Model Textbook of

Mathematics

5

Based on National Curriculum 2022-23

National Book Foundation
as
Federal Textbook Board, Islamabad

بِسۡمِ اللّٰہِ الرَّحۡمٰنِ الرَّحِیۡمِ

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Mathematics

Grade 5

Based on National Curriculum 2022-23

National Curriculum Council Secretariat,
Ministry of Federal Education and Professional Training,
Government of Pakistan

Model Textbook of **Mathematics**
for Grade 5

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PREFACE

This Model Textbook for Mathematics grade 5 has been developed by NBF according to the National Curriculum of Pakistan 2022-23. The aim of this textbook is to enhance learning abilities through inculcation of logical thinking in learners. The main objective of this book is to develop higher order thinking processes by systematically building upon the foundation of learning from the previous grades. A key emphasis of the present textbook is on creating real life linkages of the concepts and methods introduced. This approach was devised with the intent of enabling students to solve daily life problems as they go up the learning curve and for them to fully grasp the conceptual basis that will be built upon in subsequent grades.

An amalgamation of the efforts of experts and experienced authors, this book was reviewed and finalized after extensive reviews by professional educationists. Efforts were made to make the contents student friendly and to develop the concepts in interesting ways.

The National Book Foundation is always striving for improvement in the quality of its books. The present book features an improved design, better illustration and interesting activities relating to real life to make it attractive for young learners. However, there is always room for improvement and the suggestions and feedback of students, teachers and the community are most welcome for further enriching the subsequent editions of this book.

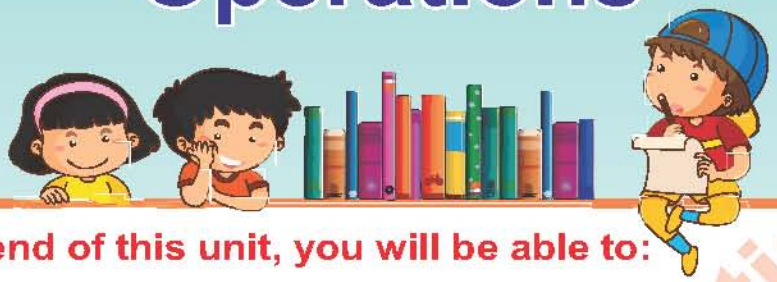
May Allah guide and help us (Ameen).

Dr. Raja Mazhar Hameed
Managing Director

Contents

Unit-1

Whole Numbers and Operations



By the end of this unit, you will be able to:

- Count, read and write numbers up to 9,999,999.
- Recognize the place value of each digit in 6 and 7 digit numbers.
- Compare and order whole numbers.
- Add and subtract up to 6-digit numbers mentally and in written form (with and without regrouping).
- Solve real-world word problems involving addition and subtraction.
- Estimate the answer to an addition and subtraction question.
- Multiply up to 5-digit numbers with 1-digit, 2-digit and 3-digit numbers and solve real world word problems involving multiplication.
- Divide up to 5-digit numbers by 1-digit and 2-digit numbers and solve real-world word problems involving division.
- Use appropriate operations to solve real-world word problems involving addition, subtraction, multiplication and division.
- Using a pattern rule, describe the pattern found in a given table or chart.
- Identify and apply the pattern rule of a given increasing and decreasing pattern.
- Recognize and use square numbers and cube numbers.

The minimum distance between the earth and the moon is about 363,104 kilometres and the maximum distance is about 405,696 kilometres. How will you write these distances in words?

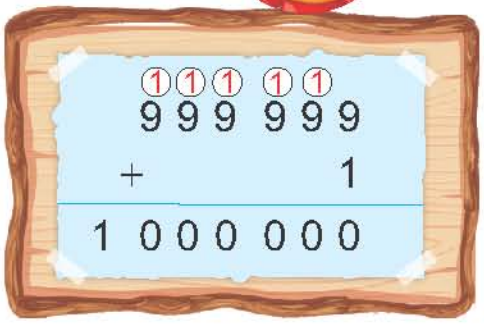
Numbers up to 1 Million

There are about 391,000 types of plants in the world. How can we write this number in words?

To denote place values, we put commas after every 3 digits, from the right. We can also denote this number by putting spaces after every 3 digits, from the right.
For example 391,000 can be written as 391 000.

The number 391 000 can be read as "Three hundred ninety one thousand".

We know that 999 999 is the greatest 6-digit number. If we add 1 to it, we get one million; (1 000 000), which is the smallest 7-digit number. 1 000 000 is the smallest 7-digit number.



We can write this number with the help of a place value chart as shown below.

Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
	9	9	9	9	9	9
1	0	0	0	0	0	0

Try Yourself

How many hundreds are there in one hundred thousands?
How many thousands are there in one million?

The number 1 456 907 in a place value chart is written as:

Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
1	4	5	6	9	0	7

We write 1 456 907 in words as, one million four hundred fifty-six thousands, nine hundred seven.

Let's write the value and place value of each digit in this number.

1 is at the millions place, its place value = $1 \times 1\,000\,000 = 1\,000\,000$

4 is at the hundred thousands place, its place value = $4 \times 100\,000 = 400\,000$

5 is at the ten thousands place, its place value = $5 \times 10\,000 = 50\,000$

6 is at the thousands place, its place value = $6 \times 1\,000 = 6\,000$

9 is at the hundreds place, its place value = $9 \times 100 = 900$

0 is at the tens place, its place value = $0 \times 10 = 00$

7 is at the ones place, its place value = $7 \times 1 = 7$

Give flash cards with place value written in numerals and words. Write a few numbers on the board and ask students to write the place value of each digit.

1 456 907 = 1 000 000 + 400 000 + 50 000 + 6 000 + 900 + 00 + 7

Writing a number as the sum of the place value of its digits is called expanded form.

Write the value and place value of each digit in 5 987 516.

5 is at millions place, so its place value	= 5 × 1 000 000	= 5 000 000
9 is at hundred thousands place, so its place value	= 9 × 100 000	= 900 000
8 is at ten thousands place, so its place value	= 8 × 10 000	= 80 000
7 is at thousands place, so its place value	= 7 × 1 000	= 7 000
5 is at hundreds place, so its place value	= 5 × 100	= 500
1 is at tens place, so its place value	= 1 × 10	= 10
6 is at ones place, so its place value	= 6 × 1	= 6

5 987 516 is read as "five million nine hundred eighty-seven thousand, five hundred sixteen".

5 987 516 = 5 000 000 + 900 000 + 80 000 + 7 000 + 500 + 10 + 6

Read and Write Numbers up to 1 Million

Identify the place values of digits and then read the following numbers.

Divide students in groups. Ask them to make a 7-digit number and write the value and place value of each digit.

(i) 6,658,211

We read as "six million six hundred fifty eight thousand two hundred eleven".

(ii) 4,079,320

We read as "four million seventy nine thousand three hundred twenty".

(iii) 1,506,056

We read as "one million five hundred six thousand fifty-six".

Write the following numbers in figures.

(i) Nine million four hundred three thousand six hundred forty-five.

(ii) Eight million seven hundred fifty three thousand forty-two.

(iii) Two million four hundred four thousand one hundred five.

We write the numbers as

(i) 9,403,645 **(ii)** 8,753,042 **(iii)** 2,404,105

Try Yourself

K-2 is the 2nd highest mountain in the world. It is located on the Pakistan-China border. Its height is 861 100 centimetres.

a) Write the height in expanded form.

b) Write the place value of each digit.

c) Write the height in words.

Try It!

What number am I?

I am a 7-digit number. My tens digit is 5.
My ten thousands digit is 3 less than my tens digit.
My ones digit is the greatest 1-digit even number.
My thousands digit is 3 times my ten thousands place digit.
My greatest place value digit is the sum of my tens digit and my ten thousands digit.
My hundred thousands place digit is the ones digit of the smallest 2-digit number.
My hundreds place digit is the product of my tens place digit and my thousands place digit.

EXERCISE-1

1. Write the following numbers in words.

a) 290 014	b) 433 453	c) 1 010 009
d) 9 871 653	e) 1 242 140	f) 2 688 069
g) 1 874 454	h) 6 495 523	

2. Write the following numbers in figures.

(i) Five million six hundred twenty two thousand three hundred forty-six.
(ii) Eight million nine hundred sixty two thousand seventy-three.
(iii) One million five hundred three thousand six hundred five.
(iv) Two million three hundred two thousand seven hundred sixty-five.
(v) Three million one hundred fifty two thousand two hundred forty-eight.
(vi) Six million three hundred three thousand five hundred six.

3. Write the following numbers in expanded form.

a) 131 441 b) 6 000 900 c) 4 949 181

d) 6 466 456 e) 7 286 019 f) 9 479 321

g) 8 510 602 h) 1 202 001

4. Match Column A with Column B.

Column A	Column B
a) Eight million seven thousand eight hundred.	8 808 808
b) Two hundred seventy-eight thousand seventy-eight.	2 006 002
c) Eight million eight hundred eight thousand eight hundred eight	8 007 800
d) Two million seven thousand five hundred five	278 078
e) Two million six thousand two	2 007 505

5. Write the value and place value of the coloured digits.

a) 4 545 445 b) 9 846 532 c) 6 782 456 d) 9 080 714

e) 2 997 924 f) 8 425 419 g) 7 817 656 h) 1 701 232

6. Look at the colored digit in 1 434 501 and jump:

(i) 1 000 steps forward.

1 434 501, ----------, ----------, ----------, ----------, ----------

(ii) 10 000 steps backward.

1 434 501, ----------, ----------, ----------, ----------, ----------

(iii) 100 steps backward.

1 434 501, ----------, ----------, ----------, ----------, ----------

(iv) 100 000 steps forward.

1 434 501, ----------, ----------, ----------, ----------, ----------

7. According to the 2017 census, the population of Islamabad is 1 014 825.

a) Write it in words.

b) Write the place value of each digit.

c) Write it in expanded form.

8. The speed of light in a vacuum, is 299 792 kilometres per second.

a) Write it in words.

b) Write the place value of each digit.

c) Write it in expanded form.

Comparing and Ordering Whole Numbers

Salary of Aslam is Rs.45,678 while that of Amir is Rs.44,999.
How can we compare the salaries of both?

We start comparing from the left.

(i) Both numbers have same digits at the ten thousands place.

45 678 44 999
Same

(ii) Now compare digits in the thousands place.

45 678 44 999
greater less

Therefore, 45,678 is greater than 44,999.
Symbolically:

45 678 > 44 999

We can also say that 44 999 is less than 45 678.
Symbolically:

44 999 < 45 678

Key Fact

(i) The symbol "<" is read as "less than".
(ii) The symbol ">" is read as "greater than".

Try Yourself

(i) Two numbers have 6 and 7 digits respectively. Which one is greater?
(ii) Which number is lesser? 888888 or 8888888

Compare numbers 7 776 439, 7 775 854 using symbols: <, >

Start comparing from left:

(i) First three digits are same
(ii) Now look at the fourth digit in both numbers.
As 6 > 5

Therefore, 7,776,439 > 7,775,854

EXERCISE-2

1. Compare the following numbers using symbols: <, > or =.

(a) 44 444 ☐ 333 333
(b) 69 312 ☐ 68 311
(c) 344 121 ☐ 345 333
(d) 120 312 ☐ 69 311
(e) 801 000 ☐ 810 000
(f) 52 613 ☐ 52 970
(g) 800 002 ☐ 800 020
(h) 54 321 ☐ 54 321
(i) 60 993 ☐ 60 423

2. Write in ascending and descending order.

(i) 15 150, 15 140, 15 101, 15 110, 15 000
(ii) 14 050, 12 100, 21 150, 19 888, 19 099
(iii) 5 150, 5 051, 15 150, 5 151, 1 515
(iv) 696 966, 696 900, 696 969, 696 960, 696 906
(v) 101 010, 100 100, 101 101, 100 110, 101 001

Mental Addition and Subtraction

There are 225 beads in basket and 735 beads in bowl. Let us find the total number of beads.

225 can be written as:

$$225 = 200 + 25$$

Similarly, 735 can be written as:

$$735 = 700 + 35$$

Now, $225 + 735 = (200 + 25) + (700 + 35)$

$= (200 + 700) + (25 + 35)$

$= 900 + 60 = 960$

Try Yourself

Add 497 and 505 mentally.

