159 m.
Now, subtract metres: 1159 – 580 = 579 m. Write 579 m in the m column.

	km	m	cm
	10	160	55
–	4	580	76
		579	79

3. In the kilometres column, there remained 9 km. Subtract kilometres: 9 – 4 = 5 km. Write 5 in the km column.

	km	m	cm
	10	160	55
–	4	580	76
	5	579	79

Therefore, the answer is 5 km 579 m 79 cm.

Exercis 4

Work out the following:

1.

	km	m
	26	580
–	12	870

2.

	km	m	cm
	27	240	64
–	14	860	95

3.

	m	cm
	12	30
–	4	35

4.

	km	m	dm
	125	120	8
–	85	260	3

5.

	km	m	cm
	19	122	71
–	13	410	90

6.

	dm	cm
	10	5
–	3	7

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7.

dm	cm	mm
9	4	5
– 3	7	6

8.

cm	mm
9	9
– 2	3

9.

km	m
9	400
– 5	700

10.

km	m
9	500
– 4	700

11.

km	m
9	390
– 6	800

12.

km	m
105	200
– 5	105

13.

dm	mm
75	2
– 4	5

14.

km	dam	cm
17	6	6
– 10	3	5

15.

m	cm
8	4
– 1	6

Metric units of mass

Masses of objects can be measured in metric units which are tons (t), kilograms (kg), hectograms (hg), decagrams (dag), grams (g), decigrams (dg), centigrams (cg) and milligrams (mg).

Relationship between metric units of mass

milligrams (mg)	centigrams (cg)	decigrams (dg)	grams (g)	decagrams (dag)	hectograms (hg)	kilograms (kg)
1						
10	1					
100	10	1				
1 000	100	10	1			
10 000	1 000	100	10	1		
100 000	10 000	1 000	100	10	1	
1 000 000	100 000	10 000	1 000	100	10	1

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Relationships between the given metric units of mass can be established by using the given table. For example;

(a) 1 g = 1 000 mg (b) 1 cg = 10 mg

(c) 1 g = 100 cg (d) 1 kg = 1 000 g

Converting metric units of mass

Converting a large unit of mass into a small unit of mass involves multiplication.
Converting a small unit of mass into a large unit of mass involves division.

Example 1

(a) Convert 5 kilograms into grams.

Solution

1 kg = 1 000 g

5 kg =?

Then, $5\,\text{kg} = \dfrac{1\,000\,\text{g} \times 5\,\text{kg}}{1\,\text{kg}} = 5\,000\,\text{g}.$

Therefore, 5 kilograms are equal to 5 000 grams.

(b) Convert $8\frac{1}{2}$ tons into kilograms.

Solution

1 ton = 1 000 kilograms

$8\frac{1}{2}$ tons =?

Then, $8\frac{1}{2}\,\text{tons} = \dfrac{1\,000\,\text{kg} \times 8\frac{1}{2}\,\text{tons}}{1\,\text{ton}}$

= 8 000 kg+ 500 kg = 8 500 kg.

Therefore, $8\frac{1}{2}$ tons are equal to 8 500 kilograms.

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Example 2

(a) Convert 6 000 grams into kilograms.

Solution

1 000 g = 1kg

6 000 g = ?

So, $6\,000\,g = \frac{6\,000\,g \times 1\,kg}{1\,000\,g} = 6\,kg.$

Therefore, 6 000 grams are equal to 6 kilograms.

(b) How many kilograms are in 600 000 milligrams?

Solution

1 kg = 1 000 000 mg

? = 600 000 mg

Then, $600\,000\,mg = \frac{600\,000\,mg \times 1\,kg}{1\,000\,000\,mg} = 0.6\,kg.$

Therefore, there are 0.6 kilograms in 600 000 milligrams.

Exercise 5

Answer the following questions:

1. Convert each of the following kilograms into tons:

(a) 1 200 kg (b) 40 000 kg (c) 6 500 kg

2. Convert each of the following tons into kilograms:

(a) 6 tons (b) 15 tons (c) $4\frac{1}{2}$ tons

3. Convert each of the following milligrams into grams:

(a) 4 250 mg (b) 500 000 mg (c) 200 000 mg

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4. How many kilograms are there in each of the following grams?

(a) 180 g (b) 3 500 g (c) 7 500 g

5. How many milligrams are there in each of the following grams?

(a) 6 g (b) 10 g (c) $1\frac{1}{2}$ g

Addition of metric units of mass

When adding metric units of mass, start with the smallest metric unit of mass to the largest metric unit of mass while considering the relationships between units of given metric units.

Example 1

	g	mg
	4	225
+	4	370

Solution

Steps:

1. Add milligrams: 225 + 370 = 595 mg. Write 595 in the mg column.	g mg 4 225 + 4 370 595
2. Add grams: 4 + 4 = 8 g. Write 8 in the g column.	g mg 4 225 + 4 370 8 595

Therefore, the answer is 8 g 595 mg.

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Example 2

	t	kg
	4	450
+	3	350

Solution

Steps:

1. Add kilograms: 450 + 350 = 800 kg. Write 800 in the kg column.	t kg 4 450 + 3 350 800
2. Add tons: 4 + 3 = 7 t. Write 7 in the tons column.	t kg 4 450 + 3 350 7 800

Therefore, the answer is 7 t 800 kg.

Example 3

	t	kg
	10	470
+	17	475

Solution

	t	kg
	10	470
+	17	475
	27	945

Therefore, the answer is 24 t 945 kg.

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Exercise 6

Answer the following questions:

1.

	t	kg
	6	750
+	5	250

2.

	g	mg
	6	523
+	9	874

3.

	t	kg
	6	345
+	6	820

4.

	kg	dag
	4	75
+	8	25

5.

	g	mg
	2	175
+	3	945

6.

	hg	dg
	19	375
+	14	765

7.

	t	dag
	4	500
+	7	660

8.

	kg	g
	3	800
+	3	434

9.

	kg	dg
	3	460
+	1	630

10.

	g	mg
	6	200
+	3	450

11.

	g	cg
	112	1
+	36	27

12.

	kg	hg
	3	4
+	3	1

13.

	t	cg	mg
	12	216	9
+	5	801	6

14.

	t	hg	g
	50	90	10
	25	70	30
+	20	55	30

15.

	hg	g	sg
	40	80	30
	71	14	40
+	20	22	70

16.

	kg	g
	14	365
	9	475
+	3	300

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Subtraction of metric units of mass

When subtracting metric units of mass, start with the smallest metric unit and proceed to the largest metric unit while considering the relationship between the given metric units of mass.

Example 1

	t	kg
	12	740
–	6	420

Solution

Steps:

1. Subtract kilograms: 740 – 420 = 320 kg. Write 320 in the kg column.	t kg 12 740 – 6 420 320
2. Subtract tons: 12 – 6 = 6 t. Write 6 in the tons column.	t kg 12 740 – 6 420 6 320

Therefore, the answer is 6 t 320 kg.

Example 2

	t	kg	g
	6	200	550
–	2	300	750

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Solution

Steps:

1. Subtract grams: 550 – 750. It is not sufficient. Take 1 kg from the 200 kg and convert it into grams. That is, 1 kg = 1 000 g. Add the obtained 1000 g to 550 g to get 1550 g. Now, subtract grams: 1550 – 750 = 800 g. Write 800 in the g column.

	t	kg	g
	6	200	550
–	2	300	750
			800

2. Remember that 199 kg remained in the kg column. Subtract kilograms: 199 – 300. It is not sufficient. Take 1 t from the 6 t and convert it into kg. That is, 1 t = 1000 kg. Add the obtained 1000 kg to 199 kg to get 1199 kg.
Now, subtract kg: 1199 – 300 = 899 kg. Write 899 in the kg column.

	t	kg	g
	6	200	550
–	2	300	750
		899	800

3. Subtract tons: 5 t remained in the t column.
5 – 2 = 3 t. Write 3 in the t column.

	t	kg	g
	6	200	550
–	2	300	750
	3	899	800

Therefore, the answer is 3 t 899 kg 800 g.

Exercise 7

Answer the following questions:

1.

	t	kg
	6	220
–	4	114

2.

	t	kg
	26	370
–	13	250

3.

	t	kg
	15	620
–	13	220

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4.

kg	g
14	190
– 8	650

5.

kg	g
14	239
– 12	910

6.

t	hg
4	54
– 2	340

7.

kg	dag
20	600
– 6	560

8.

g	mg
17	910
– 12	440

9.

kg	g
16	860
– 13	900

10.

t	hg	g
10	43	64
–	37	27

11.

g	mg
40	720
– 15	570

12.

hg	g
15	85
– 12	90

13.

t	g	cg
70	40	60
– 15	12	38

14.

t	g	mg
6	800	660
– 3	280	830

15.

hg	g	cg
4	31	12
– 1	81	04

Metric units of volume

Volume of objects can be measured in metric units which are litre (l) and millilitre (ml).

The basic metric unit of volume is the litre (l).

1 litre = 1000 millilitres (ml).

Converting metric units of volume

Converting large metric units of volume into small metric units of volume involves multiplication, and converting small metric units of volume into large metric units of volume involves division. In each case, the relationships between the metric units of volume must be considered.

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Example 1

(a) How many millilitres are there in 9 litres?

Solution

1 litre = 1 000 millilitres

9 litres = ?

Then, $9\,\text{litres} = \dfrac{9\,\text{litres} \times 1\,000\,\text{ml}}{1\,\text{litre}} = 9\,000\,\text{ml}.$

Therefore, there are 9 000 millilitres in 9 litres.

(b) How many millilitres are there in $6\frac{1}{2}$ litres?

Solution

1 litre = 1 000 ml

$6\frac{1}{2}$ litres = ?

Then, $6\,\text{litres} = \dfrac{6\,\text{litres} \times 1\,000\,\text{ml}}{1\,\text{litre}} = 6\,000\,\text{ml}.$

$$\frac{1}{2}\,\text{litre} = \frac{\frac{1}{2}\,\text{litre} \times 1\,000\,\text{ml}}{1\,\text{litre}} = 500\,\text{ml}$$

Add the two results:

$6\frac{1}{2}$ litres = 6 litres + $\frac{1}{2}$ litres = 6 000 ml + 500 ml = 6 500 ml.

Therefore, there are 6 500 millilitres in $6\frac{1}{2}$ litres.

Example 2

(a) How many litres are in 18 000 millilitres?

(b) Change 8 500 millilitres into litres.

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Solution

(a) How many litres are in 18 000 millilitres?

1 litre = 1 000 ml

1 ml = $\frac{1}{1000}$ litres.

But, 18 000 ml = 18 000 × 1 ml = 18 000 $\left(\frac{1}{1000}\right)$ litres = 18 litres.

Therefore, there are 18 litres in 18 000 milliliters.

(b) Change 8 500 millilitres into litres.

1 litre = 1 000 ml

1 ml = $\frac{1}{1000}$ litres.

But 8 500 ml = 8 000 ml + 500 ml

8 000 ml = 8 000 × 1 ml

= 8 000 × $\frac{1}{1000}$ litres

= 8 litres

500 ml = 500 × $\frac{1}{1000}$ litres = $\frac{1}{2}$ litres

Add the two results:

8 500 ml = 8 000 ml + 500 ml

= 8 litres + $\frac{1}{2}$ litres = $8\frac{1}{2}$ litres

= 8.5 litres.

Therefore, 8 500 ml = $8\frac{1}{2}$ litres or 8.5 litres.

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Exercise 8

Answer the following questions:

1. How many mililitres are there in each of the following litres?
   (a) 9 litres
   (b) $4\frac{1}{2}$ litres
   (c) $3\frac{1}{4}$ litres
   (d) 5 litres

2. How many litres are there in the following measurements?
   (a) 14 000 ml
   (b) 6 000 ml
   (c) 2 000 ml
   (d) 8 500 ml

3. Salome carried a bucket of 20 litres of water. What volume of water did she carry in millilitres?

Addition of metric units of volume

Example 1

	l	ml
	3	600
+	4	450

Solution

Steps:

1. Add millilitres: 600 + 450 = 1 050 ml, but 1 litre = 1 000 ml. Convert 1 050 ml into 1 litre and 50 ml. Write 50 in the ml column and carry over 1 litre.

	l	ml
	3	600
+	4	450
		50

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2. Add litres: Remember the 1 litre that was carried over in step 1. That is, 1 + 3 + 4 = 8 l. Write 8 in the litres column.

	l	ml
	3	600
+	4	450
	8	50

Therefore, the answer is 8 l 50 ml.

Example 2

	l	ml
	6	550
+	3	160

Solution

	l	ml
	6	550
+	3	160
	9	710

Therefore, the answer is 9 l 710 ml.

Exercise 9

Answer the following questions:

1.

	l	ml
	415	205
+	27	8

2.

	l	ml
	360	350
+	124	230

3.

	l	ml
	600	40
+	350	250

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4.

l	ml
475	75
+ 126	520

5.

l	ml
78	426
+ 55	542

6.

l	ml
14	760
+ 14	138

7.

l	ml
4	750
316	250
+ 15	101

8.

l	ml
17	800
+ 3	366

9.

l	ml
3	400
+ 4	360

10.

l	ml
20	920
14	112
+ 13	126

Subtraction of metric units of volume

Example 1

80 l 370 ml – 45 l 160 ml =

Solution

Steps:

1. Subtract ml: 370 – 160 = 210 ml. Write 210 in the ml column.

l	ml
80	370
– 45	160
	210

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2. Subtract litres: 80 – 45 = 35 l. Write 35 in the litre column.

	l	ml
	80	370
–	45	160
	35	210

Therefore, the answer is 35 l 210 ml.

Example 2

	l	ml
	15	350
–	10	370

Solution

	l	ml
	15	350
–	10	370
	4	980

Therefore, the answer is 4 l 980 ml.

Exercise 10

Answer the following questions:

1.

	l	ml
	30	75
–	16	87

2.

	l	ml
	500	50
–	300	250

3.

	l	ml
	68	423
–	41	544

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4.

	l	ml
	45	513
–	16	701

5.

	l	ml
	46	48
–	33	35

6.

	l	ml
	72	490
–	37	541

7.

	l	ml
	100	100
–	15	900

8.

	l	ml
	330	800
–	130	600

9.

	l	ml
	75	426
–	53	532

10.

	l	ml
	11	41
–	8	74

11.

	l	ml
	20	93
–	16	37

12.

	l	ml
	90	180
–	45	382

13.

	l	ml
	31	510
–	16	600

14.

	l	ml
	48	17
–	33	35

15.

	l	ml
	62	281
–	37	541

16.

	l	ml
	100	700
–	15	900

17.

	l	ml
	330	600
–	130	800

18.

	l	ml
	75	378
–	53	532

19.

	l	ml
	25	61
–	8	75

20.

	l	ml
	66	89
–	52	48

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Exercise 11

Answer the following questions:

1.

dm	cm	mm
6	25	6
+ 3	12	2

2.

t	kg	g
11	500	174
+ 7	751	937

3.

l	ml
50	25
– 45	675

4.

km	m	cm
5	400	80
+ 10	200	40

5.

kg	g
474	572
– 340	281

6.

l	ml
315	950
+ 16	250

7. A tank containing 45 litres spilled out some water. If 23 litres of water remained in the tank, how many litres of water spilled out?

8. A fisherman sold 3 tons and 680 kg of fish in January and 4 tons and 250 kg in February. Find the difference between the weight of fish sold in February and January.

9. Three line segments of length 14 cm, 9 cm and 21 cm were drawn and joined together. What is the length of the line segment obtained by joining together all three line segments?

10. Mr. Mapesa had two tanks of kerosene. The first tank was filled with 216 litres of kerosene. The second tank contained $\frac{3}{4}$ of the kerosene contained in the first tank. How many litres of kerosene were in the second tank?

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11. In one year, a shopkeeper bought 76 000 kg of flour, 61 000 kg of rice and 7 200 kg of salt. How many kilograms of the three items did he buy in that year?

12. A carpenter joined two pieces of wood into one piece of length 10 metres. If the length of the first piece was 3.5 metres, what was the length of the second piece of wood?

Summary

1. The relationship between metre and centimetre is: 1 m = 100 cm.
2. The relationship between kilogram and gram is: 1 kg = 1 000 g.
3. The relationship between litre and millilitre is: 1ℓ = 1 000 mℓ.
4. In adding and subtracting metric units of length, mass or volume, consider the relationship between the given units involved in the operation.

