IDeAL®
Get Involved

Std. 6

TEACHER SUPPORT MATERIAL

READY FOR NEW EDUCATION POLICY (NEP)

- ✓ Helpful for Teachers
- ✓ Suitable for all Ideal Workbooks

Mathematics

IDeAL®
Get Involved

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E-19

Preface

What does the new National Education Policy 2020 state?

- Inclusive and equitable quality education and lifelong learning opportunities for all must be ensured. Thus the entire education system must be reconfigured to achieve such a lofty goal while supporting and fostering learning.
- The teacher must be at the centre of the fundamental reforms in the education system. The new education policy must help re-establish teachers, at all levels, as the most respected and essential members of our society, because they truly shape our next generation of citizens. It must do everything to empower teachers and help them to do their job as effectively as possible.
- Teachers actually shape the future of children and hence they also build the nation. It is because of this noble contribution of teachers that they are the most honoured members of Indian society from the very beginning. To ensure the best future of our children and the nation it is necessary to further promote and empower the education process.
- The National Education Policy (NEP) emphasizes that to make the learning process more effective and practical, teachers need to be provided with the necessary resources. Additionally, their role in the evaluation process is crucial. Thus, teachers play a vital role in the entire learning and teaching process.

NEP-2020 and The Ideal

- Recognizing the crucial role of teachers in the learning and teaching process, Ideal Experiential Learning (P) Ltd has developed and provided Teacher Support Material. This aims to ensure that the core objectives of education are met through effective teaching and learning.
- The National Curriculum Framework (NCF) emphasizes that planning for teaching is important because "Good planning is at the heart of good education." To achieve desired learning outcomes, it's essential to plan classroom activities in advance. Key elements to consider while planning include learning objectives, competencies, outcomes, teaching-learning materials, content, annual planning, evaluation, etc.
- Therefore, we provide Teacher Support Material to assist educators.
- A teacher is a valuable resource, a treasure of knowledge. To simplify their educational tasks, we provide specific materials that teachers can adapt according to their school and students' environment.
- This material is created by the teachers, exclusively for teachers. Its sole purpose is to serve as a tool to help educators. It's not mandatary for Teachers to follow everything in this book; instead, they are encouraged to modify it according to their school's and students' needs.

Ideal with You Happy Teaching.

Teacher Support Material you get:

- ✓ Annual planning
- ✓ Format of timetable
- ✓ Formative Exam Pattern
- ✓ Semester Exam Pattern
- ✓ Softcopy of sample paper
- ✓ Exam pattern update on QR
- ✓ Softcopy of the necessary material as per NEP
- ✓ Essential questions and their answers

Annual planning

This is a trial plan that teachers and schools can modify as needed. A blank row is provided under the months for teachers to make changes that align with their school's curriculum.

Sem-1	Month	June	July	August	Sep. - Oct.	
	Chap No.	1	2, 3	4, 5	6	
	Chap No. As per School Plan					
Sem-2	Month	November	December	January	February	Mar. - April
	Chap No.	7	8, 9	10	11	12
	Chap No. As per School Plan					

Date of First Formative Exam	Date of First Semester Exam

Date of Second Formative Exam	Date of Second Semester Exam

Timetable

(**Note:** In the blank timetable below, the teacher can write their schedule.)

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Period - 1						
Period - 2						
Period - 3						
Period - 4						
Period - 5						
Period - 6						
Period - 7						
Period - 8						

If your school conducts formative examinations, paper patterns are provided here. It is not mandatory to follow this exact format. A QR code is included and if there are any changes to the printed pattern, simply scan the QR code to access the updated version.