Example:

i. Subtract 1 160 from 4 563.

ii. Find 16 540 – 2 300

Solution:

i. Subtract 3 from 4 563 to make 4 560. $4\,563 - 3 = 4\,560$

Now $4\,560 - 1\,160 = 3\,400$

As we have subtracted 3 form 4 563 to make calculation easy, add it back to 3 400.

$3\,400 + 3 = 3\,403$

ii. Subtract 40 from 16 540 to make 16 500. $16\,540 - 40 = 16\,500$

Now $16\,500 - 2\,300$

$= 14\,200$

Again $14\,200 + 40$

$= 14\,240$

Addition and Subtraction

Addition

After the construction of a new national hospital, 40 655 beds were arranged during the first month. In the second month, 32 263 more beds were arranged. Find the total number of beds.

By adding the numbers 40 655 and 32 263 we can find the total number of beds.

		T.Th	Th	H	T	O
				(1)		
Number of beds in the first month =		4	0	6	5	5
Number of beds in the second month =	+	3	2	2	6	3
Total number of beds =		7	2	9	1	8

Thus, the total number of beds arranged are 72 918.

Try Yourself

Add 567 098 and 381 940.

Example:

There are 124 789 books on Mathematics and 200 699 books on History in a digital library. Find the total number of books.

Solution:

	H.Th	T.Th	Th	H	T	O
			(1)	(1)	(1)	
Books on Mathematics =	1	2	4	7	8	9
Books on History =	+ 2	0	0	6	9	9
Total number of books =	3	2	5	4	8	8

So, total number of books = 325 488

Example:

Add 293 109 and 625 834.

Solution:

	H.Th	T.Th	Th	H	T	O
	①2	9	①3	1	0	9
+	6	2	5	8	3	4
	9	1	8	9	4	3

Try Yourself

Find sum of the smallest and the greatest 6-digit numbers.

Subtraction

During a tree plantation campaign, 554 876 trees were planted in March and 263 755 trees were planted in April.

a) In which month more trees were planted?

b) How many more trees were planted?

		H.Th	T.Th	Th	H	T	O
Trees planted in March	=	4 5	1 5	4	8	7	6
Trees planted in April	= −	2	6	3	7	5	5
Difference	=	2	9	1	1	2	1

a) More trees were planted in March.

b) 291 121 more trees were planted.

Try Yourself

Make any two 6-digit numbers and find the difference.

Example:

A toy factory manufactured 598 248 toys out of which 446 719 toys were in plastic material. How many toys were in non-plastic material?

To find the number of non-plastic toys, we will subtract 446 719 from 598 248.

Solution:

		H.Th	T.Th	Th	H	T	O
Total Toys	=	5	9	$^{7}\cancel{8}$	$^{1}2$	$^{3}\cancel{4}$	$^{1}8$
Plastic toys	= −	4	4	6	7	1	9
Non-plastic toys	=	1	5	1	5	2	9

Thus, the number of non-plastic toys = 151 529

Example: Subtract 289 344 from 760 862.

Solution:

H.Th	T.Th	Th	H	T	O
$^{6}\cancel{7}$	$^{15}\cancel{6}$	$^{1}0$	8	$^{5}\cancel{6}$	$^{1}2$
− 2	8	9	3	4	4
4	7	1	5	1	8

TEACHING POINT

Write the digits from 0-9 on the board and ask the students to make two 6-digit numbers. Ask them to subtract the number.

EXERCISE-3

1. Add or subtract mentally.

(a) 1 436 + 198	(b) 1 214 + 1 613	(c) 23 145 + 22 855
(d) 495 + 1 980	(e) 159 + 2 302	(f) 23 145 – 20 100
(g) 7 930 – 410	(h) 3 274 – 2 254	(i) 12 002 – 1 999

2. Solve the following.

a) 100 700 + 291 562	b) 417 381 + 309 201	c) 591 727 + 702 929
d) 319 898 + 428 888	e) 766 442 + 611 222	f) 542 001 + 621 416

3. Solve the following.

a) 209 856 – 205 660	b) 788 991 – 206 070	c) 395 108 – 165 439
d) 673 265 – 656 600	e) 686 898 – 333 333	f) 744 762 – 565 656

4. Solve the following.

(a) 135 436 + 219 588 + 109 876 (b) 128 701 + 153 130 – 200 874

(c) 923 145 – 422 805 – 33 214 (d) 540 782 – 301 980 + 400 045

5. Sadia bought a plot for Rs. 659 814 and another plot for Rs. 799 999. Find the total amount she paid for both plots.
6. Amaan has an annual income of Rs. 456 750. He spends Rs. 125 295 on the construction of a Masjid. How much money has he left?
7. Town A has a population of 459 814 and town B has a population of 325 919.
   a) What is the total population of the two towns?
   b) Which town has more population and how much?
8. The annual yield of a mango field in one year is 656 565 kilograms. In the second year, the yield decreased by 100 984 kilograms. How much mango was produced in the second year?
9. A government built 386 655 number of houses for homeless persons in one year. In the second year, 24 521 less number of houses were built than the previous year. How many houses were build in both years?

10. Fatima has Rs. 954 888 in her bank account. She withdraws Rs.135 600 from the bank to buy a laptop. How much money will be left with her?
11. A factory owner gave Rs. 448 870 as reward to his employees in the first year. In the second year 437 995 rupees were given as reward.
    a) What is the total reward given in both years?
    b) How much less reward was given in the second year?
12. Samantha's father donates Rs. 600 000 to two welfare organizations. If he pays Rs. 385 990 to one welfare organization, how much he pay to the other?

Estimation in Sum and Difference of Numbers

Fakhira has 58 students in her class.

Her brother Amjad has 44 students in his class.

Her sister has 52 students in her class.

One day Fakhira's mother asks her about number of students in both classes. Fakhira starts to add number of students using her pen and paper. But her mother stops her and asks her to just estimate number of students in both classes. How can Fakhira quickly come up with an approximate answer?

The first step in estimating a sum or a difference is to round the numbers, by changing them to the nearest ten, hundred and thousand etc.

Round the numbers first, then use mental math to estimate an answer.

When rounding, follow these rules:

(a) If the number being rounded is less than 5, round down.

(b) If the number being rounded is 5 or greater, round up.

In the above example:

58 is rounded to 60, 44 is rounded to 40 and 52 is rounded to 50.

So, estimated number of students in three classes is:

60 + 40 + 50 = 150

Now the actual sum is:

58 + 44 + 52 = 154

We note that estimated answer is closer to the original answer.

Key Fact

1. The estimation must make sense for the problem.
2. The estimation must be reasonable.
3. The estimation must be close to the exact answer.

Example:

i. **Estimate the sum:**

ii. **Estimate the difference:**

Solution:

i. **387+ 293**

387 ≈ 400 (rounds up to the nearest 100)
293 ≈ 300 (rounds up to the nearest 100)
Then estimated sum is:
400 + 300 = 700
Note: The exact sum is:
387+ 293 = 680

ii. **592 – 411**

592 ≈ 600 (rounds up to the nearest 100)
411 ≈ 400 (rounds down to the nearest 100)
Then estimated difference is:
600 – 400 = 200
Note: The exact difference is:
592 – 411= 181

EXERCISE-4

Estimate the following sums and differences.

1. 65 + 72 **2.** 42 + 55 **3.** 31+ 84 **4.** 203 + 77

5. 301+ 93 **6.** 344 + 508 **7.** 503 + 309 **8.** 671 + 429

9. 401+ 503 **10.** 688 + 408 **11.** 33 − 19 **12.** 46 – 18

13. 47 − 12 **14.** 77 – 39 **15.** 403 − 113 **16.** 98− 55

17. 87 − 44 **18.** 652 −103 **19.** 752 − 212 **20.** 989 − 199

21. 198 + 403 − 98 **22.** 532 − 204 + 111 – 45

Multiplication and Division

Multiplication

If the price of a solar panel is Rs. 18 250, then find:

a) the price of 10 panels.

b) the price of 100 panels.

c) the price of 1 000 panels.

To find the price of 10, 100 and 1 000 panels, we will multiply the price of one panel by 10, 100 and 1 000 respectively.

price of 10 panels	=	18 250 × 10	=	Rs. 182 500
price of 100 panels	=	18 250 × 100	=	Rs. 1 825 000
price of 1 000 panels	=	18 250 × 1 000	=	Rs. 18 250 000

Key Fact

- When we multiply a whole number by 10, we place one zero to the right side of the number.
- When we multiply a whole number by 100, we place two zeros to the right side of the number.
- When we multiply a whole number by 1 000, we place three zeros to the right side of the number.

Multiply 34 523 by 10, 100 and 1 000.

34 523 × 10 = 345 230

34 523 × 100 = 3 452 300

34 523 × 1000 = 34 523 000

Try Yourself

Find the products:

a) 100 × 100 = ?

b) 1 000 × 100 × 10 = ?

c) 1 000 × 10 = ?

The price of one laptop is Rs.102 900. What is the cost of 215 such laptops?

To find the price of 215 laptops, we will multiply the price of 1 laptop by 215.

Price of 1 laptop	=			1	0	2	9	0	0	
Number of laptops	=		×				2	1	5	
				5	1	4	5	0	0	→ 102 900 × 5
			1	0	2	9	0	0	0	→ 102 900 × 10
		+ 2	0	5	8	0	0	0	0	→ 102 900 × 200
Total cost	=	2	2	1	2	3	5	0	0	

Thus, cost of 215 laptops is Rs. 22 123 500.

Try Yourself

Multiply the greatest 6-digit number by the greatest 2-digit number.
Multiply the greatest 6-digit number by the smallest 3-digit number.

Example:

A company buys 185 motorbikes. The cost of one bike is Rs. 79 459. What will be the total cost of 185 motor bikes?

To find the cost of 185 bikes, we will multiply 79 459 by 185.

Solution:

Cost of 1 bike	=				7	9	4	5	9
Number of bikes	=		×				1	8	5
				3	9	7	2	9	5
			6	3	5	6	7	2	0
		+	7	9	4	5	9	0	0
Total cost	=	1	4	6	9	9	9	1	5

Thus, the cost of 185 bikes is Rs. 14 699 915.

Example:

i. Find the product of 23 678 and 32. ii. Find the product of 60 392 and 425.

Solution:

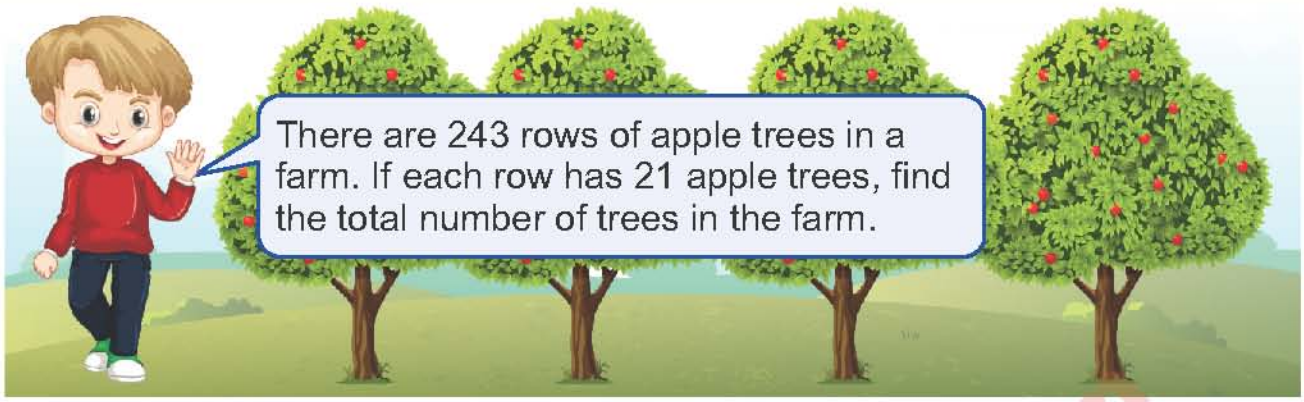
i.		2	3	6	7	8
	×				3	2
		4	7	3	5	6
+	7	1	0	3	4	0
	7	5	7	6	9	6

ii.			6	0	3	9	2
		×			4	2	5
		3	0	1	9	6	0
	1	2	0	7	8	4	0
+	2	4	1	5	6	0	0
	2	5	6	6	6	6	0

Try Yourself

Cost of 1 wall clock is Rs.1560.
What is cost of 35 such wall clocks?