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Chapter Thirteen

Tanzanian Currency

Introduction

In Standard Four, you learnt about adding, subtracting and multiplying Tanzanian currency (money). You also learnt how to solve word problems involving buying and selling various goods and services. In this chapter, you will learn how to express money in terms of shillings and cents, to add, subtract, multiply, and divide money up to one million shillings. You will also learn to solve word problems involving money. This competence will help you to know the value of your country's money. Through this competence, you will be able to buy and sell things as well as obtain a proper change when required. You are also expected to develop skills in earning, spending and saving money.

Exercise 1: Revision

Answer the following questions:

1.
sh 56 280
+ sh 38 270
_____

2.
sh 78 850
+ sh 5 850
_____

3.
sh 44 450
– sh 3 750
_____

4.
sh 5 670
– sh 3 980
_____

5.
sh 84 500
– sh 53 950
_____

6.
sh 462
× 10
_____

7.
sh 560
× 12
_____

8. sh 635 × 16 =

9. sh 99 999 − sh 86 700 =

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10. sh 11 500 + sh 80 150 =

11. sh 66 000 + sh 3 500 =

12. sh 52 670 + sh 17 380 =

13. sh 960 × 36 =

14. Juhudi had 350 shillings in his pocket. His teacher awarded him 1 000 shillings after he had passed mathematics examination. His mother also gave him a present of 1 700 shillings. How much money did Juhudi receive altogether?

15. The Head teacher bought a book for 6 500 shillings and 10 notebooks, each costing 250 shillings. He gave the shopkeeper a 10 000 shillings note. How much change did he get from the shopkeeper?

16. A bus has 32 passengers. If the fare for one passenger is 450 shillings, how much money will be paid by all the passengers?

17. sh 1 390 + sh 575 + sh 6 750 =

Tanzanian currency in shillings and cents

Tanzanian currency is in terms of shillings and cents. The value of one cent is less than the value of one shilling. Tanzanian currency is also in terms of currency coins and currency notes with different values.

(a) Currency coins in cents



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(b) Currency coins in shillings



(c) Currency notes



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The relationship that exists between shillings and cents is that, 1 shilling is the same as 100 cents. When writing money in terms of shillings and cents, always start with its value followed by the word shillings or cents. The word shillings is abbreviated as sh and the word cents is abbreviated as cts. When they are written together, the values in shillings and in cents are separated by a dot.

Example 1

(a) How many 50 cents are there in 1 shilling?
(b) Write in short form: sh 500 and 50 cts.

Solution

(a) 100 cts = sh 1
Since 100 cts = 50 cts + 50 cts and
sh 1 = 100 cts = 50 cts + 50 cts = 2 × 50 cts,
it follows that, sh 1 is the same as twice 50 cts. Therefore, there are two 50 cents in 1 shilling.

(b) Write in short form: sh 500 and 50 cts.
sh 500 and 50 cents in short is written as sh 500.50.

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Example 2

(a) Write sh 700.00 in words.
(b) Write in short form: sh 1 200 and 70 cts .

Solution

(a) 700.00 in words is written as seven hundred shillings.
(b) sh 1 200 and 70 cts is written in short form as sh 1 200.70.

Exercise 2

Answer the following questions:

1. Read and write in words the value of money written in short form in the following table. Part (a) is an example.

	Money in short form	Money in words
(a)	sh 1 100.20	One thousand one hundred shillings and twenty cents.
(b)	sh 5 88.35	
(c)	sh 75 400.10	
(d)	sh 230 000.70	
(e)	sh 1 000 000.00	
(f)	sh 632.37	
(g)	sh 48 350.05	
(h)	sh 80 495.95	
(i)	sh 1 759.50	
(j)	sh 3 600.00	

2. Read and write in short form the value of money written in words in the following table. Part (a) is an example.

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	Value of money in words	Money in short form
(a)	Two hundred shillings and twenty five cents	sh 200.25
(b)	Three hundred shillings	
(c)	2 250 shillings and 50 cents	
(d)	One hundred and forty five thousand shillings and thirty cents	
(e)	70 shillings and 10 cents	

3. For each question in the following table, read and write the value of money in short form. Part (a) is given as an example.

	Value of money in words	Money in short form
(a)	Fifty five thousand shillings and eighty five cents	sh 55 000.85
(b)	Six hundred and forty shillings and five cents	
(c)	One shilling and fifty cents	
(d)	Nine hundred and ninety nine thousand, eight hundred shillings and ninety cents	
(e)	Fifty shillings and sixty cents	

4. How many 10 cents are in 5 shillings?
5. How many shillings are 30 times 10 cents?
6. Rozi's monthly salary is 315,000 shillings and 80 cents. Express this salary in short form.

Addition of money

When adding money having a mixture of shillings and cents, the following relation between shillings and cents may be used: 1 shilling = 100 cents.

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Example 1

	sh	cts
	625	45
+	364	20

Solution

Steps:

1. Add cents: 45 + 20 = 65 cts. Write 65 in the cts column.	sh cts 625 45 + 364 20 65
2. Add shillings: 625 + 364 = sh 989. Write 989 in the sh column.	sh cts 625 45 + 364 20 989 65
Therefore, the answer is sh 989 and 65 cts.	

Example 2

	sh	cts
	4 596	65
+	3 987	75

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Solution

Steps:

1. Add cents: 65 + 75 = 140 cts. But sh 1 = 100 cts. Convert 140 cts into sh 1 and 40 cts. Write 40 in the cts column and add 1 sh to the sh column.	sh cts 4 596 65 + 3 987 75 40
2. Add shillings: 1 + 4 596 + 3 987 = sh 8 584. Write 8 584 in the sh column.	sh cts 4 596 65 + 3 987 75 8 584 40
Therefore, the answer is sh 8 584 and 40 cts.	

Example 3

sh	cts
105 001	80
+ 794 999	45

Solution

sh	cts
105 001	80
+ 794 999	45
900 001	25

Therefore, the answer is sh 900 001.25.

Exercise 3

Answer the following questions:

1. sh 863 435.10 + sh 28 375.65 =

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2. sh 645 489.15 + sh 351 432.45 =

3. sh 432 456.10 + sh 463 367.65 =

4. sh 625 445.50 + sh 357 223.85 =

5. sh 423 293.45 + sh 549 315.25 =

6. sh 14 955.50 + sh 4 955.55 =

7. sh 181 . 65 + sh 6 564 . 95 + sh 1 192 . 25 =

8.

	sh	cts
	1 060	05
+	2 175	15

9.

	sh	cts
	650	45
+	679	40

10.

	sh	cts
	5 075	05
+	3 350	50

11.

	sh	cts
	3 009	65
+	4 087	55

12.

	sh	cts
	5 707	35
	2 983	90
+	1 225	30

13.

	sh	cts
	714 370	80
+	3 056	35

14.

	sh	cts
	385 534	05
+	453 057	45

15.

	cts	cts
	433 270	55
+	433 865	45

16.

	sh	cts
	454 265	40
+	287 939	95

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17.

	sh	cts
	356 005	45
+	130 436	95

18.

	sh	cts
	456 354	50
+	130 218	95

19.

	sh	cts
	135 436	95
+	749 115	85

20.

	sh	193432.45
	sh	367 563.65
+	sh	432 210.15

Subtraction of money

Example 1

	sh	cts
	420 561	65
–	110 340	40

Solution

Steps:

1. Subtract cents: 65 – 40 = 25 cts. Write 25 in the cts column.	sh cts 420 561 65 – 110 340 40 25
2. Then, subtract shillings: 420 561 – 110 340 = sh 310 221. Write 310 221 in the sh column.	sh cts 420 561 65 – 110 340 40 310 221 25
Therefore, the answer is sh 310 221 and 25 cts.	

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Example 2

	sh	cts
	964 868	25
–	599 853	75

Solution

Steps:

1. Subtract cents: 25 – 75. This is not sufficient. Take sh 1 from sh 964 868 and convert it into cents: sh 1 = 100 cts. Add cents: 100 + 25 = 125 cts. Now, subtract cts: 125 – 75 = 50 cts. Write 50 in the cts column.	sh 964 868 – 599 853 cts 25 75 = 50
2. There remained 964 867 sh. Subtract shillings: 964 867– 599 853 = sh 365 014. Write 365 014 in the sh column.	sh 964 868 - 599 853 = 365 014 cts 25 75 50
Therefore, the answer is sh 365 014 and 50 cts.	

Example 3

	sh	cts
	953 964	45
–	599 868	65

Solution

	sh	cts
	953 964	45
–	599 868	65
	354 095	80

Therefore, the answer is sh 354 095 and 80 cts.

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Exercise 4

Answer the following questions:

1.

	sh	cts
	367 662	10
–	153 221	10

2.

	sh	cts
	444 330	30
–	367 220	10

3.

	sh	cts
	21 201	10
–	11 102	60

4.

	sh	cts
	445 540	35
–	53 102	75

5.

	sh	cts
	268 654	14
–	18 129	14

6.

	sh 571 171.00
–	sh 215 101.50

7.

	sh	cts
	511	20
–	270	05

8.

	sh	cts
	770 621	50
–	330 423	30

9.

	sh	cts
	67 501	70
–	35 322	35

10.

	sh	cts
	3 121	85
–	1 111	35

11.

	sh	cts
	612 365	35
–	81 155	25

12.

	sh	cts
	410 220	55
–	301 101	35

13.

	sh	cts
	4 505	80
–	2 321	25

14.

	sh	cts
	844 250	50
–	451 120	50

15.

	sh	cts
	568 660	45
–	34 330	15

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16.

	sh	cts
	611 180	50
–	211 070	70

17.

	sh	cts
	212 157	60
–	141 220	80

18.

	sh	cts
	774 450	00
–	274 110	00

19.

	sh 890 527.85
–	sh 30 210.80

20.

	sh	cts
	1 000 000	00
–	850 000	20

Multiplication of money

In multiplication of money by a number, start by multiplying cents followed by shillings.

Example 1

	sh	cts
	50	5
×		6

Solution

Steps:

1. Multiply cents: 6 x 5 cts = 30 cts. Write 30 in the cts column.	sh cts 50 5 × 6 30

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2. Multiply shillings: 6 x sh 50 = sh 300. Write 300 in the sh column.	sh cts 50 5 × 6 300 30
Therefore, the answer is sh 300 and 30 cts or sh 300.30.	

Example 2

sh	cts
250	75
×	10

Solution

Steps:

1. Multiply cents: 75 × 10 = 750 cts. Convert 750 cts to get sh 7 and 50 cts. Write 50 in the cts column and add sh 7 to the product of shillings after multiplying shillings.	sh cts 250 75 × 10 50
2. Multiply shillings: sh 250 × 10 = sh 2500. Add sh 7 to sh 2 500 to get sh 2 507. Write 2 507 in the shillings column.	sh cts 250 75 × 10 2 507 50
Therefore, the answer is sh 2507.50.	

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Example 3

sh	cts
5 230	90
×	29

Solution

sh	cts
5 230	90
×	29
151 696	10

Therefore, the answer is sh 151 696.10.

Exercise 5

Answer the following questions:

1.

sh	cts
500	20
×	4

2.

sh	cts
3 115	30
×	5

3.

sh	cts
601	30
×	30

4.

sh	cts
10 000	00
×	28

5.

sh	cts
4 010	90
×	2

6.

sh	cts
65	40
×	8

7.

sh	cts
21 720	60
×	20

8.

sh	cts
700	55
×	9

9.

sh	cts
180	15
×	15

10.

sh	cts
35 320	70
×	12

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Division of money

In dividing money, start by dividing shillings followed by dividing cents.

Example 1

	sh	cts
5	10	50

Solution

Steps:

1. Divide shillings: sh 10 ÷ 5 = sh 2 Write 2 in the sh position.	sh cts 5) 10 50 2
2. Divide cents: 50 cts ÷ 5 = 10 cts. Write 10 in the cents position.	sh cts 5) 10 50 2 10
Therefore, the answer is sh 2.10.	

Example 2

	sh	cts
45	205 312	50

Solution

Steps:

1. Divide sh: 205 312 ÷ 45 = 4 562 with remainder sh 22. Write 4 562 in the sh position. Change sh 22 remainder into cts, that is sh 1 = 100 cts sh 22 = 2 200 cts. Add cts: 2 200 cts + 50 cts = 2 250 cts.	sh cts 45) 205 312 50 4 562

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2. Divide cents: 2 250 cts ÷ 45 = 50 cts. Write 50 in the cents position.

	sh	cts
45)	205 312	50
	4 562	50

Therefore, the answer is sh 4 562.50.

Example 3

	sh	cts
9)	19 000	80

Solution

	sh	cts
9)	19 000	80
	2 111	20

Therefore, the answer is sh 2 111.20.

Exercise 6

Answer the following questions:

1.

	sh	cts
15)	46 740	60

2.

	sh	cts
3)	45 363	00

3.

	sh	cts
12)	24 289	20

4.

	sh	cts
15)	45 442	50

5.

	sh	cts
8)	3 200	40

6.

	sh	cts
7)	91 000	70

7.

	sh	cts
5)	136 005	40

8.

	sh	cts
13)	391 560	00

9.

	sh	cts
4)	465 600	60

10.

	sh	cts
10)	364 500	00

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11. sh 645 000.00 ÷ 8 =

12. 116) sh 8 526 cts 00

13. 24) sh 100 000 cts 80

14. 12) sh 1 740 cts 60

15. 24) sh 133 248 cts 00

16. 16) sh 144 962 cts 40

17. 25) sh 75 510 cts 00

18. 12) sh 133 248 cts 60

19. 25) sh 1 000 000 cts 00

20. sh 111.20 ÷ 20 =

Word problems involving money

Example 1

A pair of shoes is sold at sh 23 500.50. How much will 11 pairs of the same kind of shoes cost?

Solution

1 pair is sold at sh 23 500.50.

11 pairs will be sold at sh 23 500.50 × 11 = sh 258 505.50.

Therefore, 11 pairs of the shoes will be sold at 258 505.50 shillings.

Example 2

Joseph had sh 350 000. He used sh 127 500. How many shillings was he left with?

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Solution

Joseph had sh 350 000.

He used sh 127 500.

He was left with: sh 350 000 – sh 127 500 = sh 222 500.

Therefore, Joseph was left with 222 500 shillings.

Example 3

Bahati bought 3 bed sheets @ 5 000 shillings, 2 shirts @ 3 000 shillings, 4 plates @ 1 000 shillings, and 5 bowls @ 500 shillings. How much money did she pay for all the items?

Solution

The symbol @ means "each item".

Item			sh	cts
1.	3 bed sheets	@ sh 5 000	15 000	00
2.	2 shirts	@ sh 3 000	6 000	00
3.	4 plates	@ sh 1 000	4 000	00
4.	5 bowls	@ sh 500	2 500	00
Total			27 500	00

Therefore, Bahati paid 27 500 shillings for all the items.

Exercise 7

Answer the following questions:

1. Kalista bought the following items: 3 pairs of shoes @ 13 500 shillings, 3 pairs of khanga @ 9 000 shillings, 2 mobile phone batteries @ 10 000 shillings and 4 wrist watches @ 15 000 shillings. How much money did she pay for all the items?

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2. A fruit vender sold 285 mangoes for sh 119 913.75. What was the price of one mango if each mango had the same price?

3. A group of 72 friends divided sh 174 499.20 equally among themselves. How much did each member of the group get?

4. A person bought a television set for 420 000 shillings. If he sold the same television set for 580 000 shillings, what profit did he make in selling the television set?

5. A student bought the following items: 15 exercise books @ 600 shillings, 8 pens @ 500 shillings, 5 envelopes @ 200 shillings and 3 erasers @ 200 shillings. How much did the student pay for all the items?

6. Maringo had 775 000 shillings. If he spent 131 650 shillings, how much money did he remain with?

7. A farmer got 101 755 shillings for selling rice and sh 207 800.50 for selling maize. How much money did the farmer get from the two sales of crops?

8. A person had a debt of 100 000 shillings. If he managed to pay back 80 750.60 shillings, how much debt did he remain with?

9. Juma deposits into his bank account 35 000 shillings every month. How much money will he deposit in his bank account in one year?