Explain the method of multiplying a 5-digit numbers by a 3-digit numbers. Ask students to write a few 5-digits and 3-digit numbers on their notebooks and find their product.



First write both numbers in their expanded form.

$243 = 200 + 40 + 3$
$21 = 20 + 1$

Now write one number horizontally and the other one vertically in grid as shown in the table.

×	200	40	3
20			
1			

Now multiply every digit in horizontal grid by every digit in vertical grid one by one.

Finally add the resulting products (in blue grids). This will give us the product of 243 and 21.

×	200	40	3	
20	4000	800	60	4860
1	200	40	3	243
	4200	840	63	5103

$4\,000 + 800 + 60 + 200 + 40 + 3 = 5\,103$

So, there are 5 103 apple trees in the farm, altogether.

Try Yourself

Find the product of 5 623 and 418 using the box grid method.

Explain the box or grid method of multiplication to students by multiplying various numbers.

Division

A mask manufacturing factory produced 45 000 masks which are to be packed in boxes of three different sizes. Find the number of boxes required if:

· 10 masks can be packed in a small box.
· 100 masks can be packed in a medium box.
· 1 000 masks can be packed in a large box.

To find the required number of boxes, we will divide the total number of masks by 10, 100 and 1 000 respectively.

Number of small boxes having 10 masks each = 45 000 ÷ 10 = 4 500

Number of medium boxes having 100 masks = 45 000 ÷ 100 = 450

Number of large boxes having 1 000 masks = 45 000 ÷ 1 000 = 45

Key Fact

– When we divide a whole number having 0 at ones place by 10, we remove one zero from the right side of the number.
– When we divide a whole number having 0 at ones and tens place by 100, we remove two zeros from the right side of the number.
– When we divide a whole number having 0 in ones, tens and hundreds place by 1 000, we remove three zeros from the right side of the number.

TEACHING POINT

Explain the method of dividing a 5-digit number by 10, 100 and 1 000. Ask students to write a few 5-digit numbers which have zeros at ones, tens and hundreds places. Then ask them to divide these numbers by 10, 100 and 1 000.

Divide 76 000 by 10, 100 and 1 000.

76 000 ÷ 10 = 7 600

76 000 ÷ 100 = 760

76 000 ÷ 1 000 = 76

I have saved Rs. 16 620 from my pocket money. I want to distribute this amount among 12 children. How can I find the amount that each child will get?

To find the amount that each child will get, we divide 16 620 by 12.

Divisor → 12 | 16620 ← dividend

quotient ← 1385

```
 1385
12|16620
 -12
  46
 -36
  102
 - 96
   60
 - 60
    0
```

Thus, each child will get Rs. 1 385.

16 620 ÷ 12 = 1 385

Quotient = 1 385

Example:

For Pakistan Day celebrations, 10 125 students want to participate from all over the country. If groups of 95 students are to be made:

a) How many groups of students can be made?

b) Find the number of students not in any group.

c) If 720 students cannot participate due to some reason, then how many groups can be made?

Solution:

a) To find the number of groups, we will divide 10 125 by 95.

```
        1 0 6
      ---------
9 5 | 1 0 1 2 5
    - 9 5
    -------
        6 2
    -   0
    -------
        6 2 5
    - 5 7 0
    -------
          5 5
```

10 125 ÷ 95 = 106 55

Number of groups = 106

Students not in any group = 55

b) If 720 students cannot participate;

i) We will subtract 720 from 10 125 to find the students

10 125 – 720 = 9 405

ii) Now we will divide 9 405 by 95 to find the number of groups

9 405 ÷ 95 = 99

```
        9 9
      -------
9 5 | 9 4 0 5
    - 8 5 5
    -------
        8 5 5
    - 8 5 5
    -------
          0
```

So, 99 groups can be made.

Example: Divide 45 205 by 74 and find the quotient and remainder.

Solution:

```
        6 1 0
    ┌─────────
7 4 │ 4 5 2 0 5
    −4 4 4
    ─────────
        8 0
    −   7 4
    ─────────
          6 5
    −     0
    ─────────
          6 5
```

45 205 ÷ 74 = 610

quotient = 610, remainder = 65

Key Fact

When a number is divided by another number, the result is called the quotient and the left over quantity is called the remainder.

EXERCISE-5

1. Multiply the following numbers by 10, 100 and 1 000.

   a) 381 b) 4 090 c) 97 509
   d) 269 472 e) 852 118

2. Divide the following numbers by 10, 100 and 1 000.

   a) 49 000 b) 78 000 c) 65 000
   d) 597 000 e) 210 000

3. Solve the following.

   a) 624 × 23 b) 2 456 × 90 c) 1 092 × 981

   d) 78 543 × 49 e) 45 201 × 561 f) 111 256 × 342

   g) 790 902 × 643 h) 356 219 × 101

4. Solve the following.

a) 13 440 ÷ 15 b) 86 449 ÷ 29 c) 32 536 ÷ 56 d) 47 088 ÷ 48

e) 56 780 ÷ 20 f) 26 166 ÷ 98 g) 73 810 ÷ 11 h) 64 454 ÷ 32

5. Aliya has Rs. 22 580. She wants to distribute it among 18 people.
   a) How much money will each person get?
   b) How much money will be left?

6. Omar's monthly income is Rs. 13 582. Find his total income in 3 years.

7. A toy factory manufactures 28 550 toys in 25 days. How many toys will it manufacture in one day?

8. Hammad bought one laptop for Rs. 89 710. Find the price of 10 such laptops.

9. There are 145 boxes of pencils, each containing 5 pencils. If 48 boxes have blue pencils and the rest have red pencils, find:
   a) the total number of pencils.
   b) the number of red pencils.

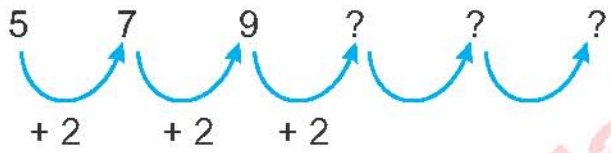
Number Patterns

Arham has started exercising. He increases his exercise time gradually. He exercised for 5 minutes on Monday, 7 minutes on Tuesday and 9 minutes on Wednesday.
If he keeps increasing the time in the same manner, for how many minutes will he exercise on Thursday?

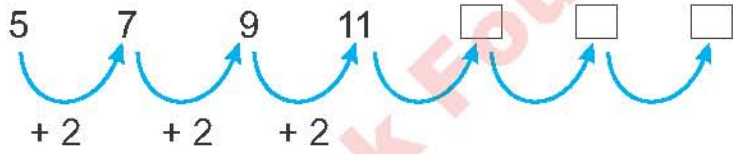
First write the given values (duration/minutes) in increasing order.

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
5	7	9	?	?	?	?

Now try finding out a rule in it. Observe that time is increasing by 2 minutes everyday.



It means by adding 2 to 9, we will get the next number that is 11.



Thus, Arham will exercise for 11 minutes on Thursday.

Can you tell how much time will he take on Friday, Saturday and Sunday?

Arham's exercise time follows a pattern according to a specific rule.
The rule is: Add 2 to the previous term.

By adding 2 to the previous term we can get the next term.

The list of numbers following a specific rule is called a Number Sequence. The numbers in the sequence are called terms of the sequence.

TEACHING POINT

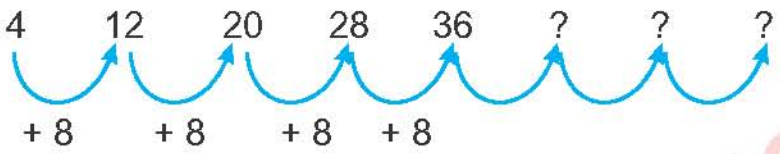
Divide the students in two groups. Ask each group to make at least five patterns. Then exchange these patterns with other groups and ask them to identify the rules of the pattern.

Example: Look at the terms of this pattern,

4, 12, 20, 28, 36, ...

– Find the rule.
– Find the next three terms.

Solution:



Rule: This is an addition pattern in which every next number is obtained by adding 8 to the previous number.

So, the next three terms are:

44, 52, 60

Try Yourself

Identify the rule for this pattern and find the next three terms: 52, 47, 42, ___, ____, ___.

Example: Observe the pattern:

2, 4, 8, 16, ___, ____, ____

i. Find the rule. ii. Find the next three terms.

Solution:

It is a multiplication pattern in which every next number is obtained by multiplying the previous number by 2.

Rule of the pattern: Multiplying by 2

Next 3 terms = 32, 64, 128.

Try Yourself

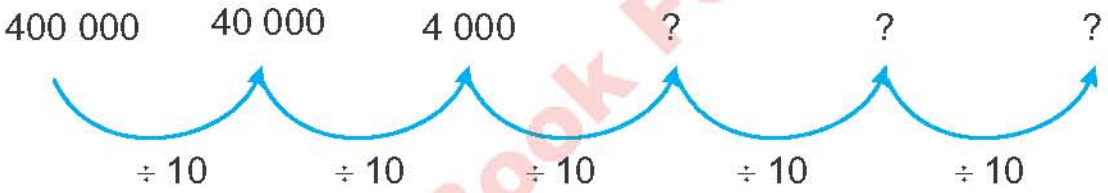
Ahad had a plant in the pot. He observed that the height of the plant is increasing by 4 centimetres daily.
If on Monday the height of the plant was 12 centimetres, find on which day the plant will be 24 centimetres high?

Example: Look at this number pattern:

400 000, 40 000, 4 000, ...

· i. Find its rule. ii. Find the next three terms.

Solution:



If we look at the terms of this pattern, we see that by dividing 400 000 by 10, we get 40 000 and by dividing 40 000 by 10, we get 4 000.
It means that this is a division pattern.

This is a division pattern in which next term is obtained by dividing the previous term by 10.

Rule: Dividing by 10.

So, its next 3 terms are:

400, 40, 4

Try Yourself

Identify if this pattern is increasing or decreasing and then find the next three terms.

60, 600, 6 000, 60 000, ___, ___, ___

We can also find patterns in a chart or table.
Observe the given hundreds chart:

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	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

By starting at 10, we can see that pattern is being made in coloured boxes, every next number is obtained by adding 9 to the previous one.

By starting at 100, we can see that a pattern is being made in coloured boxes, every next number is obtained by subtracting 11 from the previous one.

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	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Try Yourself

Observe the hundreds chart and find three patterns. Identify the rules for the patterns.

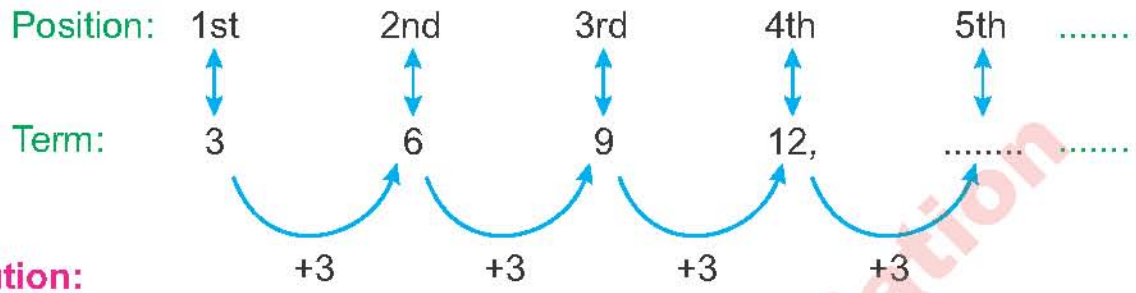
TEACHING POINT

Divide the students in groups. Ask a group to create a table of patterns. Then ask the other group to identify the rules of the patterns given in the table.

Example: Consider the following sequence:

3, 6, 9, 12, ...

Find the position number and term using the following.



Solution:

The rule of the pattern is adding 3 to the previous term.