10. Neema had 335 500 shillings. She distributed the money equally to her 11 children to enable them to buy school items. How much money did each child get?

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11. The monthly salaries of three employees of a certain school are as follows: The first employee earns sh 296 364.40, the second earns sh 350 220.35 and the third earns sh 349 416.90. Find the total amount of their monthly salaries.

12. Three cupboards were bought at the following prices: The first cupboard was bought for sh 295 000.50, the second for sh 240 000.35 and the third for sh 360 000.30. What was the cost of all three cupboards?

Exercise 8

Answer the following questions:

1. 90 cts + 45 cts =

2. sh 14 955.60 – sh 12 950.05 =

3. sh 70 300 and 40 cts + sh 113 200 and 25 cts =

4.

	sh	cts
	417	55
×		7

5.

	sh	cts
	4 500	80
–	180	45

6.

	sh	cts
	100	10
–	90	20

7.

	sh	cts
	200 500	55
–	500	60

8.

	sh	cts
	2 040	05
×		10

9.

	sh	cts
8	496	00

10.

	sh	cts
25	55 575	50

11.

	sh	cts
	475	30
×		18

12.

	sh	cts
50	8 400	00

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13. Write the following shillings and cents in words:

(a) sh 4 700.50
(b) sh 260.25
(c) sh 17 840.65
(d) sh 935.40
(e) sh 812 530.05

14. Write the following shillings and cents in short form:

(a) Eight hundred eighty-five shillings and twenty cents.
(b) One hundred thousand shillings and ninety-five cents.
(c) Three hundred and ten thousand one hundred and fifty shillings and sixty cents.
(d) Ten thousand and fifty shillings.
(e) Five hundred shillings and fifteen cents.

15. What is the value of 50 twenty cents in shillings?

16. If 10 shillings are changed into cents, how many fifty cents will be obtained?

17. Mwanahamisi got three hundred seventeen thousand shillings and seventy-five cents by selling cotton and three hundred twenty thousand shillings and twenty-five cents for selling fish. How much money did she get in total?

18. A businessman had a debt of sh 178 500.35 in a commercial bank. If he paid back sh 54 900.20, how much debt did he remain with?

19. Twenty-four members of a group divided 193 200 shillings equally among themselves. How much did each member of the group get?

20. If a pair of khanga was sold at 12 500 shillings, how much money will 44 such pairs cost?

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Summary

1. In adding, subtracting and multiplying money, start with cents followed by shillings.
2. When dividing money, start with shillings followed by cents.
3. When buying and selling items, the symbol @ means “each item”.
4. Tanzanian Currency is in the form of coins and notes of different values.
5. When shillings and cents are separated in numeral representation of money, cents are written in two numerals such as 05 cts, 12 cts and so on.

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Chapter Fourteen

Geometry

Introduction

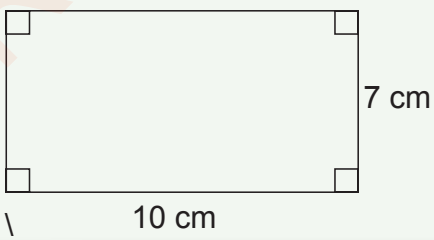
In Standard Four, you learnt how to draw lines, line segments and rays. You also learnt how to find the perimeter of rectangles, squares and triangles. In this chapter, you will learnt about types of angles, how to draw angles, parallel lines and to distinguish between different types of triangles and their properties. In addition, you will learn how to find the area of rectangles, squares and triangles. You will also learn how to solve word problems related to lines, rectangles, squares, triangles and angles. Through this competence, you will acquire the knowledge about the properties of different shapes and their relationships to mapping and architecture.

Exercise 1: Revision

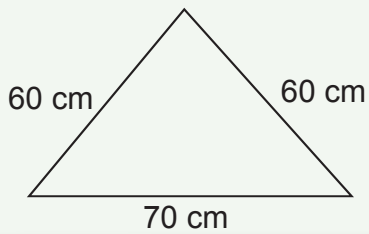
Answer the following questions:

1. Draw rays AB and BA.
2. Find the perimeter of a rectangle with length 12 cm and width 8 cm.
3. Find the perimeter of a square with length 5 cm.
4. What is the difference between a square and a triangle?
5. Draw a line segment XY.
6. Find the perimeter of each of the following figures:

(a)



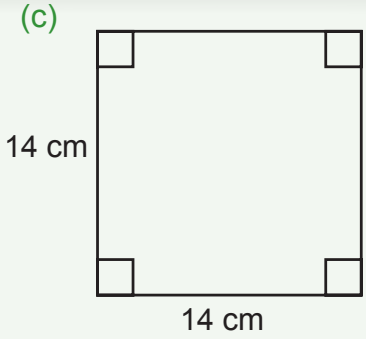
(b)



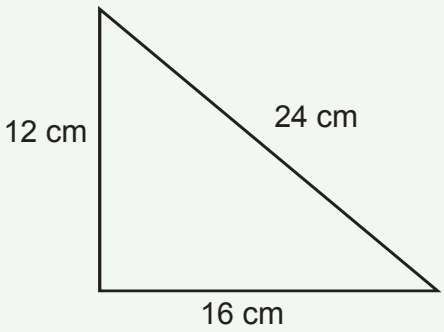
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(c)



(d)



7. Find the perimeter of a rectangle of length 5 cm and width 3 cm.

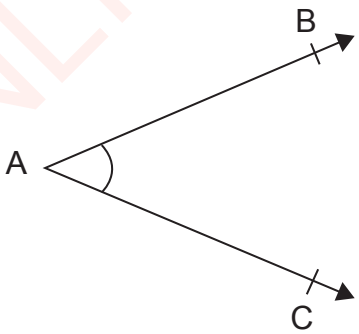
8. The perimeter of a square is 40 cm. What is the length of one of its sides?

Angles

When two rays intersect, they form an angle. The unit used when measuring an angle is degree. A symbol "o" represents the degree of an angle. Consider the following rays:



When the rays AB and AC intersect, they form an angle as shown in the following figure:



The angle formed by the intersection of the rays AB and AC is named as angle BAC or angle CAB. The notation $\angle BAC$ or $B\hat{A}C$ represents the angle BAC. The symbol $\angle$ or $\wedge$ represents the word "angle".

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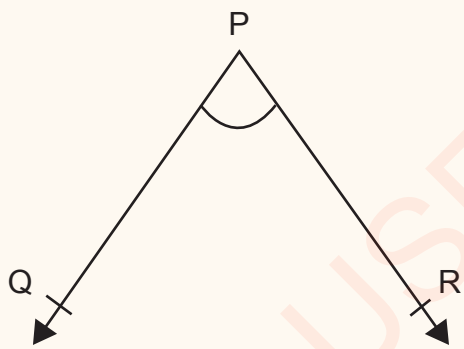
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A vertex is a point where two rays meet or intersect. The plural for vertex is vertices. When naming an angle, the middle letter must be at the vertex. For example, letter A in $B\hat{A}C$ is at the vertex A.

Naming angles

Example 1

Write in three different ways the angle given in the following figure:

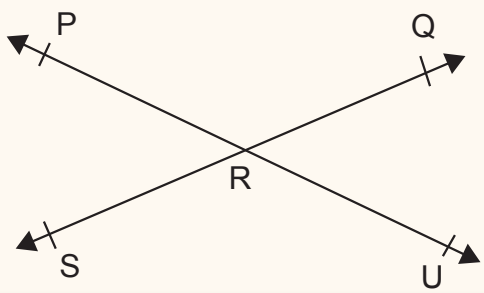


The angle can be written in three different ways as follows:

1. Angle QPR or angle RPQ
2. $Q\hat{P}R$ or $R\hat{P}Q$.
3. $\angle QPR$ or $\angle RPQ$

Example 2

Write the names of all the angles which appear in the following figure:



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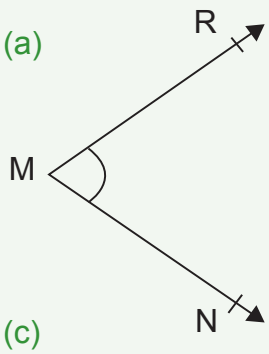
The angles which appear in the drawing are:
∠PRQ or ∠QRP, ∠PRS or ∠SRP, ∠SRUor ∠URS, and ∠QRU or ∠URQ.

Exercise 2

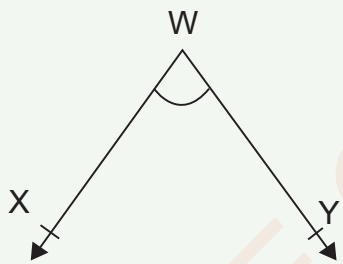
Answer the following questions:

1. Write the names of each angle in the following figures:

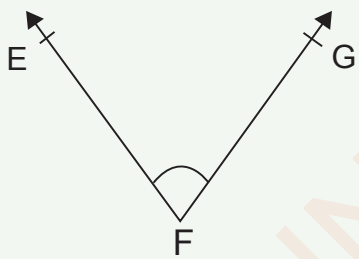
(a)



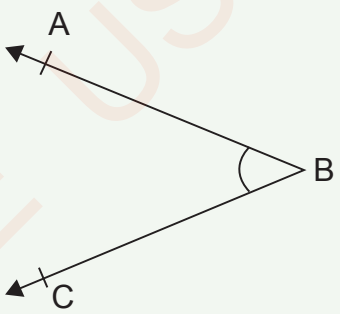
(b)



(c)

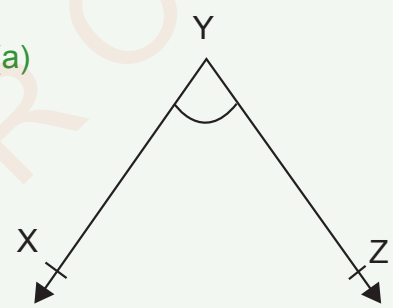


(d)

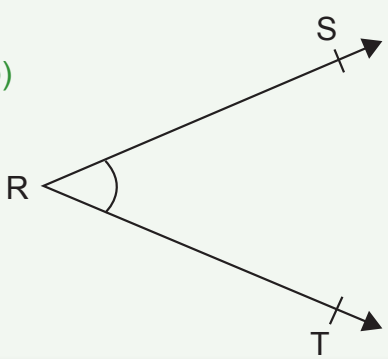


2. Mention the vertex in each of the following angles:

(a)



(b)

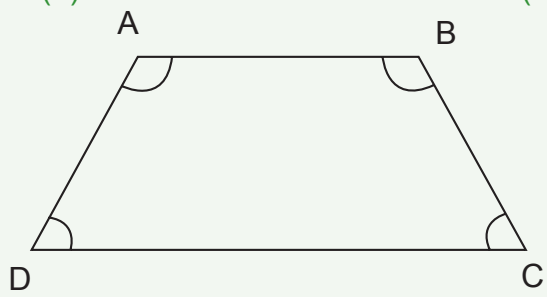


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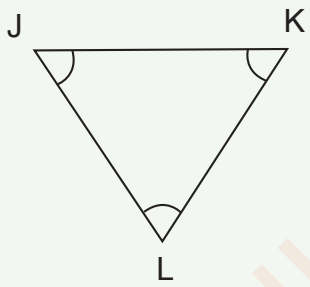
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3. Write the names of all angles in each of the following geometrical figures:

(a)



(b)



4. How many angles does each of the following figures have?

(a) A triangle

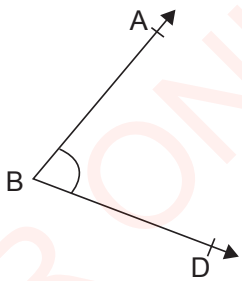
(b) A square.

Types of angles

The following are the types of angles:

Acute angle

An acute angle is an angle which is greater than 0 degrees (0°) and less than 90 degrees (90°). Angle ABD in the following figure is between 0° and 90°, thus it represents an acute angle.



Right angle

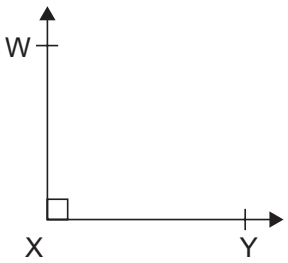
A right angle is an angle that measures exactly 90°. Angle WXY in the following figure is a right angle.

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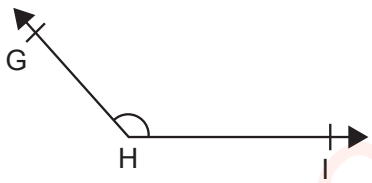
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A right angle is greater than an acute angle and less than an obtuse angle. In geometrical figures, all right angles are denoted by ⌞.



Obtuse angle

An obtuse angle is an angle that measures between 90° and 180°. In the following figure, angle GHI is an obtuse angle.



An obtuse angle is greater than a right angle and less than a straight angle.

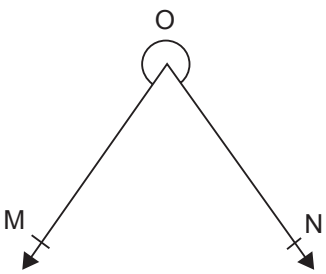
Straight angle

A straight angle is an angle that measures exactly 180°. It is represented by a straight line. In the following figure, angle STU is a straight angle.



Reflex angle

A reflex angle is an angle that is greater than 180° and less than 360°. In the following figure, ∠MON is a reflex angle.



A reflex angle is greater than 180° and less than 360°.

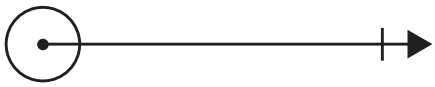
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Full angle

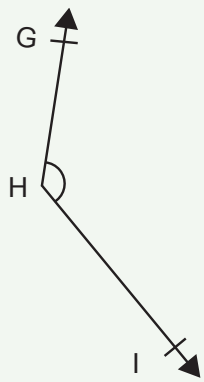
A full angle is an angle that measures exactly 360°. It is greater than all other angles. The following figure represents a full angle.



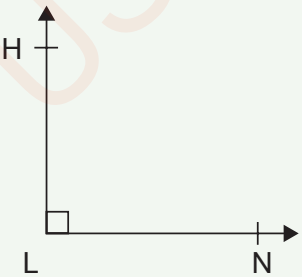
Exercise 3

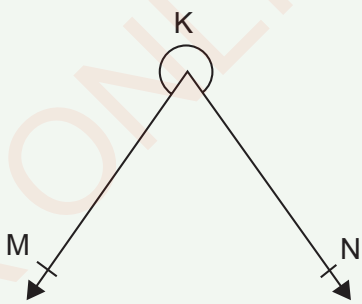
Answer the following questions:

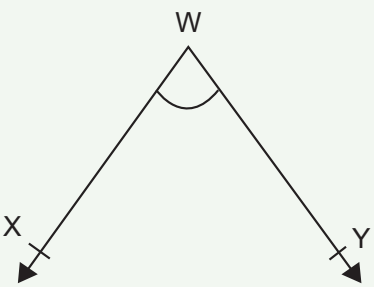
1. Study carefully the following angles and then answer the questions that follow.











(a) Which angle is an acute angle?
(b) Which angle is a right angle?
(c) Mention an obtuse angle?
(d) Which angle is a straight angle?
(e) Which angle is a reflex angle?

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2. Name all the right angles in the following figure:



3. Write "TRUE" or "FALSE" for each of the following statements:

(a) An acute angle is less than a right angle.

(b) An obtuse angle is less than an acute angle.

(c) Every straight angle equals the sum of two right angles.

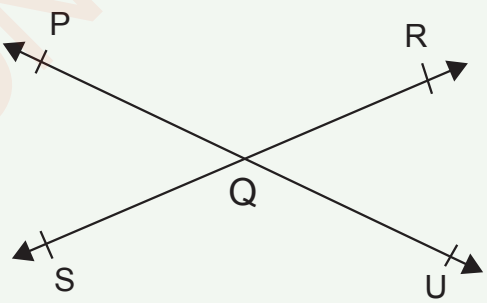
(d) A reflex angle is less than an obtuse angle.

(e) A straight angle is less than a reflex angle.

4. Name all the right angles in the following figure:



5. Write the names and types of all the angles in the following figure.



6. Name two geometrical figures whose inside angles are all right angles.

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Construction of angles by estimation

If you understand the properties of an angle, you can construct it by estimating its value.