We can write this pattern in table form as:

Position	Term
1	3
2	3 + 3 = 6
3	6 + 3 = 9
4	9 + 3 = 12
5	12 + 3 = 15

Try Yourself

Identify the rules of these pattern and also find the next three terms.

a) 3, 6, 12, 24, _____, _____, _____.

b) 5, 7, 10, 14, _____, _____, _____.

c) 100, 96, 91, 85, 78, _____, _____, _____.

d) 8, 80, 800, 8 000, _____, _____, _____.

e) 900 000, 90 000, 9 000, _____, _____, _____.

EXERCISE-6

1. Identify the rule of this pattern and also find the next three terms

   a) 10, 40, 160, 640,____, ____, ____.

   b) 22, 220, 2 200,____, ____, ____.

   c) 352, 176, 88, ____, ____, ____.

   d) 780, 880, 980, ____, ____, ____.

   e) 560, 540, 520, 500, _____, _____, _____.

2. Observe the given hundred chart. Find at least five patterns and identify the rules of these patterns.

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	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

3. Observe the given tables and find the rules defined in the pattern.

a)

Position	Term
1	4
2	5
3	6
4	7
5	8

b)

Position	Term
1	12
2	22
3	32
4	42
5	52

c)

Position	Term
1	11
2	22
3	33
4	44
5	55

d)

Position	Term
1	100
2	200
3	300
4	400
5	500
6	600

Squared Numbers

A squared number is a number multiplied by itself.

When we multiply 6 by 6, we get 36.

$6 \times 6 = 36$

Similarly, $10 \times 10 = 100$

Here 36 and 100 are called squared numbers.

The symbol for square is (^{2}).

$1 \times 1 = 1$
$2 \times 2 = 4$
$3 \times 3 = 9$
$4 \times 4 = 16$
$5 \times 5 = 25$

Some more examples of squared numbers are:

1^2

1

$1 \times 1 = 1$

2^2

1	2
3	4

$2 \times 2 = 4$

3^2

1	2	3
4	5	6
7	8	9

$3 \times 3 = 9$

4^2

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

$4 \times 4 = 16$

5^2

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

$5 \times 5 = 25$

6^2

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

$6 \times 6 = 36$

The squared numbers up to 100 are:

1, 4, 9, 16, 25, 36, 49, 64, 81, 100

Cubed Numbers

A cubed number is a number multiplied by itself three times.

When we multiply 2 three times by itself, we get:

$$2 \times 2 \times 2 = 8$$

Similarly,

$$5 \times 5 \times 5 = 125$$

Here 2 and 5 are called cubed numbers.

The symbol for cube is (^{3}).

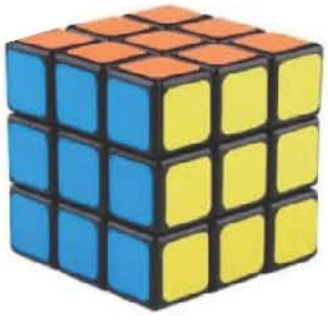
Some more examples of cubed numbers are:

$1 \times 1 \times 1 = 1$

$1^3 = 1$

$2 \times 2 \times 2 = 8$

$2^3 = 8$



$3 \times 3 \times 3 = 27$

$3^3 = 27$

EXERCISE-7

1. Find the squares of following numbers:
   (i) 6 (ii) 7 (iii) 9 (iv) 10 (v) 11 (vi) 15
2. Find the cubes of following numbers:
   (i) 1 (ii) 5 (iii) 7 (iv) 9 (v) 10 (vi) 11
3. Complete the following table.

4. Complete the following table.

I Have Learnt

- reading numbers up to 1 000 000 (one million) in numerals and words.
- writing numbers up to 1 000 000 (one million) in numerals and words.
- adding numbers up to 6-digit numbers.
- subtracting numbers up to 6-digits
- multiplying numbers, up to 5-digits, by 10, 100, and 1 000.
- multiplying numbers, up to 5-digits, by a number up to 3-digits.
- dividing a number up to 5-digits by 10, 100 and 1 000

Vocabulary

numbers	digit
place value	addition
subtraction	multiply
division	pattern
ascending	descending
table	chart
square	estimation
cube	comparing
	ordering

- dividing numbers up to 5-digits by a number up to 2-digits.
- solving real-life situations involving operations of addition, subtraction, multiplication, and division.
- identifying and applying a pattern rule to determine missing elements for a given pattern.
- identifying the pattern rule of a given increasing and decreasing pattern and extend the pattern for the next three terms
- describing the pattern found in a given table or chart.
- identifying square and cube numbers.
- comparing and ordering numbers.
- estimation in sum and difference of numbers.

Review Exercise

1. Encircle the correct option.

a) We give space after every _____ digits in numbers.

i) 2 ii) 3 iii) 4 iv) 16

b) The value of 2 in the number 6 985 621 is _____.

i) 2 ii) 20 iii) 200 iv) 2000

c) In 7 856 211 the digit _____ is the thousands place digit.

i) 2 ii) 5 iii) 6 iv) 8

d) When we multiply a number by _____ we place 3 zeros to its right end.

i) 10 ii) 100 iii) 1 000 iv) 1

e) When we _____a number by 10 we remove a zero from its right.

i) add ii) subtract iii) multiply iv) divide

f) The square of 12 is:

i) 121 ii) 142 iii) 144 iv) 148

g) The cube of 20 is:

i) 400 ii) 4000 iii) 800 iv) 8000

2. Write the following numbers in words.

a) 8 734 123 b) 6 965 129 c) 4 982 009 d) 9 012 011

3. Add the following.

a) 212 121 + 56 234 b) 18 315 + 102 376 c) 727 191 + 92 921

d) 139 657+ 247 777 e) 532 481 + 100 008 f) 200 454 + 126 654

4. Subtract the following.

a) 675 921 - 31 412 b) 986 543 - 65 219 c) 108 761 - 70 021

d) 846 109 - 591 089 e) 865 439 - 761 212 f) 696 349 - 288 888

5. Solve the following.

a) 12 356 × 122 b) 65 781 × 100

c) 262 825 × 522 d) 837 564 × 519

6. Solve the following.

a) 66 693 ÷ 33 b) 35 788 ÷ 42 c) 25 111 ÷ 69

d) 28 000 ÷ 1000 e) 58 580 ÷ 10 f) 28 104 ÷ 28

7. What are the rules for these patterns? Also find the next three terms of each pattern.

a) 50, 100, 150, 200, _____, _____, _____.

b) 180, 165, 150, 135, _____, _____, _____.

c) 18, 90, 450, 2 250, _____, _____, _____.

d) 6 100 000, 610 000, 61 000, _____, _____, _____.

8. Fill in the blanks and complete the pattern.

a) 10 × _____ = 10
10 × _____ = 100
10 × _____ = 1 000
10 × _____ = 10 000

b) _____ ÷ 10 = 1 000
_____ ÷ 100 = 100
_____ ÷ 1 000 = 10
_____ ÷ 10 000 = 1

9. The price of a car is Rs. 456 721 and the price of another car is Rs. 987 676. Find the total price of both cars.

10. There are 768 121 children and 456 789 women, in a city. How many more children are there than the women?

11. The price of a scanner is Rs. 162 900 and the price of a laser printer is Rs. 96 880. Find:

    a) the total price of both items.

    b) the total price of 15 scanners and 3 laser printers.

12. 35 288 blocks are to be packed in 28 boxes.

    a) How many blocks are there in each box?

    b) How many blocks will be left?

13. Observe the given tables and find the rules in the patterns.

a)

Position	Term
1	2
2	4
3	6
4	8

b)

Position	Term
1	10
2	25
3	40
4	55

14. In an election, the winning candidate got 738 462 votes, his rival got 245 731 votes and 2 300 votes were rejected. How many votes were polled in that constituency?

15. In an examination, 318 351 students were passed, 58 760 were failed in one subject and 24 015 were failed in two subjects.
    (a) How many students appeared in the examination?
    (b) How many students did not pass the examination?

16. A factory manufactured 192 786 bicycles in total. Of these 50 436 were sold in May, 73 471 in June and 58 471 in July.
    (a) Find total number of bicycles sold.
    (b) How many bicycles were left?

Unit-2

HCF and LCM

By the end of this unit, you will be able to:

- Identify divisibility rules for 7 and 11 and use them on up to 5-digit numbers.
- Identify and differentiate between 2-digit prime and 2-digit composite numbers up to 100.
- Find H.C.F and L.C.M of two numbers (up to 2-digits) using various methods. (For instance prime factorization, division method etc.)
- Solve real-world word problems involving H.C.F and L.C.M.

Nida wants to grow 12 Roses and 18 Jasmine plants in rows in her home garden. If she wants to grow the same type of plants in one row, find the maximum number of plants that can be grown in one row.

Divisibility Rules for 7 and 11

Ayesha has some numbers. She wants to check whether the numbers are divisible by 7 or 11 or none. How can she do?

Divisibility Rule of 7

A number is divisible by 7, if the difference between twice the unit digit of the given number and the remaining truncated part of the given number is either 0(zero) or multiple of 7.

For example, 756 is divisible by 7.

Explanation:

The unit digit of 756 is 6.

If the unit digit is doubled, we get 12 (i.e., 6 × 2 = 12)

The remaining part of the given number is 75.

Now, take the difference between 75 and 12.

75 – 12 = 63

Which is a multiple of 7. (i.e., 9 × 7 = 63)

Thus, the given number 756 is divisible by 7.

Similarly, 147 is multiple of 7 as 14 – (7 × 2) = 14 – 14 = 0

Is 2,975 divisible by 7? Check.

Try It!

How many numbers are there between 1 and 100 which are divisible by 7?

Key Fact

Divisibility test of a number helps us to check if given number is completely divisible by that number without actually doing the division.

Divisibility Rule of 11

A number is divisible by 11, if the difference between the sums of alternate digits is either 0 (zero) or multiple of 11.

For example:

(i) 4 653 is divisible by 11 as $(4 + 5) - (6 + 3) = 9 - 9 = 0$

(ii) 918 291 is divisible by 11 as $(9 + 8 + 9) - (1 + 2 + 1) = 26 - 4 = 22$

Which is multiple of 11.

Is 54 322 455 divisible by 11? Check.

Key Fact

(i) 11, 22, 33, 44, 55, 66, 77, 88, 99 are divisible by 11.

(ii) 990 is divisible by 2, 3, 5, 6, 10 and 11.

EXERCISE-1

1. Which of the following numbers are divisible by 7?

   (a) 280 (b) 3 500 (c) 5 601 (d) 7 777 (e) 1 414 (f) 11 111

2. Which of the following numbers are divisible by 11?

   (a) 484 (b) 6 000 (c) 2 816 (d) 7 777 (e) 50 187 (f) 7 172

3. Check whether 4 312 is divisible by both 7 and 11? Write three numbers which are divisible by both 7 and 11.

4. Write a 4-digit number which is:

   (i) divisible by both 5 and 7. (ii) divisible by 5, 7 and 11.

5. A number is divisible by 7. Can we say that:

   (i) the number can only be even. (ii) the number can only be odd.

   (iii) the number can be even as well as odd.

Prime Numbers

Number 3 has only two factors, 1 and 3. Similarly, 17 has only two factors, 1 and the number itself. Such numbers are called prime numbers.

A natural number which has only two distinct factors, 1 and the number itself, is called a prime number.

For example:

$2 = 1 \times 2$, $3 = 1 \times 3$, $5 = 1 \times 5$, $7 = 1 \times 7$

Here 2, 3, 5 and 7 are prime numbers. Some more examples are 19, 29 31 etc.

Key Fact

- 1 is not a prime number because its factors 1 and the number itself are the same.
- The smallest even prime number is 2.
- 2 is only even prime number. All other prime numbers are odd.
- The prime numbers which differ by 2 are called twin primes
  For example: 41 and 43 are twin primes. There are infinite number of **twin primes**.
- Every even number except 2 and 4, is sum of two or more odd prime numbers.
  For example: $12 = 5 + 7$, $16 = 3 + 3 + 3 + 7 = 13 + 3 = 5 + 11$
  Even number 4 is the sum of two even primes, that is $4 = 2 + 2$
- Three consecutive prime numbers which differ by 2 form a **prime triplet**.
  (3, 5, 7) is the only known prime triplet.