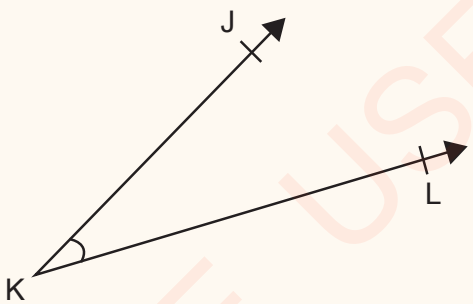
Example 1

Construct an acute angle JKL.

Solution

Steps:

1. Draw a ray KL.
2. Draw a ray KJ starting from K to J to get the vertex K and estimate ∠JKL such that it is less than 90°.
3. You get ∠ JKL with vertex at K, as seen in the following figure.



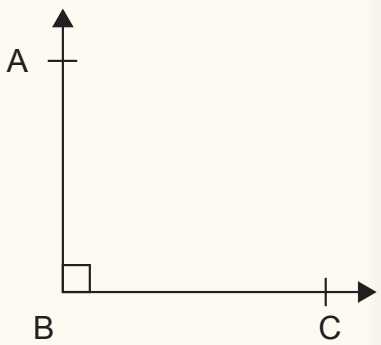
Example 2

Construct a right angle ABC.

Solution

Steps:

1. Draw a horizontal ray BC.
2. Draw a vertical ray BA starting from B to a point A. The two rays form a right angle at the vertex B.
3. Insert a small square box at the vertex B as shown in the following figure:



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Exercise 4

Answer the following questions:

1. Construct ∠ ABC and ∠ DEF such that ∠ ABC is smaller than ∠ DEF.
2. Construct a right angle LMN.
3. Construct an obtuse angle WXY.
4. Construct a straight angle ABC.
5. Construct an acute angle DEF.

Lines of symmetry

A line of symmetry is a line that divides a figure into two equal parts. Some geometrical figures have infinite lines of symmetry, some have few lines of symmetry and others have no lines of symmetry, especially figures with irregular shapes.

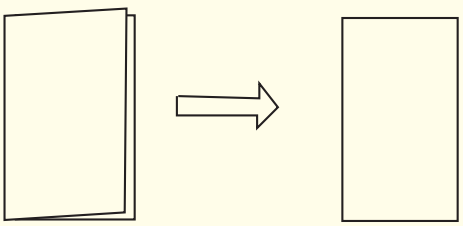
Activity 1: Identifying lines of symmetry of a square

Steps:

1. Take a square shaped piece of paper.



2. Fold the piece of paper into two equal parts as shown in the following figure:

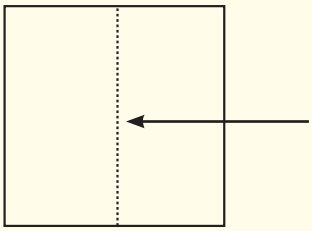


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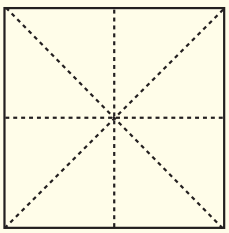
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3. Unfold the paper. You will see the line of folding in the middle of the paper. This line is called line of symmetry.



4. Fold the other sides of the square piece of paper. You will get lines of symmetry as seen in the following figure:

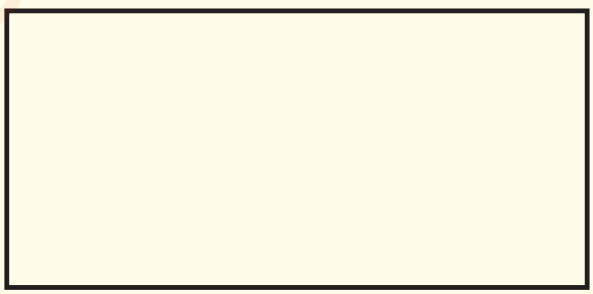


Therefore, a square has four lines of symmetry.

Activity 2: Identifying lines of symmetry of a rectangle

Steps:

1. Take a piece of paper with the shape of a rectangle as shown in the following figure:

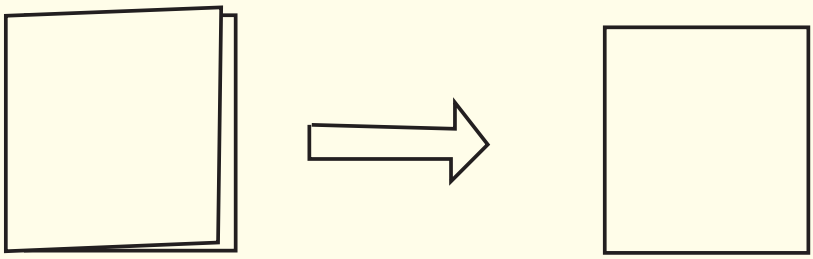


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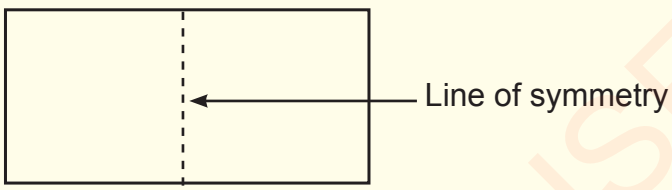
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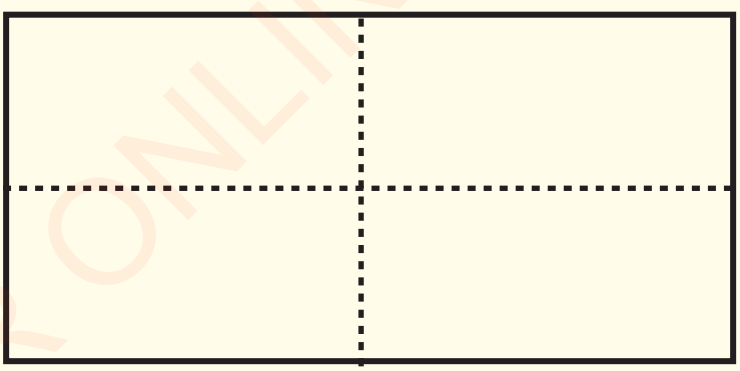
2. Fold the piece of paper to get two equal parts as shown in the following figure:



3. After unfolding the piece of paper, you will see a straight vertical line in the middle of the paper as seen in the following figure:



4. Fold again the folded piece of paper along its length through the centre. Unfold the piece of paper to get lines of symmetry as seen in the following figure:



Therefore, a rectangle has two lines of symmetry.

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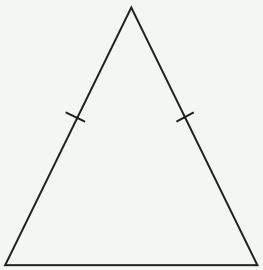
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Exercise 5

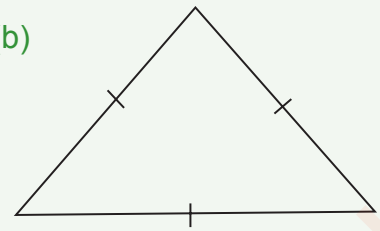
Answer the following questions:

1. Determine the number of lines of symmetry in each of the following figures:

(a)



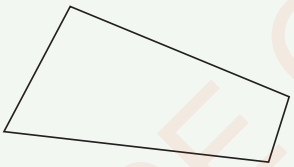
(b)



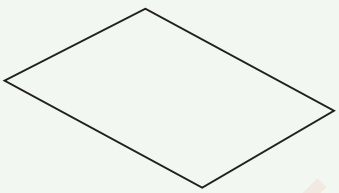
(c)



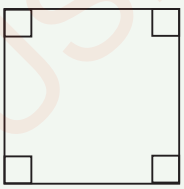
(d)



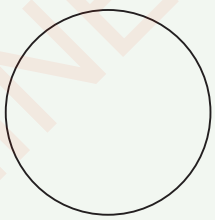
(e)



(f)

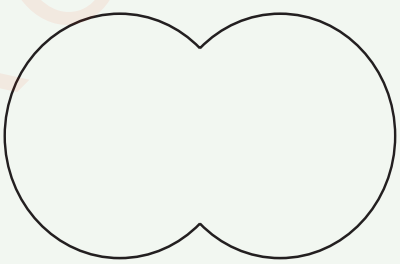


(g)

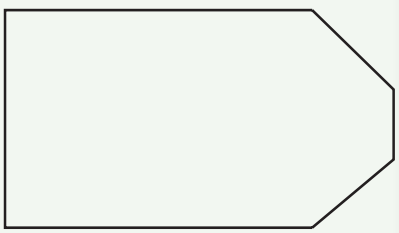


2. How many lines of symmetry do the following figures have?

(a)



(b)



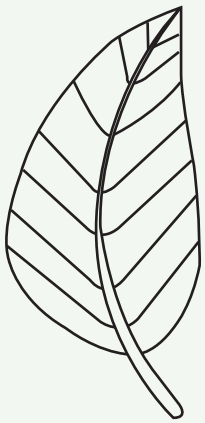
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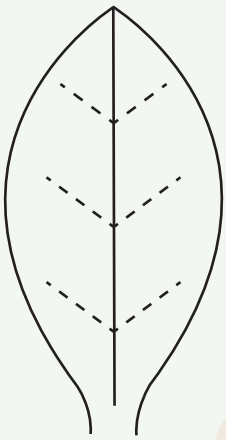
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3. Find the number of the lines of symmetry in the following figures.

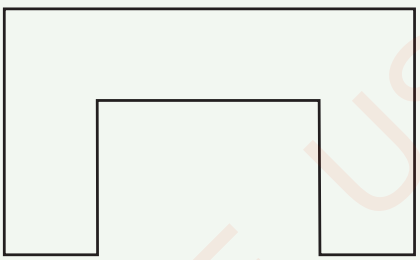
(a)



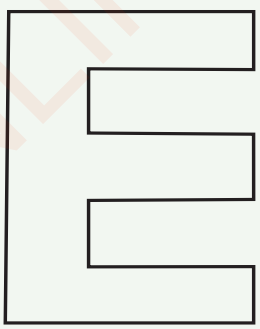
(b)



4. How many lines of symmetry does the following geometrical figure have?



5. How many lines of symmetry does the following figure have?



6. Draw a geometrical figure with a shape of number 8 and show its lines of symmetry.

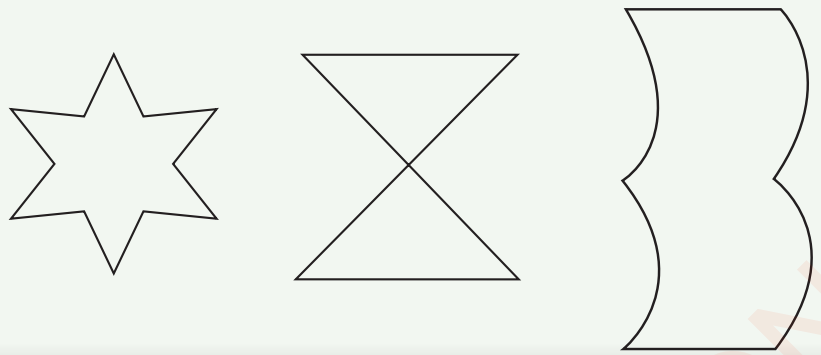
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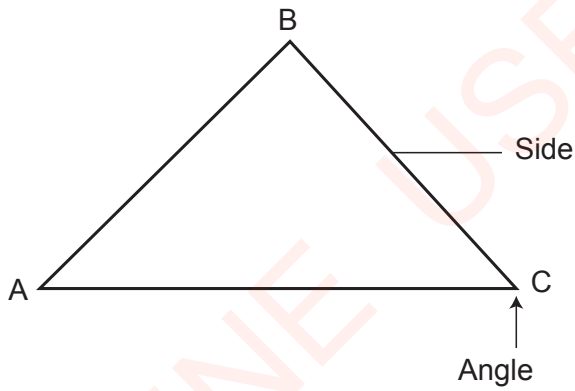
7. Copy the following figures and draw the lines of symmetry for each figure.

(a) (b) (c)



Triangles

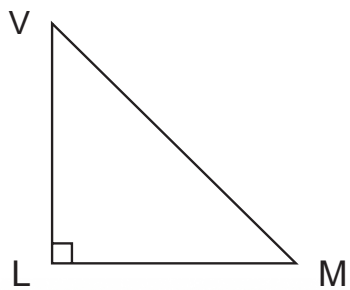
A triangle is a plane geometrical figure with three angles and three sides.



Types of triangles

(a) Right angled triangle

This is a type of a triangle with 90° among its three angles. Triangle VLM is an example of a right angled triangle with ∠VLM = 90°.



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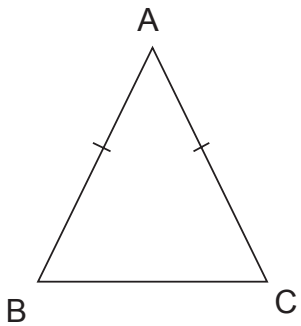
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The two sides, $\overline{VL}$ and $\overline{LM}$ are perpendicular. That is, they intersect at 90°. Also, right angled triangle has two acute angles LVM and VML.

(b) Isosceles triangle

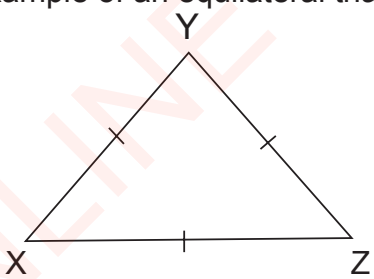
It is a type of a triangle with two equal sides and two equal angles. The following figure is an example of an isosceles triangle.



In this triangle, the two sides $\overline{AB}$ and $\overline{AC}$ are equal. Also, two of its angles, that is, $\angle ABC$ and $\angle ACB$ are equal. Isosceles triangles have one line of symmetry.

(c) Equilateral triangle

This is a type of a triangle with all its sides equal and all its angles equal. The following figure is an example of an equilateral triangle.



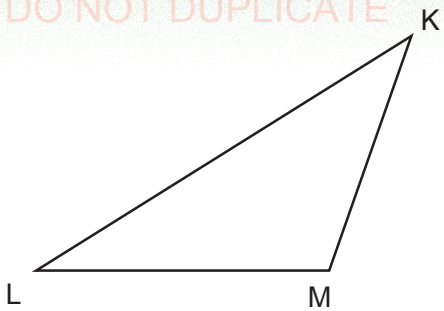
All sides of the triangle XYZ are equal, that is, $\overline{XY} = \overline{XZ} = \overline{YZ}$. Also, all its angles are equal, that is, $\angle XYZ = \angle YXZ = \angle XZY$. Equilateral triangle has three lines of symmetry.

(d) Obtuse angled triangle

This is a triangle with one obtuse angle and two acute angles. Triangle DEF in the following figure is an example of an obtuse triangle.

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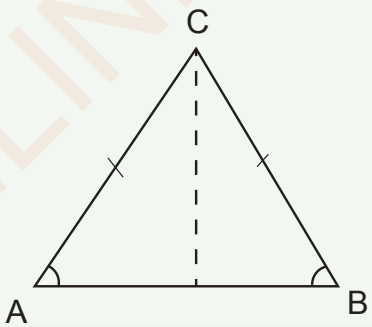


All the three sides and angles of an obtuse triangle are not equal. An obtuse triangle has no line of symmetry.

Exercise 6

Answer the following questions:

1. List down the properties of a right angled triangle.
2. What is the difference between an equilateral triangle and an isosceles triangle?
3. Mention the types of triangles.
4. How many vertices does an equilateral triangle have?
5. Why is the following figure known as an isosceles triangle?



Areas of rectangles, squares and triangles

The area of a geometrical figure is a space occupied by a flat shape or the surface of an object. The area can be calculated by subdividing the figure using equal square units and then count the squares. The area can also be obtained using proper derived formulas.

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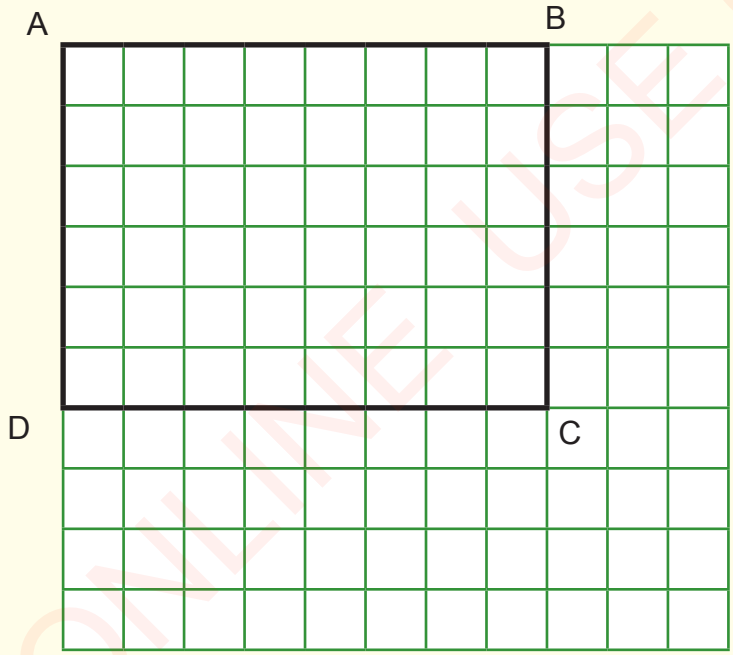
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The area of a rectangle

Activity 3: Finding the area of a rectangle by counting squares units

Steps:

1. Draw a rectangle ABCD with a length of 8 square units and width of 6 square units on a graph paper.
2. Count the number of small squares in the rectangle ABCD.
3. The number of square units is the area of the rectangle ABCD.



Rectangle ABCD has 48 square units. So, the area of the rectangle is 48 square units.

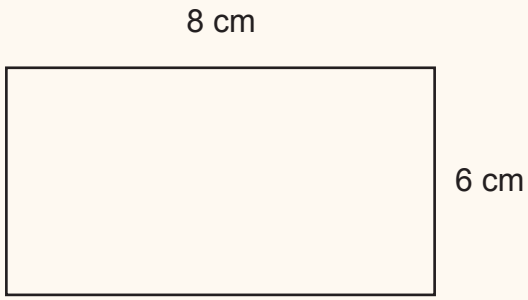
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Example 1

Finding the area of a rectangle by using formula and measurements.



Solution

The area 'A' of a rectangle of length L and width W is given by the product of its length and its width. That is, L × W.

The length is 8 cm and the width is 6 cm.

The area of the rectangle = length × width

= 8 cm × 6 cm

A = 48 square centimetres or 48 cm^2.

Therefore, the area of a rectangle is 48 cm^2.

Example 2

(a) The area of a rectangle is 800 cm^2. If the length of the rectangle is 40 cm, find its width.

Solution

The area is 800 cm^2.

The length is 40 cm.

Area = length × width

800 cm = 40 cm × width

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To get the width we divide Area by Length:

$$\text{Width} = \frac{800\ \text{cm}^2}{40\ \text{cm}} = \frac{800 \times \text{cm} \times \text{cm}}{40 \times \text{cm}}$$

$$\text{Width} = \frac{800\ \text{cm}}{40} = 20\ \text{cm}$$

Therefore, the width of the rectangle is 20 cm.

(b) The length of the cover page of a book is 30 cm and its width is 20 cm. Find the area of the cover page of the book.

Solution

The cover page of the book has the shape of a rectangle.

The area of a rectangle = length × width

Length = 30 cm

Width = 20 cm

Area = 30 cm × 20 cm

= 600 cm^2

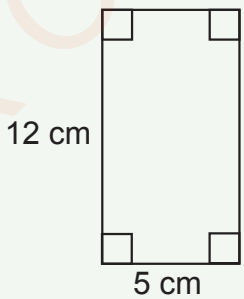
Therefore, the area of the cover page of the book is 600 cm^2.

Exercise 7

Answer the following questions:

1. Find the area of each of the following figures:

(a)



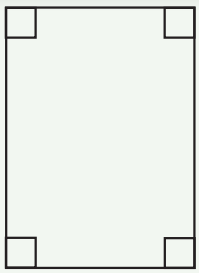
(b)



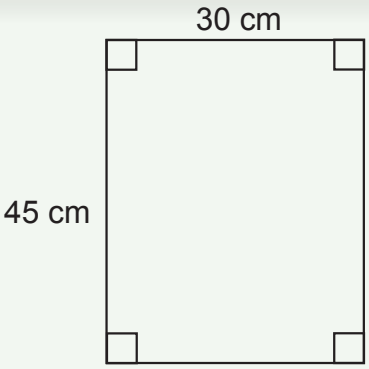
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(c)



(d)



(e)



(f)



2. Find the area of a rectangle of 10 cm length and 9 cm width.

3. The area of a rectangle is 100 m^2 and its width is 4 m. Find its length.

4. If a teacher's table has a length of 80 cm and width of 60 cm. Find its surface area.

5. The area of the school farm is 820 m^2. If its length is 41 m, what is its width?

6. The floor of a classroom has a length of 7 m and a width of 6 m. Find its area.

7. A rectangle has a length of 35 cm and a width of 26 cm. Find its area.

8. A road has a length of 8 800 m and a width of 9 m. Find its surface area.

9. A rectangular garden measures 15 m by 330 m. What is its area?

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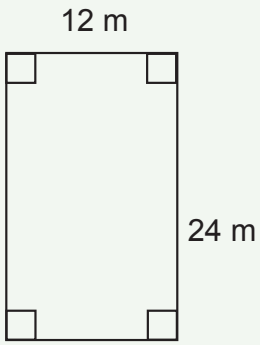
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10. Find the area of a piece of paper of length 32 cm and width 20 cm.

11. The length of a rectangle is 215 metres. If its area is 19 780 square metres, find the width of the rectangle in centimetres.

12. Find the area of each of the following figures:

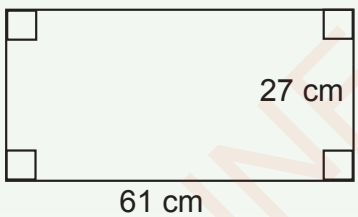
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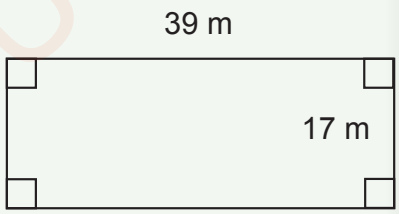
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(d)



Area of a square

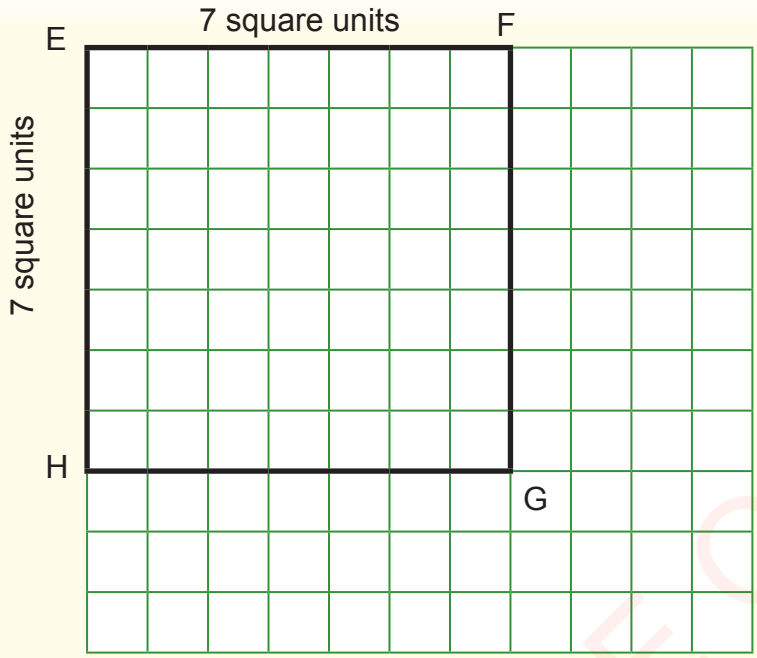
Activity 4: Finding the area of a square by counting square units

Steps:

1. Construct a square EFGH having 7 horizontal and 7 vertical square units on a graph paper.
2. Count all the square units in the square EFGH.

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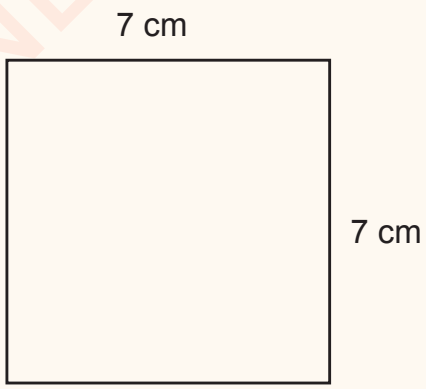
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3. The number of square units equals the area of the square EFGH.
4. The square EFGH has 49 square units. Therefore, the area of the square EFGH is 49 square units.

Example 1

Finding the area of a square using a formula.



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Solution

The formula for calculating the area of a square is to multiply the lengths of two adjacent sides.

Area of the square = length × length

= 7 cm × 7 cm

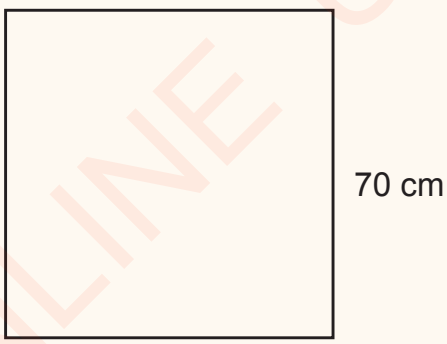
= 49 cm^2

Therefore, the area of the square is 49 cm^2.

Example 2

A window has a length of 70 cm and width of 70 cm. Find the area of the window.

Solution



The shape of the window is a square.
One side has length 70 cm.
The adjacent side has length 70 cm.
Area of the square = length × length

= 70 cm × 70 cm

= 4900 cm^2

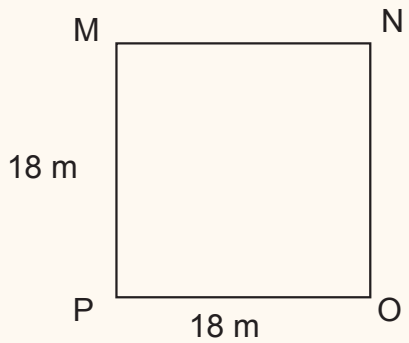
Therefore, the area of the window is 4 900 cm^2.

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Example 3

Find the area of the following square.



Solution

A side of the above square has length m 18.

Area of the square = length × length

= 18 m × 18 m

= 324 m^2

Therefore, the area of the square is 324 m^2.

Example 4

The area of a square is 576 cm^2. Find the length of one of its sides.

Solution

Area = 576 cm^2.
Length of one side = ?

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$\text{length} \times \text{length}$ = Area of a square
= 576 cm^2.

$\sqrt{\text{length} \times \text{length}} = \sqrt{576\ cm^2}$

Length $= \sqrt{24\ cm \times 24\ cm}$
= 24 cm

Therefore, the length of the square is 24 cm.

Exercise 8

Answer the following questions:

1. A square has a side of length 40 cm. Find its area.

2. The area of a square garden is 441 square metres. What is the length of the garden?

3. Find the area of a square region whose side has a length of 50 centimetres.

4. A square has an area 784 square centimetres. What is the length of its sides?

5. The floor of a classroom is in the form of a square. If the length of one of its sides is 9 metres, what is the area of the floor?

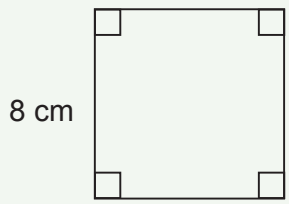
6. Find the area of each of the following figures:

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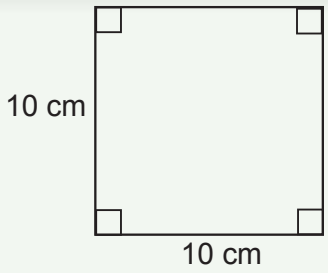
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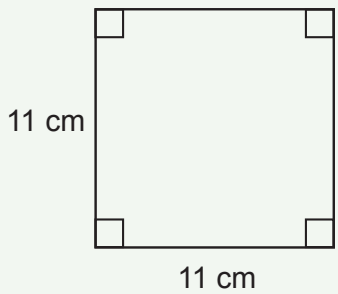
(a)



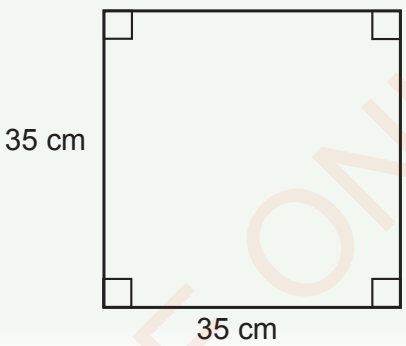
(b)



(c)

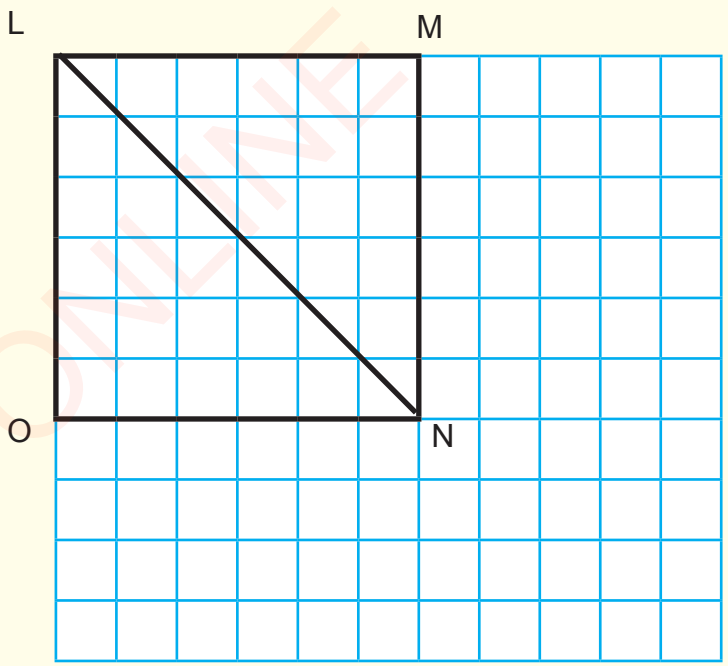


(d)



Area of a triangle

Activity 5: Finding the area of a triangle by counting square units



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Steps:

1. Construct the square LMNO on a graph paper having 6 square units by 6 square units.
2. Draw a straight line to join the points N and L to get two triangles LMN and LON.
3. Count the number of square units and the number of half square units in the triangle LON.

   Number of square units = 15.

   Number of half square units = 6.

   But, 2 half square units are equal to 1 unit square.

   Thus, the 6 half square units are equal to $6 \div 2 = 3$ square units.

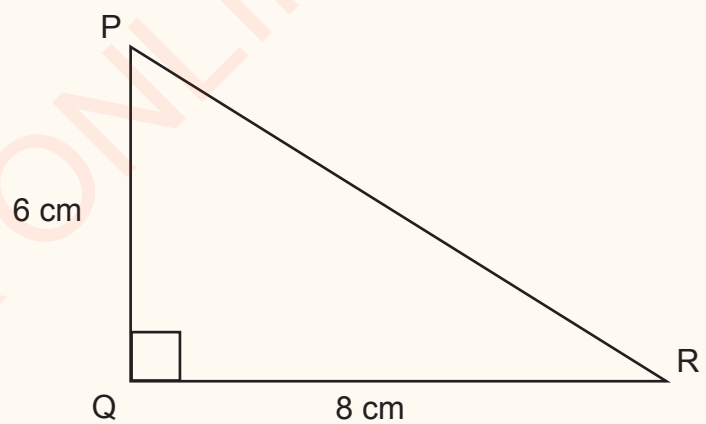
   The total number of square units in a triangle LON is $15 + 3 = 18$.

   Therefore, the area of triangle LON is 18 square units.

   This area of triiangle LON is the same as the area of triangle LMN.

Example 1

Find the area of triangle PQR by using a formula.



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Solution

The area of a triangle is given by the formula

Area (A) = $\frac{1}{2}$ base (b) × height (h).