Class Activity (Sieve of Eratosthenes)

The Sieve of Eratosthenes is a method for finding all primes up to a given natural number. Let us find all prime numbers among the first 100 natural numbers.

(i) List first 100 natural numbers in ten rows as shown below.

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	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

(ii) Cross out 1 as it is not a prime number.

(iii) Circle the number 2 and cross out all other multiples of 2.

(iv) Circle the number 3 and cross out all other multiples of 3.

(v) Circle the number 5 and cross out all other multiples of 5.

(vi) Circle the number 7 and cross out all other multiples of 7.

(vii) Circle the remaining natural numbers.

The natural numbers that are circled are the primes up to 100. These are:

2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97

Key Fact

There are 25 prime numbers between 1 and 100 and are one-fourth of the first 100 natural numbers.

Composite Numbers

Many natural numbers have more than two factors. These are called composite numbers.

A natural number which has more than two different factors is called a composite number. For example:

4 is a composite number because its factors are 1, 2, 4 (more than two).

18 is a composite number because its factors are 1, 2, 3, 6, 9, 18.

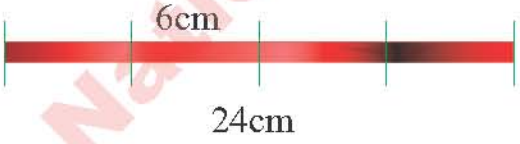
Key Fact

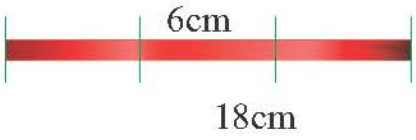
- 1 is neither a prime nor a composite number.
- The smallest composite number is 4.
- All natural numbers except 1 are either prime numbers or composite numbers.
- Product of two prime numbers is never a prime number.
  For example: $3 \times 5 = 15$
- Sum of two prime numbers may or may not be a prime number.
  For example: $2 + 3 = 5$, $5 + 5 = 12$

EXERCISE-2

1. List all prime numbers between 20 and 60.
2. A prime number when added to 101 gives an odd prime number. Find it.
3. One of the twin primes is 7. Find the other prime number if the sum of both numbers is an even number.
4. Find the greatest two digit prime number which when added with 4, gives the smallest three digit prime number.
5. Express each of the following as sum of two prime numbers.
   (a) 34 (b) 33 (c) 42 (d) 60 (e) 54
6. Find a pair of twin primes between 40 and 70.
7. Write the following composite numbers as sum of twin primes.
   (a) 36 (b) 84 (c) 144 (d) 60
8. List ten composite numbers between 41 and 55.
9. List five consecutive composite numbers between 60 and 70.

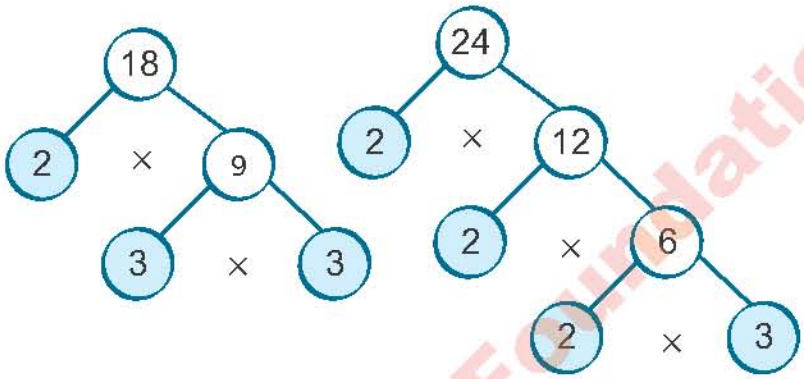
Highest Common Factor HCF





Sara has two pieces of ribbon with lengths 18 centimetres and 24 centimetres. She wants to cut the ribbon into smaller pieces of equal lengths with no remainder.
What is the greatest possible length of each piece?

To cut both ribbons in equal lengths, we need to find the greatest number which can divide both 18 and 24 simultaneously.



Prime factorization of 18 = $2 \times 3 \times 3$

Prime factorization of 24 = $2 \times 3 \times 2 \times 2$

common prime factors of 18 and 24 = 2, 3

product of 2 and 3 = $2 \times 3 = 6$

6 is the greatest factor which divides both 18 and 24 completely.

6 is called the HCF of 18 and 24

The greatest possible length of each piece is 6 cm.

Key Fact

The greatest number which divides two or more numbers simultaneously, is called their HCF.

Give ropes of different lengths to students. Ask them to divide the pieces of ropes in equal lengths.

Example: Find HCF of 12, 30 and 44 by using prime factorization.

Solution:

2	12
2	6
3	3
	1

2	30
3	15
5	5
	1

2	44
2	22
11	11
	1

Prime factorization of 12 = $2 \times 2 \times 3$

Prime factorization of 30 = $2 \times 3 \times 5$

Prime factorization of 44 = $2 \times 2 \times 11$

Common prime factor = 2

HCF = 2

Ali has 36 red pencils and 54 blue pencils. He wants to put his pencils in boxes such that every box has equal pencils of the same colour.
What will be the maximum number of pencils in each box?

We will find HCF of 36 and 54 by using division.

1. Divide the greater number 54 by the smaller number 36 and find remainder 18.
2. Divide 36 by the remainder 18.
3. We will get zero as remainder.

$$
\begin{array}{r}
1 \\
36\overline{)\,54} \\
-36 \\
\hline
18\overline{)\,36} \quad 2 \\
-36 \\
\hline
0
\end{array}
$$

4. The last divisor is 18. So, it is the HCF of 36 and 54.

HCF of 36 and 54 = 18

Thus, the maximum number of pencils of the same colour in each box is 18.

Example:

Find the greatest number which completely divides 26, 48 and 60.

Solution:

First, divide the greatest number 60 by 48.

$$
\begin{array}{r}
\quad 1 \\
48 \overline{)\,60} \\
-48 \quad\quad 4 \\
\hline
\quad 12 \overline{)\,48} \\
\quad -48 \\
\hline
\quad\quad 0
\end{array}
$$

Key Fact

The HCF of two or more than two numbers, which have no common prime factors, is always 1.

HCF of 48 and 60 = 12

Now divide the number (remaining number) 26 by 12

$$
\begin{array}{r}
\quad 2 \\
12 \overline{)\,26} \\
-24 \quad\quad 6 \\
\hline
\quad 2 \overline{)\,12} \\
\quad -12 \\
\hline
\quad\quad 0
\end{array}
$$

The number 2 is the last divisor. So, this is the greatest number which completely divides 26, 48 and 60.

Try It!

Find three 2- digit numbers whose sum is 152 and HCF is 8.

EXERCISE-3

1. Find HCF of the following numbers using prime factorization method.

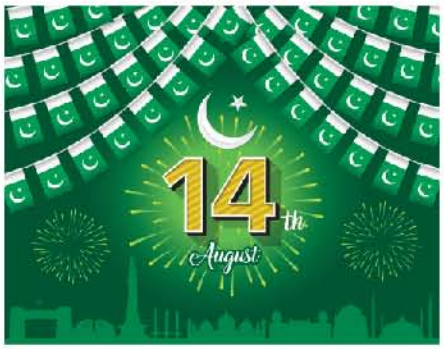
a) 58, 72	b) 21, 48	c) 56, 70	d) 45, 90
e) 42, 49	f) 15, 18, 56	g) 42, 54, 64	h) 18, 30, 90
i) 12, 24, 36	j) 18, 36, 76	k) 5, 35, 40	l) 13, 52, 78

2. Find HCF of the following numbers using division method.

a) 13, 65	b) 25, 75	c) 42, 98	d) 16, 20, 70
e) 56, 84, 88	f) 57, 76, 95	g) 16, 32, 96	h) 20, 40, 80
i) 48, 76, 96	j) 24, 48, 72	k) 51, 65, 75	l) 13, 39, 78

3. The lengths of two ropes is 24 metres and 14 metres. Ali wants to cut the ropes into pieces of equal lengths completely. What will be the maximum length of each piece?

4. For the Independence day celebrations, 52 students in white, 65 students in green and 39 students in golden dress are to be arranged in equal rows such that students of the same colour dress are in each row. What is the greatest number of students that could be in each row?



5. Find the greatest number that divides 16, 24 and 48 completely.

6. Ibrahim and Marwa are preparing first aid kits for the students. They have 30 perforated adhesive bandages, 60 triangular bandages and 75 rectangular bandages. They must distribute these equally in the kits, with nothing left over. What is the greatest number of kits they can be made with this quantity of bandages?

Least Common Multiple LCM

For a science project, grade 4 students visit the science laboratory after every 8 days. Grade 5 students visit the laboratory after every 12 days. If students of both grades visit the laboratory today, find when they will visit the laboratory on the same day again?

Methed-1

Multiples of 8 and 12 will be used to find the day when the students of both grades will visit the laboratory on the same day.

Multiple of 8 are: 8, 16, 24, 32, 40, 48,...

Multiples of 12 are: 12, 24, 36, 48,...

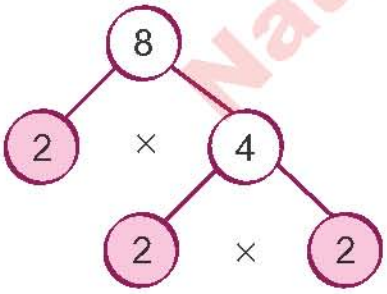
The first two common multiples of 8 and 12 are 24, 48.

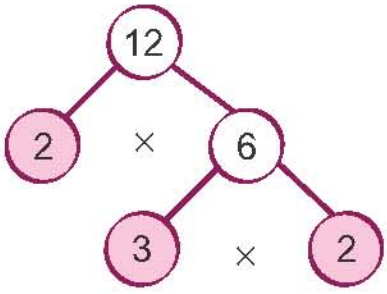
The smallest common multiple of 8 and12 is 24.

24 is called least common multiple of 8 and 12.

Thus, students of both grades will visit the laboratory together after 24 days.

Methed-2





Key Fact

When we multiply any number by any other number, their product is called multiple of that number.

Write pairs of numbers on the board. Ask students to find the first two common factors of these numbers.

Prime factorization of 8 = $2 \times 2 \times 2$

Prime factorization of 12 = $2 \times 2 \times 3$

Product of common prime factors of 8 and 12 = $2 \times 2 = 4$

Product of non-common prime factors 8 and 12 = $2 \times 3 = 6$

LCM = Product of common prime factors × Product non-common prime factors

LCM = 4 × 6

LCM = 24

So, next time students of both grades will visit the laboratory together after 24 days.

Key Fact

The LCM of two or more numbers is the smallest number which is completely divisible by the given numbers.

Example: Find LCM of 16, 30 and 64 using prime factorization.

Solution:

2	16
2	8
2	4
2	2
	1

2	30
5	15
3	3
	1

2	64
2	32
2	16
2	8
2	4
2	2
	1

Prime factorization of 16 = $2 \times 2 \times 2 \times 2$

Prime factorization of 30 = $2 \times 5 \times 3$

Prime factorization of 64 = $2 \times 2 \times 2 \times 2 \times 2 \times 2$

Product of common prime factors of 16, 30 and 64 = $2 \times 2 \times 2 \times 2$

= 16

Ask students to differentiate between HCF and LCM. Give two or three numbers on the board and ask them to find their LCM.

Non common prime factors of 16, 30 and 64 $= 2 \times 2 \times 3 \times 5$

$= 60$

LCM = Product of common prime factors $\times$ Product of non-common prime factors

LCM = 16 $\times$ 60

LCM = 960

The LCM of 16, 30 and 64 = 960

Ali, Ahmad and Umar exercise physical training after every 10, 18 and 20 days respectively. If they all are exercising today, find out when will the next exercise on the same day again.

To find the day, when they will exercise together, we will find LCM of 10, 18 and 20.

LCM = Product of all prime factors

LCM = $2 \times 2 \times 3 \times 3 \times 5$

LCM = 180

2	18, 10, 20
2	9, 5, 10
3	9, 5, 5
3	3, 5, 5
5	1, 5, 5
	1, 1, 1

So, they will exercise together after 180 days.

Example: Find LCM of 12, 20 and 30 using division method.