That is, $A = \frac{1}{2} \times b \times h$.

In the case of the above triangle,

b = 8 cm

h = 6 cm

$$\text{Area} = \frac{1}{2} \times 8\,\text{cm} \times 6\text{cm}$$

$$= \frac{48}{2}\,\text{cm}^2$$

$$= 24\ \text{cm}^2$$

Therefore, the area of the triangle PQR is 24 cm^2.

Example 2

Find the area of a triangle whose height is 10 m and whose base is 15 m.

Solution

h = 10 m

b = 15 m

$$A = \frac{1}{2} \times b \times h$$

$$= \frac{1}{2} \times 15\ \text{m} \times 10\ \text{m}$$

$$= \frac{150}{2}\ \text{m}^2$$

$$= 75\ \text{m}^2$$

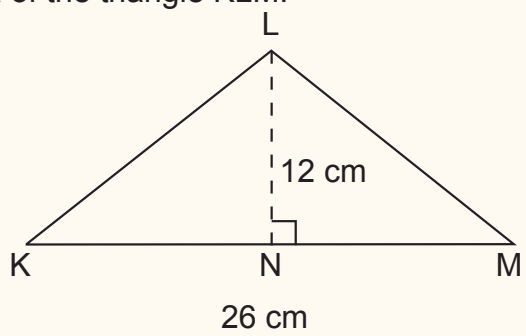
Therefore, the area of the triangle is 75 m^2.

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Example 3

(a) Calculate the area of the triangle KLM.



Solution

The base is KM = 26 cm

The height is LN = 12 cm

$$A = \frac{1}{2} \times b \times h$$

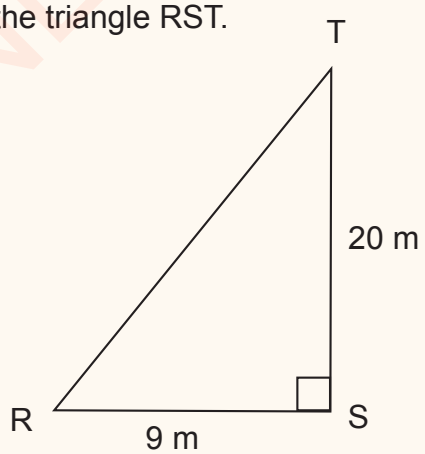
$$= \frac{1}{2} \times 26 \text{ cm} \times 12 \text{ cm}$$

$$= \frac{312}{2} \text{ cm}^2$$

$$= 156 \text{ cm}^2$$

Therefore, the area of the triangle KLM is 156 cm^2.

(b) Find the area of the triangle RST.



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Solution

Area of triangle $= \frac{1}{2} \times$ base $\times$ height

The base is the line RS whose length is 9 cm.
The height is the line ST whose length is 20 cm.

$$\text{Area} = \frac{1}{2} \times 9\text{ m} \times 20\text{ m}$$

$$= \frac{180}{2}\text{ m}^2$$

$$= 90\text{ m}^2$$

Therefore, the area of triangle RST is 90 m^2.

(c) The area of a certain triangle is 225 m^2. If it has a base of 30 m, find its height.

Solution

Area of a triangle $= \frac{1}{2} \times$ base $\times$ height

Area = 225 m

Base = 30 m

$$225\text{ m}^2 = \frac{1}{2} \times 30\text{m} \times \text{h}$$

$$225\text{ m}^2 = 15\text{m} \times \text{h}$$

$$\text{h} = \frac{225 \times \text{m} \times \text{m}}{15\text{ m}}$$

$$= \frac{225\text{ m}}{15}$$

$$= 15\text{ m}.$$

Therefore, the height of the triangle is 15 m.

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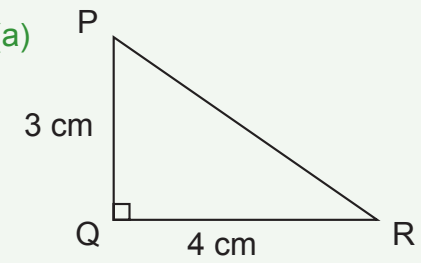
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Exercise 9

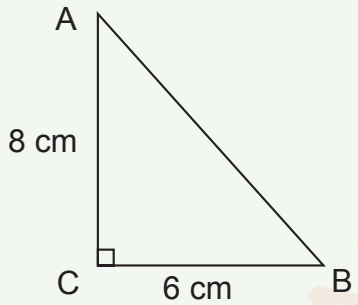
Answer the following questions:

1. Calculate the area of each of the following geometrical figures:

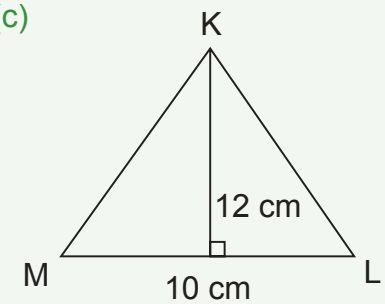
(a)



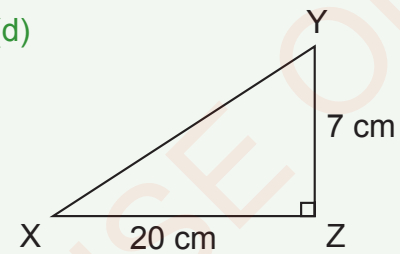
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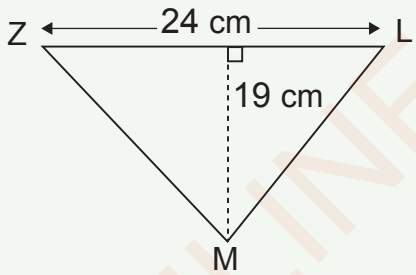
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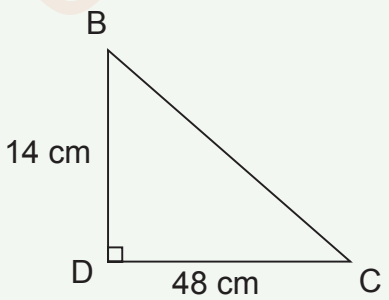
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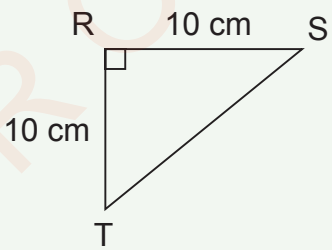
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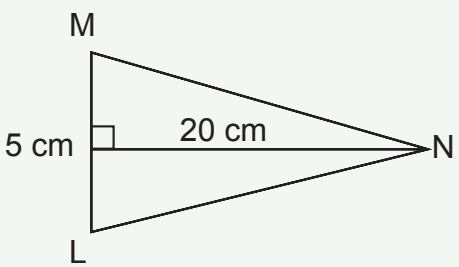
(f)



(g)



(h)



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2. Find the area of a triangle with a height of 16 metres and a base of 19 metres.

3. A triangle whose height is 30 cm has an area of 600 cm^2. Find of base.

4. A triangle has an area of 195 square metres. If it has a base of 26 metres, what is its height?

Exercise 10

Answer the following questions:

1. List five types of angles.

2. How many right angles are in a straight angle?

3. What is the smallest angle among the five types of angles?

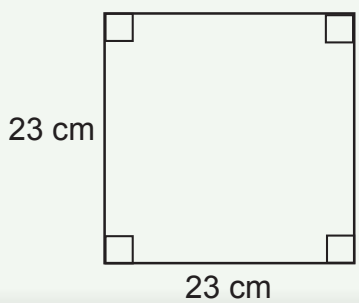
4. Give the properties of a reflex angle.

5. Give the properties of an equilateral triangle.

6. Write the type of triangle which has one right angle and two acute angles.

7. Write the formula for calculating the area of a rectangle.

8. Calculate the area of the following geometrical figure:



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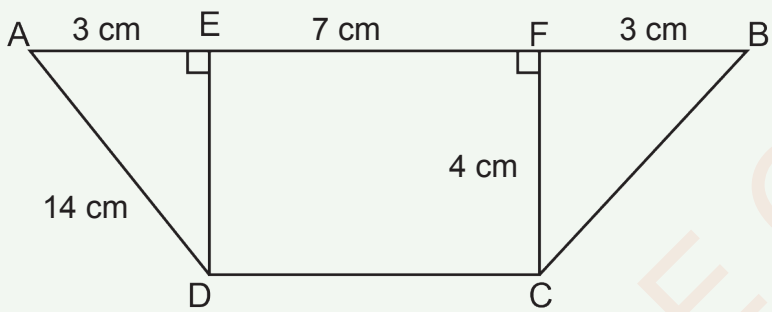
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9. The area of a square is 900 square centimetres. Calculate the length of its sides.

10. A square has a side of length 41 centimetres. Find its area.

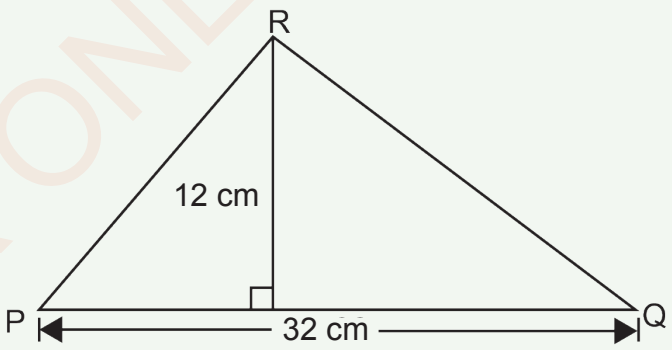
11. Calculate the area of the following geometrical figure.



12. The area of a triangle is 1 485 square centimetres. If its base is 66 centimetres, find its height.

13. A triangle has a height of 25 metres and a base of 32 metres. Calculate its area.

14. Find the area of the geometrical figure PQR.

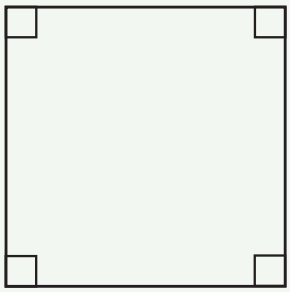


15. Calculate the area of the following square:

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16. A rectangle RSTU has a length of 18 centimetres and a width of 14 centimetres. Find the area of the rectangle.

17. The area of a rectangle is 1 134 square centimetres. If it has a length of 42 centimetres, calculate its width.

18. The area of a triangle is 372 square centimetres. If it has a height of 24 centimetres, find its base.

19. A rectangle has a length of 37 centimetres and a width of 27 centimetres. Calculate the area of the rectangle.

20. Calculate the area of a triangle with a base of 70 cm and a height of 84 cm.

Summary

1. An angle is formed when two straight lines meet at a point.
2. A vertex is the point where two straight lines meet.
3. The height of a triangle can be measured inside or outside the triangle.
4. The formula for calculating the area of a rectangle is length × width.
5. The formula for calculating the area of a triangle is $\frac{1}{2}$ × base × height.
6. The formula for calculating the area of a square is length × length.

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Chapter Fifteen

Algebra

Introduction

Algebra is a branch of mathematics which uses both alphabetical letters and numerals. The alphabetical letters represent either numbers or objects. In this chapter, you will learn about algebraic expressions. You will also learn how to use arithmetic operations to represent algebraic expressions and their simplifications.

Algebraic expressions

Algebra is used in everyday life to simplify mathematical operations. For example; suppose that, each of four families has one chicken; If we represent a chicken by the alphabet k, then, the total number of chickens owned by the four families is

$$k + k + k + k = 4k.$$

Similarly, suppose that, the four families keep goats as follows: the first family has 2 goats, the second family has 3 goats, the third family has 2 goats, and the fourth family has 4 goats. If we represent a goat by the alphabet m, then the total number of goats owned by the four families is

$$2m + 3m + 2m + 4m = 11m.$$

Again, if the four families have children as follows: the first family has 2 children, the second family has 3 children, the third family has 3 children, and the fourth family has 4 children. If we represent a child by the alphabet w, then the total number of children in the four families is

$$2w + 3w + 3w + 4w = 12w.$$

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The algebraic expressions obtained for the four families are 4k, 11m and 12w. These are examples of algebraic expressions in which k represents chicken, m represents goats, and w represents children.

In the term of the expression such as 4k, the number 4 is called the coefficient of k and the alphabet k is called the variable. Similarly, in the term 11m, 11 is the coefficient of m and m is the variable. Also, in the term 12w, 12 is the coefficient of w and w is the variable. A term may also have two or more variables, such as in the expression 8km, where 8 is the coefficient of k and m, and k and m are variables.

Example 1

Identify the coefficient and the variable in each of the following terms:
(a) 6a (b) y

Answer
(a) In the term 6a; 6 is the coefficient of a and a is the variable.
(b) For the term y; 1 is the coefficient of y and y is the variable.

Example 2

Write the variables and coefficient in each of the following terms:
(a) 3pq (b) 5wz

Answer
(a) In the term 3pq; 3 is the coefficient, while p and q are variables.
(b) In the term 5wz; 5 is the coefficient, while w and z are variables.

Algebraic expressions are constructed using terms such as 4k, 11m and 12w. Algebraic expressions may be combined using arithmetic operations. The following are examples of algebraic expressions: 4k + 6k; 11m – m; 6m × 3; 12w ÷ 2n.

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Exercise1

Answer the following questions:

1. Write the variables in each of the following terms:
   (a) 7mn (b) 5p (c) n
   (d) 10tp (e) 3yw

2. Write the coefficient in each of the following terms:
   (a) 3pq (b) 4ab (c) pk
   (d) m (e) a

Addition of algebraic expressions

Terms in the algebraic expression are said to be alike if they have the same variable, such as 4k, 8k, 5k and 7k. Like terms can be added to obtain a single algebraic term. In adding like terms, you add the coefficients and leave the variable unchanged. Terms which have different variables are called unlike terms. For example; 3a, 4m, 6p and 7w. Unlike terms cannot be added to obtain a single algebraic term.

Example 1

Simplify the following expressions:

1. (a) 4k + 8k =
   (b) 6n + n + 2n =
2. (a) 2p + 4a + p + 2a =
   (b) 4m + 3n + 4m + 3n =

Solution

1. (a) 4k + 8k =
   First, add the coefficients: 4 + 8 = 12.
   Therefore, 4k + 8k = 12k.

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(b) 6n + n + 2n =
First, add the coefficients: 6 + 1 + 2 = 9.
Therefore, 6n + n + 2n = 9n.

2. (a) 2p + 4a + p + 2a =
First, rewrite the expression by collecting together the like terms as follows:
2p + p + 4a + 2a.

Add the coefficients of like terms for the variable p: 2 + 1 = 3.
Add the coefficients of like terms for the variable a: 4 + 2 = 6.
Therefore, 2p + p + 4a + 2a = 3p + 6a.

(b) 4m + 3n + 4m + 3n =
Add the like terms: (4 + 4)m + (3 +3)n = 8m + 6n.
Therefore, 4m + 3n + 4m + 3n = 8m + 6n.

Exercise 2

Simplify the following expressions:

1. 3p + 4p + 5p =
2. 2m + 7m + m =
3. m + n + m + n + m =
4. p + w + p + w + p + w + w =
5. 5n + k + 2k + 3n =
6. 6m + 2n + m + n =
7. x + 3y + 4x + y + 2y =
8. x + 4w + 2w + 2w + x + 3x =
9. 15m + 16p + 3t + t =
10. 5k + 2pq + k + pq =
11. 2p+ q + b + 3b + 2q =
12. 6ay + 4ab + 4ay + 8ab =
13. 3a + 3b + 3c =
14. 2w + 5m + 5m + 8w =
15. 6gh + 6gh + 6gh =

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Subtraction of algebraic expressions

Like terms in the algebraic expression can be subtracted to obtain a single algebraic expression. When subtracting like terms, subtract the coefficients leaving the variables unchanged. Unlike terms cannot be subtracted.

Example

Simplify the following expressions:

(a) $4x - x =$ (b) $5ae - 2ab - 2ae =$ (c) $6k - 6n =$

Solution

(a) $4x - x =$

Subtract coefficients: $4 - 1 = 3$.

Therefore, $4x - x = 3x$.

(b) $5ae - 2ab - 2ae =$

Collect together the like terms and then simplify.