Solution:

2	12, 20, 30
2	6, 10, 15
3	3, 5, 15
5	1, 5, 5
	1, 1, 1

LCM = $2 \times 2 \times 3 \times 5$

LCM = 60

So, LCM of 12, 20 and 30 = 60

Try It!

A welfare organization is distributing bundles of basic safety items among people containing a packet of 25 masks, a packet of 20 pairs of gloves and a packet of 5 sanitizer bottles. Find out minimum number of packets of each item so that every bundle has one mask, one pair of gloves and one sanitizer bottle in it and no object is left over.

(Hint: first find the LCM of 25, 20 and 5)

EXERCISE-4

1. Find LCM of the following numbers using prime factorization.

a) 3, 21 b) 12, 80 c) 20, 15 d) 4, 10, 16

e) 9, 18, 27 f) 10, 20, 35 g) 20, 60, 75 h) 30, 45, 90

i) 16, 24, 36 j) 18, 60, 75 k) 49, 51, 56 l) 13, 65, 71

2. Find LCM of the following numbers using division method.

a) 14, 70	b) 15, 30	c) 45, 90	d) 35, 60, 75
e) 7, 21, 49	f) 25, 45, 95	g) 16, 32, 48	h) 28, 32, 40
i) 12, 14, 26	j) 10, 20, 25	k) 7, 14, 21	l) 8, 32, 42

3. Find minimum length of the ribbon which can be completely cut into pieces of lengths 45 cm, 75 cm and 85 cm without any leftover.

4. Find the smallest number that is completely divisible by 42, 38 and 16.

5. The tour buses for Badshahi Masjid leaves the station after every 25 minutes, for the interior city after every 15 minutes, and for the zoo after every 30 minutes. If the three buses leave the station simultaneously at 11:05 am, find the time when the three buses will leave the next station simultaneously.

6. Boxes having heights of 22 cm, 35 cm and 50 cm respectively are to be stacked next to each other. What is the shortest possible height at which the three types of boxes will be at the same height?

7. Students of grade 5 have a Mathematics test after every 3 days, English test after every 6 days and Science test after every 9 days. If all the three tests were conducted today, find when will the three tests be conducted together again?

I Have Learnt

- divisibility tests of 7 and 11.
- recognition of 2-digit prime and composite numbers.
- finding HCF of two or three numbers up to 2 - digit numbers using prime factorization method and division method.

Vocabulary

- HCF, LCM
- prime factors
- prime factorization
- multiples
- composite
- divisibility

- finding LCM of:
  - two or three numbers up to 2 - digit numbers using prime factorization method and division method.
- solving real life situations involving HCF and LCM.

Review Exercise

1. Choose the correct option.

a) The HCF of 20, 48 and 56 is _____.

i) 4 ii) 3 iii) 5 iv) 1

b) Which of the following is a prime number?

i) 33 ii) 35 iii) 37 iv) 39

c) The prime factorization of 16 is _____.

i) 2×8 ii) 1×16 iii) $2 \times 2 \times 2 \times 2$ iv) $2 \times 4 \times 2$

d) The LCM of 33, 66 and 81 is _____.

i) 1 770 ii) 1 872 iii) 1 782 iv) 1 287

e) The LCM of two or more prime numbers is always equal to their _____.

i) prime factor ii) quotient iii) LCM iv) product

f) Which of the following is a composite number?

i) 1 ii) 2 iii) 3 iv) 4

2. Find HCF of the following numbers using prime factorization.

a) 15, 18 b) 10, 20 c) 25, 40 d) 56, 88
e) 10, 18, 22 f) 20, 40, 82 g) 16, 38, 98 h) 39, 51, 75

3. Find HCF of the following numbers using the division method.

a) 20, 50 b) 15, 45 c) 60, 70, 80 d) 22, 28, 32
e) 44, 55, 99 f) 34, 48, 62 g) 30, 45, 70 h) 26, 52, 65

4. Find LCM of the following numbers using prime factorization method.

a) 2, 5 b) 3, 7 c) 5, 8 d) 4, 10, 16
e) 20, 25, 50 f) 45, 90, 95 g) 32, 70, 80 h) 33, 66

5. Find LCM of the following numbers using division method.

a) 4, 9 b) 7, 11 c) 14, 26 d) 20, 40
e) 6, 24, 42 f) 10, 20, 30 g) 12, 18, 38 h) 6, 15, 21

6. 84 apples, 56 bananas and 21 oranges were distributed equally among some children. If the same combination of all kinds of fruits is distributed among all the children, find the maximum possible number of children who can receive the fruits?

7. Three water containers contain 12 litres, 24 litres and 42 litres of water.
   a) Find the maximum capacity of a measuring container that can fully measure the amount of water in all three containers.
   b) Find how many times the container needs to be filled to empty each container.

8. Find the smallest number that is completely divisible by 32 and 55.

9. Find the least number of stickers which can be equally distributed among 15, 12 and 10 children.

Unit-3

Fractions

By the end of this unit, you will be able to:

- Compare and order proper, improper fractions and mixed numbers in ascending and descending order.
- Add and subtract two or three unlike fractions and mixed numbers.
- Multiply and divide proper, improper fractions and mixed numbers and express the answer in its simplest form (if applicable).
- Solve real-world word problems involving fractions.

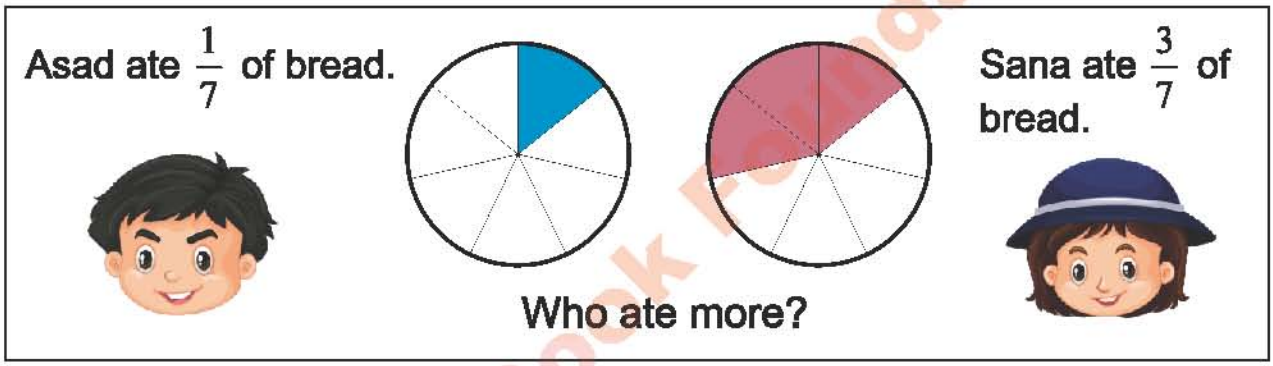
The earth is made up of land and water. If $\frac{2}{3}$ part of earth is covered with water, what part of the earth is land?

Comparing and Ordering Fractions

In our everyday life, we often come across situations where we have to compare two or more fractions. Comparing two fractions means determining the larger and the smaller fraction among them.

Let us go through the different methods of comparing fractions.

Comparing Fractions with Like Denominators



To check who ate more, we will compare $\frac{1}{7}$ and $\frac{3}{7}$.

In $\frac{1}{7}$ and $\frac{3}{7}$, the denominator 7 is the same and numerator $1 < 3$.

So, $\frac{1}{7} < \frac{3}{7}$. Therefore, Sana ate more bread.

To compare fractions with like denominators, we use the following steps:

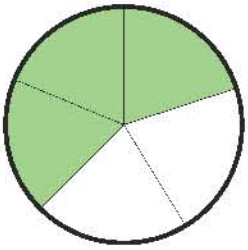
Step 1: Compare numerators.

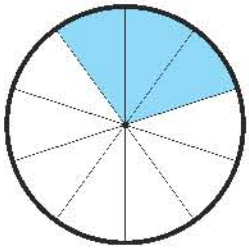
Step 2: The fraction with a larger numerator is larger.

Comparing Fractions with Like Numerators

In a school match, Hassan won 3 games out of 5. Nabeel won 3 games out of 10. Who is a better player?

Hassan





Nabeel

To find who played better, let us compare $\frac{3}{5}$ and $\frac{3}{10}$.

Figure shows that Hassan played better.

To compare fractions with like numerators, we use the following steps:

Step 1: Compare denominators.

Step 2: The fraction with a larger denominator is smaller.

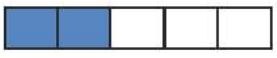
Try Yourself

Tick the smaller fraction in each of the following pairs of fractions.

(i) $\frac{5}{9}, \frac{4}{9}$ **(ii)** $\frac{5}{6}, \frac{5}{9}$

Comparing Fractions with Unlike Numerators and Denominators

Urwa reads $\frac{1}{4}$ of the book and Amna reads $\frac{2}{5}$ of the book. Who read less?



To compare fractions with unlike numerators and denominators, we use the following steps:

Step 1: Find the LCM of the denominators of the given fractions.

The LCM of denominators of 4 and 5 is 20.

Step 2: Convert each fraction to its equivalent fraction with the denominator equal to LCM obtained i.e. 20.

$$\frac{1}{4}=\frac{1}{4}\times\frac{5}{5}=\frac{5}{20} \text{ and } \frac{2}{5}=\frac{2}{5}\times\frac{4}{4}=\frac{8}{20}$$

Step 3: Compare the numerators of the equivalent fractions.
We see that 5 < 8

Step 4: The fraction with a larger numerator is larger.

So, < or <

Therefore, Urwa reads less part of the book.

Example: Compare the following pairs of fractions.

(i) (ii)

Solution:

(i) LCM of 3 and 4 is 12.

$\frac{5}{3}=\frac{5}{3}\times\frac{4}{4}=\frac{20}{12}$ and $\frac{7}{4}=\frac{7}{4}\times\frac{3}{3}=\frac{21}{12}$

As

Therefore,

Try Yourself

Which one is larger or

(ii) LCM of 5 and 4 is 20.

$2\frac{1}{4}=\frac{9}{4}=\frac{9}{4}\times\frac{5}{5}=\frac{45}{20}$ and $\frac{8}{5}=\frac{8}{5}\times\frac{4}{4}=\frac{32}{20}$

As

Therefore,

Comparing Fractions Using Cross Multiplication

In this method, we cross multiply the numerator of one fraction with the denominator of the other fraction.

Let us compare $\frac{3}{4}$ and $\frac{7}{8}$.

Step 1: Cross multiply and place the two products in order.

$\frac{3}{4}$ ◄——► $\frac{7}{8}$

3×8 $\qquad$ 4×7

24 $\qquad$ 28

Step 2: Check which product is greater or less.

As $24 < 28$

Therefore, $\frac{3}{4} < \frac{7}{8}$

Try Yourself

Compare $\frac{5}{8}$ and $\frac{5}{6}$ by cross multiplication.

Ordering Fractions

Sometimes, we need to write fractions in order from least to greatest or from greatest to least.

Saleem wants to order from least to greatest (in ascending order). How can he order the fractions?

LCM of denominators (2, 3, 4) is 12.

Therefore

$\frac{1}{2} = \frac{1}{2} \times \frac{6}{6} = \frac{6}{12}$, $\frac{1}{3} = \frac{1}{3} \times \frac{4}{4} = \frac{4}{12}$, $\frac{3}{4} = \frac{3}{4} \times \frac{3}{3} = \frac{9}{12}$, $\frac{2}{3} = \frac{2}{3} \times \frac{4}{4} = \frac{8}{12}$

As $\frac{4}{12} < \frac{6}{12} < \frac{8}{12} < \frac{9}{12}$

Therefore ascending order of given fractions is: $\frac{1}{3}, \frac{1}{2}, \frac{2}{3}, \frac{3}{4}$

EXERCISE-1

1. Compare the following pairs of fractions using symbol < or >.

   (i) $\frac{4}{5}, \frac{3}{5}$ (ii) $\frac{1}{4}, \frac{1}{5}$ (iii) $\frac{5}{6}, \frac{6}{7}$ (iv) $2\frac{1}{3}, \frac{8}{5}$

   (v) $\frac{7}{3}, 1\frac{3}{5}$ (vi) $\frac{3}{4}, \frac{2}{5}$ (vii) $1\frac{5}{9}, \frac{5}{2}$ (viii) $3\frac{1}{2}, 1\frac{2}{3}$

2. Of the vegetables in the shop, $\frac{3}{4}$ were carrots and $\frac{7}{8}$ were radishes. Which vegetable is less in quantity?