$5ae - 2ae - 2ab = (5 - 2)\,ae - 2ab$

$= 3ae - 2ab$

Therefore, $5ae - 2ab - 2ae = 3ae - 2ab$.

(c) $6k - 6n =$

This expression does not contain like terms.

Thus, subtraction cannot be performed.

Therefore, $6k - 6n = 6k - 6n$.

Exercise 3

Answer the following questions:

1. $2m - m =$
2. $4m - 2m =$
3. $6k - k - 3k =$
4. $10n - 5n - n =$

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5. $10x - 4x - x =$	**6.** $5a - 2a =$
7. $4t - t - 2 =$	**8.** $10a - 2a - 8a =$
9. $8x - 8 =$	**10.** $4n - 4k =$
11. $m - m =$	**12.** $7e - 7e =$
13. $7mk - 4mk - mk =$	**14.** $8ad - ad - 2ad =$
15. $16x - x - 14x =$	**16.** $2p - p=$

Addition and subtraction of algebraic terms

Addition and subtraction of algebraic terms may be used to simplify a long expression. Like terms can be added and subtracted to obtain a simpler algebraic expression. Terms with different variables cannot be added or subtracted.

Example

Simplify the following expressions:

1. (a) $2a + 3b - a =$
   (b) $4xy - xw + 3xw + 3xy =$

Solution

(a) $2a + 3b - a =$

Collect together the like terms and simplify. In other words, arrange together similar expressions and then, add or subtract their coefficients.

$2a + 3b - a = 2a - a + 3b$

$= a + 3b$

Therefore, $2a + 3b - a = a + 3b$.

(b) $4xy - xw + 3xw + 3xy =$

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Collect together the like terms and simplify. In other words, arrange similar expressions and then add or subtract their coefficients.

$4xy - xw + 3xw + 3xy = 4xy + 3xy - xw + 3xw$

$= 7xy + 2xw$

Therefore, $4xy - xw + 3xw + 3xy = 7xy + 2xw$.

2. $3a - a + 4pq - pq =$

Solution

$3a - a + 4pq - pq =$

Collect similar expressions together and then simplify:

$3a - a + 4pq - pq = 2a + 3pq$

Therefore, $3a - a + 4pq - pq = 2a + 3pq$.

Exercise 4

Simplify the following expressions:

1. $8a + 6a - a =$
2. $7m - m + 2m =$
3. $4b + 3b - 2b =$
4. $8t + t - 8t =$
5. $y + 4y - 3y =$
6. $5t - 4t + t - t =$
7. $12e - 2e =$
8. $9n - 8n + n =$
9. $15k - 4k + 3k - k =$
10. $7w - 5w + 2w =$
11. $10b + 2a - 5b =$
12. $16pa + 4q - 6pa - 3q =$

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13. 16y – 10y + 2a + 11y =

14. 8wz + 8wy – wz – 2wy =

15. 6e – 4f + 6f – e =

16. 4w + 6z – 2w – 2z =

17. 4n + 2n + n =

18. 9m + 6n – m + n =

19. 10a – 10b – 10a + 10b =

20. xy + 3xy + 2xy – xy =

Multiplication of algebraic terms

Algebraic terms can be multiplied by a number or by another like or unlike terms. In multiplying terms by a number, multiply the coefficient by the number and maintain the variable. If the number is zero, 0, then the product is 0. In multiplying algebraic terms, first multiply the coefficients and then multiply the variables.

Example

Simplify the following expressions:

1. (a) y × y = (b) 4a × 4 =
2. (a) 3k × 2k = (b) n × 3n =

Solution

1. (a) y × y =

In this expression, y is the only variable involved, and both coefficients are 1. When a variable is multiplied by itself, the product is its square.

Therefore, $y \times y = y^2$.

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(b) $4a \times 4 =$

In this question, an expression is being multiplied by 4.

Therefore, $4a \times 4 = 16a$.

Solution

2. (a) $3k \times 2k =$

This expression is a product of two like terms. The variable is k and the coefficients are 3 and 2.

Multiply the coefficients: $3 \times 2 = 6$.

Multiply the variables: $k \times k = k^2$.

Therefore, $3k \times 2k = 6k^2$.

(b) $n \times 3n =$

This expression is a product of two like terms. The variable is n and the coefficients are 1 and 3.

Multiply both the coefficients and the variables to get

$n \times 3n = (1 \times 3) \times (n \times n) = 3n^2$.

Therefore, $n \times 3n = 3n^2$.

Exercise 5

Simplify the following expressions:

1. $b \times b =$
2. $2n \times 2n =$
3. $3p \times p =$
4. $3y \times 3y =$
5. $t \times k \times r =$
6. $4a \times 3b \times 2c =$
7. $3a \times 3b \times a =$
8. $m \times m =$
9. $4k \times 4t =$
10. $3a \times 2e \times 4 =$
11. $2p \times t \times 3p =$
12. $y \times w \times 2y \times 3w =$

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13. $4a \times b \times a \times b =$

14. $10t \times 10p =$

15. $6p \times q \times 6p =$

16. $3b \times 3 \times 4b =$

17. $3na \times 4 \times 2n =$

18. $p \times q \times 5q \times 5w =$

19. $3tp \times 0 =$

20. $7vfk \times kp =$

Division of algebraic terms

In dividing algebraic terms, divide the coefficients and the same variables.

Example

Simplify the following expressions:

1. (a) $4a \div 2a =$ (b) $4b \div 4b =$
2. (a) $4k \div 2k =$ (b) $6ab \div 3ab =$

Solution

1. (a) $4a \div 2a =$

Identify the coefficients and the variables. Then, divide coefficient by coefficient and variable by variable:

$$4a \div 2a = \frac{4a}{2a} = \left(\frac{4}{2}\right) \times \left(\frac{a}{a}\right) = 2 \times 1 = 2$$

Therefore, $4a \div 2a = 2$.

(b) $4b \div 4b =$

Identify the coefficients and the variables. Then divide coefficient by coefficient and variable by variable:

$$4b \div 4b = \frac{4b}{4b} = \left(\frac{4}{4}\right) \times \left(\frac{b}{b}\right) = 1 \times 1 = 1$$

Therefore, $4b \div 4b = 1$.

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2. (a) $4k^2 \div 2k = \frac{4k^2}{2k} = \left(\frac{4}{2}\right) \times \left(\frac{k^2}{k}\right) = \left(\frac{4}{2}\right) \times \left(\frac{k \times k}{k}\right)$

$= 2 \times k$

$= 2k$

Therefore, $4k^2 \div 2k = 2k$.

(b) $6a^2 b \div 3ab = \frac{6a^2 b}{3ab} = \left(\frac{6}{3}\right) \times \left(\frac{a^2}{a}\right) \times \left(\frac{b}{b}\right)$

$= \left(\frac{6}{3}\right) \times \left(\frac{a \times a}{a}\right) \times \left(\frac{b}{b}\right)$

$= 2 \times a \times 1$

$= 2a$

Therefore, $6a^2b \div 3ab = 2a$.

Exercise 6

Simplify the following expressions:

1. $6b \div 2 =$
2. $3b \div b =$
3. $4c \div 4c =$
4. $8b \div 2b =$
5. $6b \div 3b =$
6. $10y \div y =$
7. $15a \div 5a =$
8. $5a^2 \div a =$
9. $8k^2 \div 8 =$
10. $10p^2 \div 2p =$
11. $t^2 \div t =$
12. $4m^2 \div 2m^2 =$
13. $6k^2 p \div 2p =$
14. $10n^2 \div 10n =$
15. $18x^2 \div 9x =$
16. $10y^2p \div 10yp =$
17. $12nm^2 \div 12m =$
18. $10a^2b^2 \div 10ab =$
19. $12m^2n \div 3m^2 =$
20. $8y^2w^2 \div 4yw^2 =$

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Exercise 7

Simplify the following expressions:

1. $3n + n =$
2. $7n - p =$
3. $8k - 4k =$
4. $3a \times b \times b =$
5. $4y + 2y =$
6. $8n - 6n =$
7. $8p^2 \div p^2 =$
8. $3n \times n =$
9. $4k^2 \div 2k^2 =$
10. $6e \div e =$
11. $4p^2 \div 4 =$
12. $6k^2 \div 6k =$
13. $16m \div 4m =$
14. $10n^2 \div 10n =$
15. $18x^2 \div 9x =$
16. $pt^2 \div pt =$
17. $5ya^2 \div 5ya =$
18. $12t^2 p \div 4tp =$
19. $10ab^2 c \div 5ab =$
20. $a^2 b^2 e \div abe =$
21. $10 + 2y - 10 =$
22. $5a + 3b - 2a - 2b =$
23. $9t - t + z - z =$
24. $6y^2 - 2x^2 - 2y^2 + 3x^2 =$

Summary

1. Algebraic terms are made up of coefficients and variables.
2. Algebraic expressions are constructed using the terms.
3. Like terms have the same variables.
4. To add like terms, add the coefficients. The variable remains the same.
5. To subtract like terms, subtract the coefficients. The variable remains the same.
6. Unlike terms cannot be combined to obtain a single expression, but they may be simplified.
7. To multiply algebraic terms, multiply the coefficients, as well as the variables.
8. To divide algebraic terms, divide the coefficients, as well as the variables.

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Chapter Sixteen

Statistics

Introduction

Statistics is the branch of mathematics which deals with the collection, analysis and interpretation of data. Different types of data can be collected from schools, government agencies, hospitals, business centres and so on. In Standard Four, you learnt how to collect and record as well as drawing pictorial statistics using the information presented. In this chapter, you will learn how to calculate average using different data, reading and interpreting bar graphs. This competence will help you to collect different required data and present it systematically as well as providing proper interpretation of data. For instance, information about population, harvests, rainfall, health information, financial information, pupils age and the like can be collected and analysed.

Exercise 1: Revision

1. Study carefully the following pictorial statistics which show the daily sales of cups in one week.

   Key: A picture of 1 cup represents 5 cups

Days	Cups
Monday	
Tuesday	
Wednesday	

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Thursday	
Friday	
Saturday	
Sunday	

Answer the following questions:

(i) How many cups were sold on Monday?

(ii) Which day had many sales of cups?

(iii) Which days had the same sales of cups?

(iv) How many cups were sold on Sunday?

(v) Which day had less sales of cups?

(vi) What is the difference in the sales of cups between Tuesday and Sunday.

(vii) Which day had less than 25 sales of cups?

3. The following pictorial data shows the number of Standard Three up to Standard Seven pupils who attended classes on Monday. Study it carefully and then answer the questions that follow:

Key: A picture of one pupil represents 10 pupils

Class	Students
Standard three	

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Standard four	
Standard five	
Standard six	
Standard seven	

(i) Which class had the smallest number of pupils? How many pupils were they?

(ii) Which class had the highest number of pupils? How many pupils were they?

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(iii) Which classes had equal number of pupils? How many pupils were they in each class?
(iv) How many Standard three pupils attended?
(v) How many pupils attended classes on that day?

3. The following table shows the number of books for five subjects taught in Standard Five in one of the primary schools.

Title of the book	Science	Mathematics	Kiswahili	English	Social Studies
Number of books	35	20	30	40	15

(i) Construct a bar chart to show the number of books for different subjects.
Vertical scale: 1 cm represents 5 books.
Horizontal scale: 1 cm represents the width of a bar.
(ii) Which subject has the highest number of books?
(iii) What is the difference between the number of English books and Social Studies books?

Average

The average is obtained by dividing the sum of the item values by the total number of items.

The following examples help to determine the meaning of an average:

(a) Ali had 6 mangoes while Sara had 2 mangoes. In order to have the same number of mangoes, they put all the mangoes in one container and then divided the total number of mangoes by two. The total number of mangoes is 6 + 2 = 8. Dividing the total by two gives 8 ÷ 2 = 4. Therefore, Ali and Sara got 4 mangoes each.

(b) Five pupils of Msange Primary School were sent to pick maize from the school farm. Musa picked 5 maize, Ramadhani 7, Mariamu 3, Neema 9 and Zacharia 6. The teacher asked them to share the maize equally. The pupils followed the following steps in order to get equal number of maize:

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1. The pupils collected all the maize in one container.
2. They counted the maize in the container and found the total:
   5 + 7 + 3 + 9 + 6 = 30.
3. They divided the total number of maize by the total number of pupils, that is, 30 ÷ 5 = 6.

Thus, each pupil got 6 maize.

Therefore, Average $= \frac{\text{Sum of the item values}}{\text{Number of items}}$.

Example 1

The ages of four standard three pupils at Mwenge Primary School were as follows: Selina was 9 years old, Ashura 8 years old, Emmanuel 10 years old, and Hassan 9 years old. Find the average of their ages.

Solution

1. Add the ages of all pupils: 9 years + 8 years + 10 years + 9 years = 36 years.
2. The number of pupils is 4.
3. Average $= \frac{\text{Total number of ages}}{\text{Number of pupils}}$

$= \frac{36}{4}$ years

= 9 years.

Therefore, the average age of the four pupils is 9 years.

Example 2

Find the average of 5, 10, 15, 25 and 20.

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Solution

There are 5 numbers.

Total of the numbers: 5 + 10 + 15 + 25 + 20 = 75.

$$\text{Average} = \frac{\text{Sum of numbers}}{\text{Number of values}} = \frac{75}{5} = 15.$$

Therefore, the average of the numbers is 15.

Exercise 2

Answer the following questions:

1. Kulwa bought crates of tomatoes from the market as follows:
   On the first day, she bought 5 crates, on the second day 3 crates, and 4 crates on the third day. Find the average number of tomato crates bought per day?

2. A businessman sold motor cycles on six consecutive days as follows: Monday 5, Tuesday 4, Wednesday 7, Thursday 11, Friday 12 and Saturday 15. Find the daily average number of motor cycles that were sold.

3. The class attendance of standard five pupils in a week was as follows:

Day	Monday	Tuesday	Wednesday	Thursday	Friday
Attendance	33	45	48	45	39

   Find the daily average attendance of pupils during the week.

4. The following table shows school attendance of pupils in five days:

Day	Monday	Tuesday	Wednesday	Thursday	Friday
Attendance	330	350	340	300	280

   (a) Find the daily average attendance of pupils during the week.
   (b) On which days was the attendance above the average?

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5. Find the average of 28 000 shillings, 32 000 shillings and 96 000 shillings.

6. If seven lorries are loaded with bags of maize weighing the following kilograms: 1 050 kg, 600 kg, 800 kg, 940 kg, 900 kg, 850 kg and 600 kg. What is the average weight of maize in a lorry?

7. The weights of seven people are: 50 kg, 59 kg, 72 kg, 45 kg, 80 kg, 52 kg and 48 kg. What is their average weight?

8. Four cows produce milk as follows: 8 litres, 15 litres, 7 litres and 14 litres. Find the average of the litres of milk.

9. Find the average of the following lengths:
36 cm, 54 cm, 44 cm, 50 cm and 66 cm.

10. The following table gives information on five children. Use this information to answer the questions that follow:

Name	Weight in kg	Height in cm
Kisuda	35	140
Amani	32	135
Furaha	28	142
Musa	28	128
Salimu	25	125

(a) Find the average weight of the children in kilograms.
(b) Find the average height of the children in metres.
(c) How many children have their weights above the average?
(d) How many children have their heights above the average?

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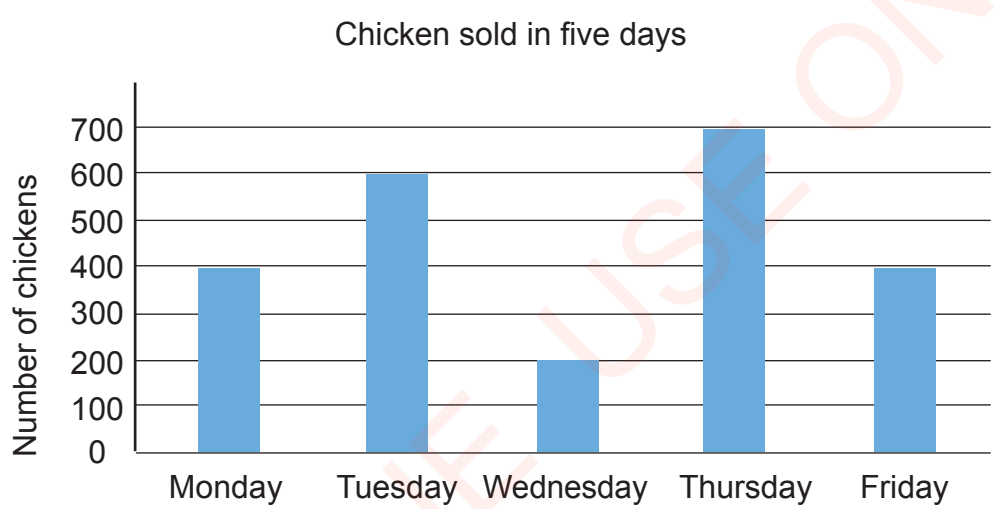
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Bar graphs

A bar graph is a chart that uses bars to show comparisons between categories of data. It can be either horizontal or vertical. The heights of bars represent the total number of items for a given category.