3. Hafsa ate $\frac{4}{5}$ of the cake while Aliza ate $\frac{3}{7}$ of it. Who ate more?

4. Write the fractions $\frac{7}{3}, 1\frac{5}{3}, 2\frac{3}{4}$ in decreasing order.

5. Zain lives $\frac{3}{5}$ *km* from the school, Sami lives $\frac{5}{4}$ *km* from school and Hamid lives $\frac{1}{2}$ *km* from the school. Who lives closest to school?

6. Arrange the following fractions in ascending order:

   (i) $\frac{3}{2}, \frac{1}{3}, \frac{3}{4}, \frac{5}{3}$ (ii) $\frac{3}{8}, \frac{1}{4}, \frac{3}{3}, \frac{4}{3}$

   (iii) $1\frac{1}{6}, 2\frac{1}{3}, \frac{5}{2}, \frac{4}{3}$ (iv) $\frac{7}{10}, \frac{4}{5}, 1\frac{1}{10}, 2\frac{1}{5}$

7. Arrange the following fractions in descending order:

   (i) $\frac{7}{6}, \frac{4}{6}, \frac{5}{4}, \frac{5}{3}$ (ii) $\frac{6}{7}, 1\frac{1}{7}, 2\frac{1}{2}, \frac{3}{2}$

   (iii) $\frac{7}{6}, \frac{4}{3}, \frac{5}{2}, \frac{3}{2}$ (iv) $\frac{7}{20}, \frac{9}{10}, \frac{7}{5}, 1\frac{1}{10}$

8. Maria cuts three lengths of ribbon. They are $\frac{3}{4}m$, $\frac{4}{5}m$ and $\frac{5}{8}m$ long. Which one is the longest length? Which one is the shortest?

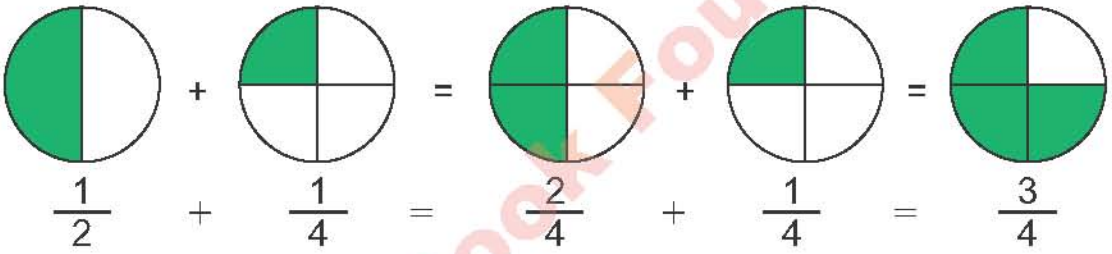
9. In a garden, plants of flowers are $3\frac{2}{3}$ part while plants of fruits are $4\frac{1}{2}$. Which of the plants are more in number?

Addition and Subtraction of Fractions

Addition of Fractions

Yesterday we spent $\frac{1}{2}$ hour and today we spent $\frac{1}{4}$ hour in the computer lab. How much time have we spent in the lab altogether?

To find the total time spent in the lab, we need to add these fractions.



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

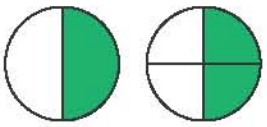
Time spent yesterday $= \frac{1}{2}$ h

Time spent today $= \frac{1}{4}$ h

Total time spent $=$?

To make the denominator same,

$\frac{1}{2} = \frac{1 \times 2}{2 \times 2} = \frac{2}{4}$ Multiply the numerator and the denominator with 2 to make the denominator 4



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

$\frac{1}{4} = \frac{1 \times 1}{4 \times 1} = \frac{1}{4}$ Multiply the numerator and the denominator with 1

$\frac{2}{4} + \frac{1}{4} = \frac{2+1}{4} = \frac{3}{4}$ Now add these equivalent fractions

Thus, the total time spent in the lab in 2 days is $\frac{3}{4}$ h.

Use cut outs of different shapes and ask students to represent equivalent fractions using the shapes.

Let's solve. $\frac{2}{5} + \frac{3}{10} + \frac{1}{20} = \square$

To convert the fraction into an equivalent fraction.

Step I Find the LCM of 5, 10, 20.

2	5, 10, 20
2	5, 5, 10
5	5, 5, 5
	1, 1, 1

LCM of 5, 10, 20 $= 2 \times 2 \times 5$

$= 20$

Step II Multiply all the fractions with a number, so that the denominators become equal to the LCM.

$$\frac{2}{5} = \frac{2 \times 4}{5 \times 4} = \frac{8}{20}$$

$$\frac{3}{10} = \frac{3 \times 2}{10 \times 2} = \frac{6}{20}$$

$$\frac{1}{20} = \frac{1 \times 1}{20 \times 1} = \frac{1}{20}$$

Try Yourself

What is the sum of $\frac{2}{3}$ and $\frac{5}{6}$?

Step III Now add these equivalent fractions.

$$\frac{2}{5} + \frac{3}{10} + \frac{1}{20} = \frac{8}{20} + \frac{6}{20} + \frac{1}{20}$$

$$= \frac{8 + 6 + 1}{20}$$

$$= \frac{15}{20}$$

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

Write different fractions on the board. Explain how to make their denominators same and then find their sum.

Sidra used $1\frac{3}{4}$ metres of red ribbon and $\frac{7}{8}$ metres of blue ribbon to decorate the gift boxes. Find the total length of the ribbon she used.

Convert the mixed fraction to improper fraction.

Red ribbon $= 1\frac{3}{4}$ m $= \frac{7}{4}$ m

Blue ribbon $= \frac{7}{8}$ m

The total length of both ribbons $= \frac{7}{4} + \frac{7}{8}$

$= \frac{7 \times 2}{4 \times 2} + \frac{7 \times 1}{8 \times 1}$ (converted into equivalent fractions with denominator)

$= \frac{14}{8} + \frac{7}{8}$

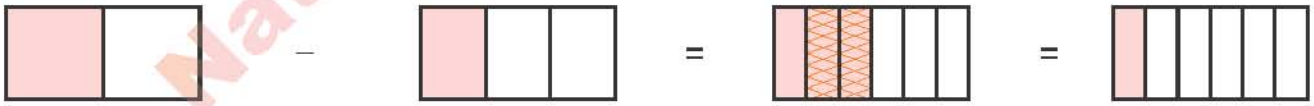
$= \frac{14 + 7}{8} = \frac{21}{8} = 2\frac{5}{8}$

Thus, the total length of the ribbon Sidra used is $2\frac{5}{8}$ m.

Subtraction of Fractions

Sara uses $\frac{1}{2}$ spoon of sugar and $\frac{1}{3}$ spoon of tea to make a cup of tea. Find how much more sugar she uses than the tea?

To find this, we will subtract the quantity of tea from the quantity of sugar.



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

Key Fact

The order of fractions does not matter while adding, however, when subtracting two fractions, always subtract the smaller fraction from the greater fraction.

Quantity of sugar $= \frac{1}{2}$

Quantity of tea $= \frac{1}{3}$

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

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

$= \frac{3}{6} - \frac{2}{6}$

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

Sara used $\frac{1}{6}$ more spoons of sugar than tea.

Example: Subtract $\frac{3}{4}$ from $2\frac{2}{3}$

Solution:

1. Convert the mixed fraction into an improper fraction.
2. Find the LCM of 3 and 4.
3. Now multiply all the fractions by a number so that the denominator of all the fractions become equal to the LCM.
4. Subtract the fractions.

$$2\frac{2}{3} - \frac{3}{4} = \frac{8}{3} - \frac{3}{4}$$

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

$$= \frac{32}{12} - \frac{9}{12} = \frac{32-9}{12}$$

$$= \frac{23}{12} = 1\frac{11}{12}$$

Try Yourself

- Subtract $\frac{6}{9}$ from $\frac{5}{6}$.
- Subtract $\frac{7}{12}$ from the sum of $\frac{5}{9}$ and $\frac{2}{3}$.

Try It!

a) Write three fractions with their sum greater than 1.
b) Write two fractions with a difference of 1.
c) Create and solve a real life situation involving addition of fractions with the answer 1.

EXERCISE-2

1. Add the following fractions.

a) $\frac{1}{2} + \frac{2}{4}$

b) $5\frac{2}{3} + 2\frac{5}{7}$

c) $3\frac{4}{5} + \frac{5}{7}$

d) $4\frac{7}{10} + \frac{6}{8}$

e) $\frac{7}{9} + \frac{6}{8} + \frac{6}{3}$

f) $1\frac{3}{10} + 6\frac{14}{20} + 2\frac{15}{40}$

g) $\frac{24}{6} + \frac{31}{12} + \frac{43}{24}$

h) $\frac{7}{8} + 4\frac{1}{4} + \frac{15}{16}$

2. Subtract the following fractions.

a) $\frac{3}{2} - \frac{2}{24}$

b) $2\frac{16}{18} - 1\frac{4}{6}$

c) $3\frac{5}{14} - 1\frac{2}{21}$

d) $\frac{5}{6} - \frac{6}{11}$

e) $4\frac{1}{6} - \frac{17}{18}$

f) $\frac{21}{12} - \frac{8}{10}$

g) $2\frac{13}{24} - \frac{4}{18}$

h) $5\frac{1}{8} - \frac{5}{15}$

3. To practice for a marathon race, Raheel ran $\frac{1}{4}$ kilometres on Monday, $\frac{7}{8}$ kilometres on Tuesday and $\frac{15}{6}$ kilometres on Wednesday. Find the total distance he covered in three days.

4. Saad spent $2\frac{1}{2}$ hours to prepare for his Mathematics test and $1\frac{1}{4}$ hours to prepare for his Urdu test. Calculate:

a) in which subject did he spend more time and how much?

b) how much time did he spend studying altogether?

5. An electrician has $18\frac{8}{9}$ metres of wire. If he uses $\frac{2}{9}$ metres and $2\frac{1}{3}$ metres in two rooms, calculate:

   a) how much wire did he use?

   b) how much wire does he have left?

6. Write $\frac{10}{12}$ as the sum of three fractions and show this using figures.

7. Write $\frac{4}{7}$ as the difference of two fractions.

Multiplication and Division of Fractions

Multiplication of Fractions

Ibrahim takes $\frac{3}{4}$ hours daily to complete his homework.
How much time does he spend on his homework in a week?

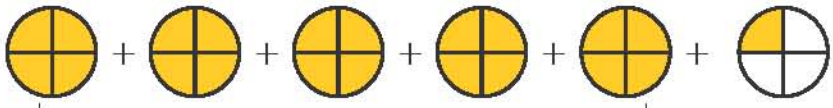
There are 7 days in a week. To find the required time, we will multiply $\frac{3}{4}$ hours with 7.

As multiplication is repeated addition.

To multiply $\frac{3}{4}$ to 7 we will add $\frac{3}{4}$ seven times.

$$\frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} = 7 \times \frac{3}{4}$$

$$7 \times \frac{3}{4} = \frac{3}{4} \quad \frac{3}{4} \quad \frac{3}{4} \quad \frac{3}{4} \quad \frac{3}{4} \quad \frac{3}{4} \quad \frac{3}{4}$$



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

$$7 \times \frac{3}{4} = 5 + \frac{1}{4}$$

$$\frac{21}{4} = 5\frac{1}{4}$$

Alternatively

Time to do homework in one day $= \frac{3}{4}$ h

Time to do homework in the whole week $= \frac{3}{4}$ h $\times 7$

$$7 \times \frac{3}{4} = \frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} = \frac{21}{4} = 5\frac{1}{4}$$

So, the time taken by Ibrahim to complete the homework in a week is $5\frac{1}{4}$ h.

Example:

Rabia completed one round of the park and covered a distance of $2\frac{1}{2}$ kilometres. If she takes 3 rounds of the park, how much distance will she cover?