Example 1

Study carefully the following bar graph which represents the number of chickens sold in five days of the week and answer the questions that follow:



Questions

(a) Which day had the lowest sales of chickens? How many chickens were sold on that day?

(b) Which day had the highest sales of chickens? How many chickens were sold on that day?

(c) Which days had the same sales of chickens? How many chickens were sold on those days?

(d) How many chickens were sold on Tuesday?

(e) How many more chickens were sold on Tuesday compared to Monday?

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Solution

(a) The shortest bar shows that Wednesday had the lowest sales of chickens. Thus, 200 chickens were sold on that day.

(b) The tallest bar shows that Thursday had the highest sales of chickens. Thus, 700 chickens were sold on that day.

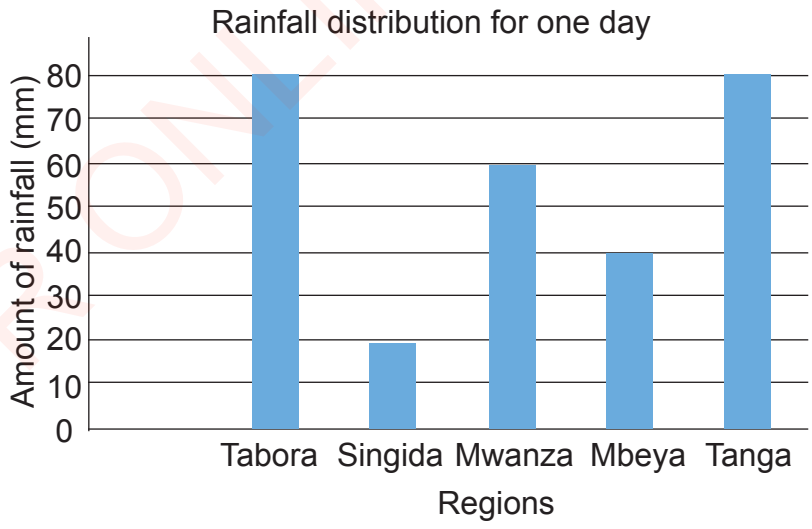
(c) By comparing the columns, it shows that the bars on Monday and Friday had equal heights, which means that the same number of chickens were sold on both days. So, 400 chickens were sold on each of the two days.

(d) By looking at the bar for the sales on Tuesday, you observe that 600 chickens were sold.

(e) Since 600 chickens were sold on Tuesday and 400 chickens were sold on Monday, then, the difference between the two sales was 200. Therefore, 200 more chickens were sold on Tuesday compared to Monday.

Example 2

The following bar graph shows the amount of rainfall in millimetres in five regions. Study the graph and answer questions that follow:



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(a) Which regions recorded the same amount of rainfall? How many millimetres of rainfall were recorded in each of these regions?
(b) Which region had the lowest amount of rainfall on that day? What was the recorded amount of rainfall in that region?
(c) Find the difference in the amount of rainfall recorded in Mwanza and Mbeya.
(d) Find the total amount of rainfall recorded in all the five regions.

Solution

(a) By comparing the bars, the bars which have the same height represent the same amount of rainfall. Therefore, Tabora and Tanga regions recorded the same amount of rainfall, which was 80 millimetres.
(b) By comparing the bars, the shortest bar represents the lowest amount of rainfall. The region which recorded the lowest amount of rainfall was Singida, with 20 millimetres.
(c) By comparing the bars it shows that, the difference in the amount of rainfall in Mwanza and Mbeya was: 60 mm – 40 mm = 20 mm.
(d) The total amount of rainfall in all five regions is obtained by adding all the records of rainfall:

Total amount of rainfall = 80 mm + 20 mm + 60 mm + 40 mm + 80 mm
= 280 mm.

Therefore, the total amount of rainfall recorded in all five regions was 280 mm.

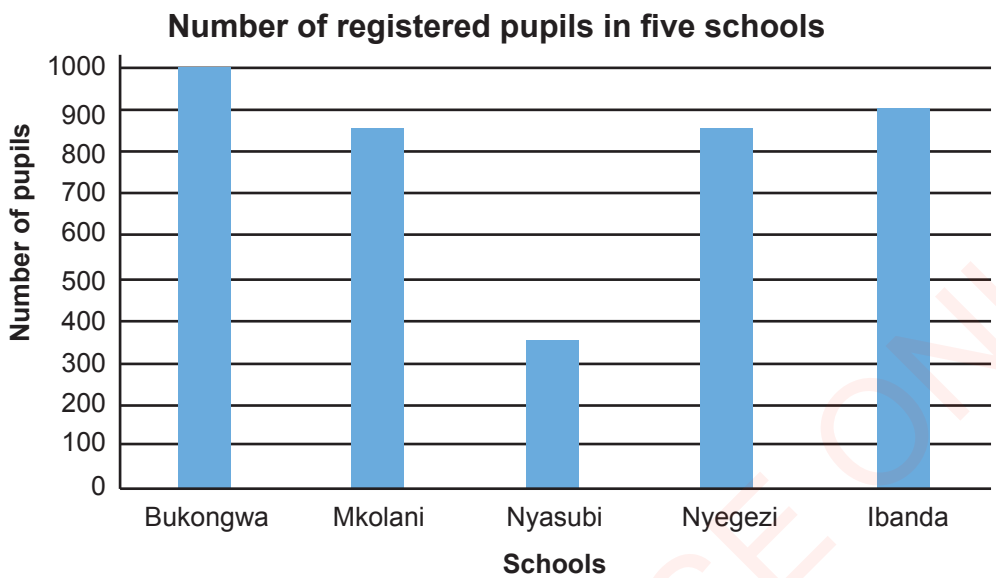
Exercise 3

Answer the following questions:

1. If a total number of Standard One registered pupils at Bukongwa, Mkolani, Nyasubi, Nyegezi and Ibanda primary schools is as shown in the following bar graph, study it and then, answer the questions that follow:

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(a) Which school registered the largest number of pupils? How many pupils were they?

(b) Which schools had equal number of registered pupils?

(c) Find the difference between the pupils registered at Bukongwa and Ibanda primary schools.

(d) What is the total number of the pupils registered in all schools?

2. The following pictorial representation of data shows the number of pineapples harvested by Baraka from his farm in seven consecutive days. Study the pictorial and then answer the questions that follow:

Key: 1 picture of a pineapple represents 100 pineapples.

Days	Number of pineapples
Saturday	

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Sunday	
Monday	
Tuesday	
Wednesday	
Thursday	
Friday	

(a) Construct a bar graph to represent the data given above.
Vertical scale: 1 cm represents 100 pineapples.
Horizontal scale: 1 cm represents the width of each bar.

(b) Which day did he harvest a largest number of pineapples? How many pineapples were harvested on that day?

(c) Which days did he harvest the same number of pineapples? How many pineapples were harvested in each of those days?

(d) Find the average number of pineapples harvested in all seven days.

3. The following table shows a number of malaria patients at Mgori Health Center. Study it and answer the questions that follow:

Month	January	February	March	April	May	June
Number of malaria patients	160	180	120	200	200	100

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(a) Construct a bar graph to represent the data given in the table.
Vertical scale: 1 cm represents 20 patients.
Horizontal scale: 1 cm represents the width of each bar.

(b) Which month recorded the highest number of patients? What was the number of patients?

(c) Find the average number of patients who reported at the Health Center from January to June.

(d) By how many patients was the number of patients in June less than the average?

4. Msunga bought bananas for five consecutive weeks as shown in the following table. Study the table and answer the questions that follow:

Week	First week	Second week	Third week	Fourth week	Fifth week
Number of bananas	350	250	450	350	150

(a) Construct a bar graph to represent the data given in the table.
Vertical scale: 1 cm represents 50 bananas.
Horizontal scale: 1 cm represents the width of each bar.

(b) In which weeks did Msunga buy the same number of bananas?

(c) Find the difference between the number of bananas bought during the third and fifth weeks.

(d) Find the average of the bought bananas in a week.

(e) How many bananas did Msunga buy in the second week?

Exercise 4

Answer the following questions:

1. Find the average of the following measurements:

(a) 20 km, 80 km, 40 km, and 60 km

(b) 35 litres, 50 litres, 45 litres, and 30 litres

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2. Anna scored 45 marks in science, 50 marks in mathematics and 55 marks in Kiswahili. What was the average score of Anna in all three subjects?

3. Paul is 11 years old, Juma is 9 years old and Aisha is 7 years old. What is the average age of the three children?

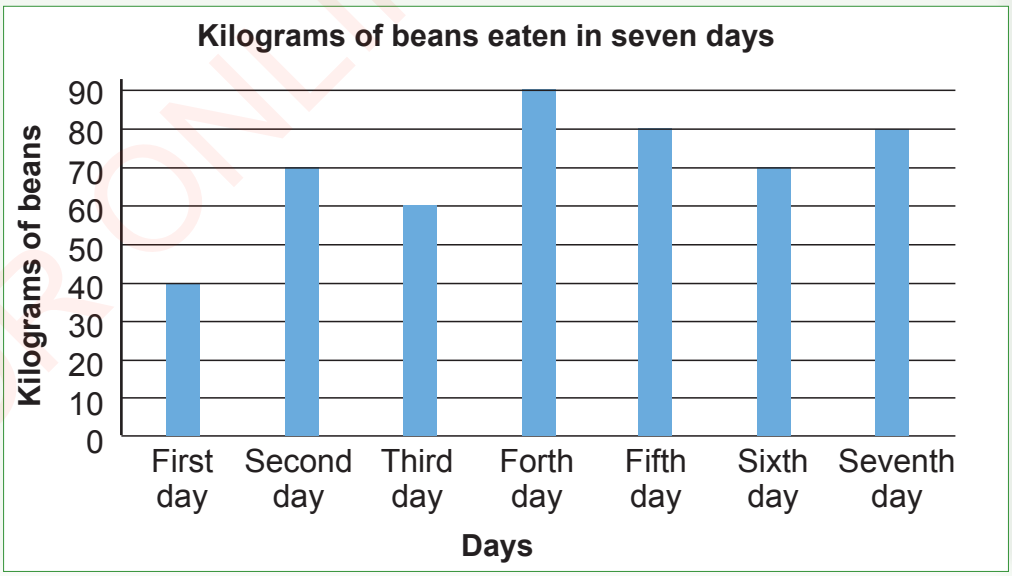
4. The weights of 6 people in kilograms are 80 kg, 70 kg, 65 kg, 90 kg, 55 kg and 60 kg. Find their average weight in kilograms.

5. If five bags of maize weigh 100 kg, 90 kg, 110 kg, 95 kg and 105 kg. What is the average weight of the five bags of maize?

6. Mr. Jombwe's sales of milk for seven consecutive days were as follows: 46 litres, 41 litres, 40 litres, 50 litres, 58 litres, 60 litres and 34 litres. What was Mr. Jombwe's average sale of milk in a day?

7. The harvests of coconuts on 8 different occasions were: 10 coconuts, 15 coconuts, 5 coconuts, 7 coconuts, 3 coconuts, 4 coconuts, 4 coconuts and 24 coconuts. What was the average harvest of coconuts on one occasion?

8. The following bar graph shows the kilograms of beans eaten by students in seven days. Study the graph and answer the questions that follow:



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(a) On which day was the largest number of kilograms of beans used?
(b) On which days was the same number of kilograms of beans used?
(c) Find the total number of kilograms of beans used during all seven days.
(d) On average, how many kilograms of beans were used in one day?

9. The number of cows sold at Songambele auction mart in 6 weeks were as in the following table:

Week	First week	Second week	Third week	Fourth week	Fifth week	Six week
Number of cows	90	40	20	25	50	75

(a) Construct a bar graph to represent the data given in the table.
Vertical scale: 1 cm represents 5 cows.
Horizontal scale: 1 cm represents the width of each bar.
(b) Which week recorded the lowest sales of cows?
(c) What is the total number of cows sold during the 6 weeks?
(d) Which week recorded the highest sales of cows?
(e) Find the average number of cows sold in a week.

10. A health centre recorded the number of patients with eye problems for six consecutive days as shown in the following table:

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Number of patients	450	310	340	520	424	356

(a) Construct a bar graph to represent the data given in the table.
Vertical scale: 1 cm represents 5 patients.
Horizontal scale: 1 cm represents the width of each bar.
(b) Which day recorded the largest number of patients? How many were they?
(c) Find the average number of patients recorded in the six days.

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Summary

1. Bar charts are used to represent and compare information or data.
2. Bar charts can be drawn using vertical or horizontal bars.
3. The average is calculated using the formula:

$$\text{Average} = \frac{\text{Sum of the item values}}{\text{Number of items}}.$$

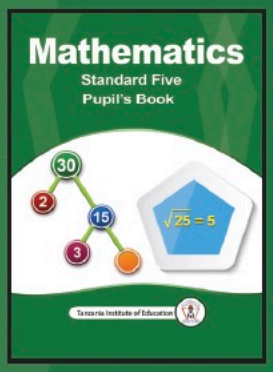
4. The choice of a scale in constructing a bar graph depends on the size of the given data.

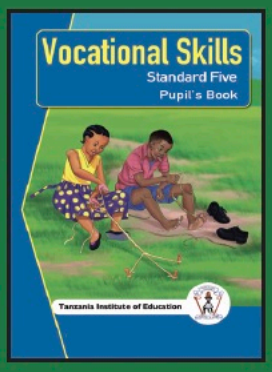
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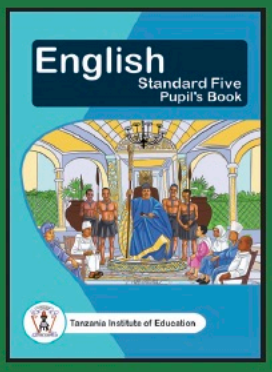
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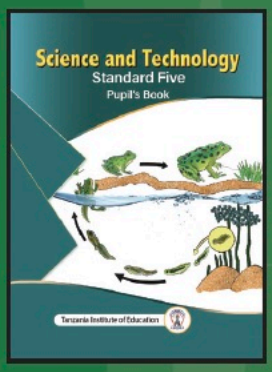
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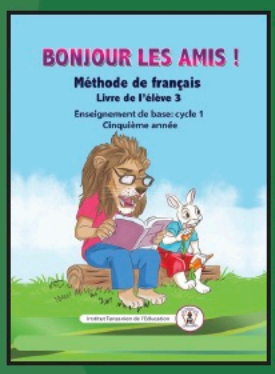
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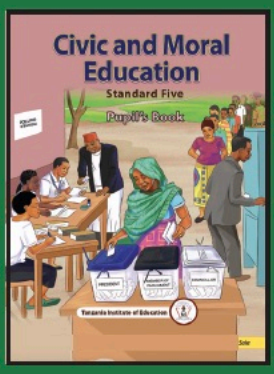


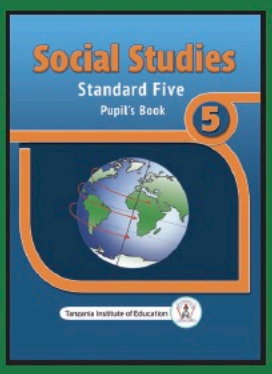


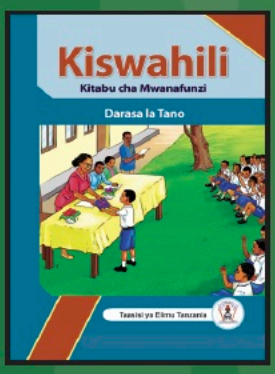












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