Solution:

Distance covered in 1 round $= 2\overset{+}{\underset{\times}{\frac{1}{2}}}$ km $= \frac{5}{2}$ km

Distance covered in 3 rounds $= \frac{3}{1} \times \frac{5}{2}$ km $= \frac{15}{2}$ km

$= 7\frac{1}{2}$ km

Thus, Rabia covered $7\frac{1}{2}$ km in 3 rounds.

Key Fact

- To multiply two fractions, multiply the numerator by the numerator and the denominator by the denominator.
- In multiplication, the order of the fractions does not affect the products.

Example:

Sania and Ali grew plants in pots. After a week, the height of Sania's plant is $3\frac{2}{5}$ centimetres while the height of Ali's plant is $1\frac{1}{4}$ times that of Sania's plant. Find the height of Ali's plant.

To find the height of Ali's plant, we will multiply the height of Sania's plant by $1\frac{1}{4}$.

Solution:

Height of Sania's plant $= 3\overset{+}{\underset{\times}{\frac{2}{5}}} = \frac{17}{5}$

Height of Ali's plant $= \frac{17}{5} \times 1\frac{1}{4}$

$= \frac{17}{\cancel{5}_{1}} \times \frac{\cancel{5}^{1}}{4}$

$= \frac{17 \times 1}{1 \times 4} = \frac{17}{4}$

Try Yourself

Find the product of $\frac{7}{2}$ and $\frac{3}{8}$.

Thus, the height of Ali's plant is $4\frac{1}{4}$ cm.

Let's multiply $\frac{1}{5}$, $\frac{9}{4}$ and $\frac{2}{3}$.

$\frac{1}{5} \times \frac{9}{4} \times \frac{2}{3}$

$= \frac{1 \times \overset{3}{\cancel{9}} \times \overset{1}{\cancel{2}}}{5 \times \underset{2}{\cancel{4}} \times \underset{1}{\cancel{3}}} = \frac{3}{10}$

Make groups of students and ask each group to create a real life problem involving multiplication of fractions. Then ask them to exchange their problems with other groups to solve.

Example: Find the product of $\frac{1}{6}$ and $\frac{2}{3}$.

Solution:

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

$$= \frac{1 \times \overset{1}{\cancel{2}}}{\underset{3}{\cancel{6}} \times 3}$$

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

$$= \frac{1}{9}$$

Division of Fractions

For an experiment on cold and hot water, I have to pour $7\frac{1}{3}$ litres of water in glasses with a capacity of $\frac{1}{3}$ litres. How many glasses will I be able to fill?

To find this, we have to divide the total volume of water $7\frac{1}{3}$ litres by the capacity of one glass which is $\frac{1}{3}$ litres.

Total volume of water $= 7\frac{1}{3}\ l = \frac{22}{3}\ l$

Capacity of one glass $= \frac{1}{3}\ l$

Total number of Glasses $= \frac{22}{3} \div \frac{1}{3} = \frac{22}{3} \times \frac{3}{1}$ Keep Change Flip

$$= \frac{22 \times \overset{1}{\cancel{3}}}{\underset{1}{\cancel{3}} \times 1} = \frac{22 \times 1}{1 \times 1} = 22$$

So I will need 22 glasses to fill $7\frac{1}{3}\ l$ of water.

Example:

How many pieces of $\frac{4}{10}$ metres of wire can be cut from a wire which is $\frac{8}{5}$ metres long?

Solution:

The number of pieces will be found by dividing $\frac{8}{5}$ by $\frac{4}{10}$.

$$\text{Total length of wire} = \frac{8}{5}$$

$$\text{Length of 1 piece} = \frac{4}{10}$$

$$\text{Number of pieces} = \frac{8}{5} \div \frac{4}{10}$$

$$\text{Number of pieces} = \frac{\cancel{8}^{2}}{\cancel{5}_{1}} \times \frac{\cancel{10}^{2}}{\cancel{4}_{1}}$$

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

Thus the number of pieces of wire is 4.

Let's divide $3\frac{5}{8}$ by $2\frac{3}{10}$.

$$3\frac{5}{8} \div 2\frac{3}{10} = \frac{29}{8} \div \frac{23}{10}$$

$$= \frac{29}{\cancel{8}^{4}} \times \frac{\cancel{10}^{5}}{23}$$

$$= \frac{145}{92} = 1\frac{53}{92}$$

Try Yourself

Find the product of $\frac{1}{6}$ and $\frac{9}{12}$, and divide it by $\frac{7}{8}$.

EXERCISE-3

1. Solve the following with the help of figures.

a) $\frac{1}{2} \times 12$ b) $\frac{5}{9} \times 7$ c) $\frac{6}{7} \times 3$

d) $\frac{3}{4} \times 4$ e) $\frac{2}{3} \times 5$ f) $\frac{5}{6} \times 9$

2. Multiply the following.

a) $\frac{4}{5} \times \frac{1}{4}$ b) $\frac{3}{7} \times \frac{14}{18}$ c) $\frac{5}{3} \times \frac{75}{20}$

d) $\frac{58}{60} \times \frac{4}{20} \times \frac{10}{20}$ e) $\frac{2}{7} \times \frac{4}{5} \times \frac{3}{7}$ f) $\frac{30}{28} \times \frac{2}{8} \times \frac{6}{9}$

g) $1\frac{3}{5} \times 2\frac{3}{7} \times 3\frac{3}{4}$ h) $5\frac{10}{35} \times 8\frac{2}{5} \times 9\frac{3}{11}$

i) $9\frac{1}{9} \times 10\frac{1}{3} \times 5\frac{1}{2}$

3. Divide the following.

a) $\frac{4}{12} \div \frac{4}{18}$ b) $\frac{3}{25} \div \frac{9}{45}$ c) $\frac{5}{60} \div \frac{7}{20}$

d) $2\frac{58}{60} \div 4\frac{4}{20}$ e) $5\frac{5}{9} \div 9\frac{6}{7}$ f) $6\frac{30}{32} \div 7\frac{2}{4}$

g) $2\frac{5}{6} \div 4\frac{2}{9}$ h) $3\frac{1}{2} \div \frac{4}{9}$ i) $\frac{1}{7} \div 2\frac{6}{7}$

4. If $5\frac{1}{2}$ metres of cloth is used to stitch one dress, how much cloth will be used to stitch 7 dresses?

5. Hina ate $\frac{1}{2}$ of a cake. If there were 8 pieces of cake, how many pieces did Hina eat?

6. Nida had $\frac{3}{12}$ of a pizza. She gave $\frac{1}{8}$ of it to her friend, Madeeha. Find what part of the whole pizza did Madeeha get?

7. To decorate the classroom, Hassan used ribbons in two colours. The length of the blue ribbon is $5\frac{7}{8}$ metres. The length of the red ribbon is $\frac{2}{3}$ of the length of the blue ribbon.
   a) What is the length of red ribbon?
   b) Find the total length of both ribbons.

8. Find the number which results in $4\frac{5}{9}$ when multiplied by $6\frac{1}{6}$.

9. $44\frac{1}{6}$ kilograms of sugar is to be packed in $4\frac{5}{12}$ kilogram packets. Find:
   a) in how many packets will the sugar be packed?
   b) how much sugar will be there in 9 packets of mass $4\frac{5}{12}$ kilograms?

I Have Learnt

— comparing and ordering fractions.
— adding and subtracting two or three fractions with different denominators.
— multiplying a fraction by a 1 - digit number and demonstrating it with the help of a diagram.
— multiplying two or three fractions involving proper fractions, improper fractions, and mixed numbers.
— solving real life situations involving the multiplication of fractions.
— dividing a fraction by another fraction involving proper fractions, improper fractions, and mixed numbers.
— solving real life situations involving the division of fractions.

Vocabulary

equivalent fractions
ascending
descending
comparing
ordering

Review Exercise

1. Encircle the correct option where appropriate.

a) $\frac{1}{3} + \frac{2}{5} =$ ___

i) $\frac{3}{5}$ ii) $\frac{11}{15}$ iii) $\frac{3}{8}$ iv) $\frac{2}{15}$

b) $\frac{7}{9} - \frac{2}{3} =$ ___

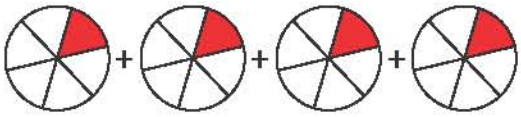
i) $\frac{3}{9}$ ii) $\frac{7}{3}$ iii) $\frac{1}{9}$ iv) $\frac{7}{9}$

c) The product $\frac{3}{4}$ and $\frac{4}{3}$ is _____.

i) 1 000 ii) 10 iii) 1 iv) 111

d) Which figure of the following shows $5 \times \frac{1}{3}$?

i) 

iii) 

iii) 

iv) 

e) Which one of the following is the smallest fraction?

i) $\frac{2}{5}$ ii) $\frac{1}{3}$ iii) $\frac{2}{3}$ iv) $\frac{3}{5}$

2. Solve the following.

a) $\frac{7}{20} + 4\frac{3}{10}$ b) $\frac{8}{5} + \frac{19}{15} + 5\frac{4}{30}$ c) $3\frac{14}{50} - 2\frac{9}{25}$

d) $1\frac{16}{44} \div \frac{4}{11}$ e) $2\frac{6}{31} \times \frac{62}{24}$ f) $1\frac{4}{7} + 2\frac{13}{28} + \frac{3}{4}$

g) $3\frac{6}{8} + 3\frac{3}{4}$ h) $1\frac{3}{9} \times 25$ i) $6\frac{2}{3} \div 3\frac{1}{12}$

3. Find $2\frac{3}{4}$ of 36.

4. How many months will be there in $\frac{3}{4}$ year?

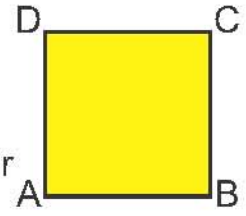
5. Add the product of $\frac{4}{5}$ and $\frac{12}{2}$ to the quotient of $\frac{4}{45} \div \frac{4}{5}$.

6. Marwa prepared $5\frac{6}{7}$ litres of apple juice. She served $3\frac{2}{5}$ litres of juice to the guests. Find how much juice is left?

7. Ali's mother bought $3\frac{1}{2}$ kg of chicken, $1\frac{1}{2}$ kg of fish and $2\frac{1}{4}$ kg of mutton. Calculate how many kilograms of meat she bought, altogether?

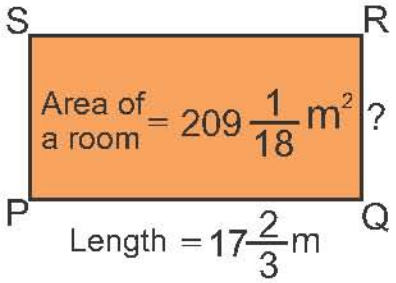
8. Omair exercises for $2\frac{1}{5}$ hours daily. How many hours will he exercise in 30 days?

9. The length of a side of a square is $1\frac{7}{8}$ metres.
If the perimeter of a square is 4 × length of a side, calculate the perimeter of the square. Also, verify your answer by adding this length four times.



Length of a side = $1\frac{7}{8}$ m

10. The area of a room is 209 $\frac{1}{18}$ m^2. If the length of the room is 17 $\frac{2}{3}$ metres, find the width of the room.



Hint

The area of the room is calculated by multiplying its length and width.

11. Write $\frac{29}{30}, \frac{3}{5}, \frac{14}{15}, \frac{13}{6}$ in ascending as well as in descending order.

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National Curriculum Council Secretariat
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قومی ترانہ

پاک سَر زمین شاد باد! کشورِ حسین شاد باد!
تو نِشانِ عزمِ عالی شان ارضِ پاکستان
مرکزِ یقین شاد باد!

پاک سر زمین کا نِظام قُوّتِ اُخوّتِ عوام
قوم ، مُلک ، سلطنت پائندہ تابندہ باد!
شاد باد منزلِ مُراد!

پرچَمِ سِتارہ و ہِلال رہبرِ ترقی و کمال
ترجُمانِ ماضی، شانِ حال جانِ اِستقبال
سایۂ خُدائے ذُوالجلال!

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