First Formative Exam Pattern

(2 Hours)	(Chapter - 1, 2, 3)	(40 Marks)

Q.1	Choose the correct option.		(8)
Q.2	(A)	Fill in the blanks .	(4)
	(B)	Solve the following. (Chapter 3) (Any two)	(4)
Q.3	Answer the following questions. (Each carries four marks)		(8)
Q.4	Do as directed. (Each carries one mark)		(8)
Q.5	(A)	Answer the following questions. (Any two) (Each carries two marks)	(4)
	(B)	Mark the following as '✓' or '✗'.	(4)

First Semester Exam Pattern

(3 Hours)	(Chapter 1 to 6)	(80 Marks)

Q.1	Choose the correct option for each of the following questions.		(16)
Q.2	(A)	Fill in the blanks.	(6)
	(B)	Do as directed. (Each carries 1 mark) (Ch. 1, 2, 3, 4, 5, 6)	(10)
Q.3	(A)	Do as directed. (Any two) (Each carries 2 marks) (Ch. 1, 2)	(4)
	(B)	Do as directed. (Any four) (Each carries 3 marks) (Ch. 1, 3, 4, 5)	(12)
Q.4	(A)	Solve the following. (Any two) (Each carries 3 marks)	(6)
	(B)	Do as directed. (Any two) (Each carries 5 marks) (Ch. 3, 4)	(10)
Q.5	(A)	Do as directed. (Any four) (Each carries 2 marks) (Ch. 3, 5, 6)	(8)
	(B)	Match the following. (Ch. 3, 4, 5)	(4)
	(C)	Mark the following as '✓' or '✗'.	(4)

Second Formative Exam Pattern

(2 Hours)	**(Chapter : 7, 8, 9)**	**(40 Marks)**

Q.1	Choose the correct option.	(8)
Q.2	(A) Fill in the blanks.	(4)
	(B) Do as directed. (Each carries one mark)	(4)
Q.3	Do as directed. (Each carries four marks)	(8)
Q.4	(A) Do as directed.	(3)
	(B) Solve the following. (Any one) (From Data handling)	(5)
Q.5	(A) Answer the following questions. (Any two) (Each carries two marks)	(4)
	(B) Mark the following as '✓' or '✗'.	(4)

Second Semester Exam Pattern

(3 Hours)	**(Chapter - 7 to 12)**	**(80 Marks)**

Q.1	Choose the correct option.	(16)
Q.2	(A) Fill in the blanks.	(8)
	(B) Do as directed. (Each carries one mark)	(8)
Q.3	(A) Do as directed. (Any two) (Each carries two marks)	(4)
	(B) Do as directed. (Any three) (Each carries four marks)	(12)
Q.4	(A) Do as directed. (Any two) (Each carries three marks)	(6)
	(B) Do as directed. (Any two) (Each carries five marks)	(10)
Q.5	(A) Do as directed. (Any four) (Each carries two marks)	(8)
	(B) Match the following.	(4)
	(C) Mark the following as '✓' or '✗'.	(4)

Updation in Paper Pattern

If the paper pattern provided above changes for any reason, Scan the given QR code. The new pattern can be obtained as a soft copy by scanning it.

Sample paper

Scan the given QR code to access a sample paper according to the new paper pattern.

Guidance for Writing Answers

- According to NEP-20 and NCF-23, it is must for students to write meaningful answers in their own words, maintaining originality. Most educators recognize the importance of this practice. With this in mind, essential questions and answers are provided here.
- We believe that teachers do not require the answer key because they possess a wealth of knowledge. This book contains various answers written by teachers. The questions and answers provided can be modified by teachers in their own way and then shared with students through writing or explanation.
- Teachers often ask us certain questions. Based on those, we have provided some FAQs here. Read them carefully, as they will answer many of your queries.

FAQs (Frequently Asked Questions with their answers)

Q-1 These questions and answers are meant for whom?

A-1 These essential questions and answers are provided to support teachers in institutions that use Ideal's books (I-Mentor & Class Buddy).

Q-2 Are the questions and answers aligned with the series of Ideal Books used in our institutions?

A-2 Yes, it is aligned with Ideal Workbook Series. Approximately 90% (means almost) of questions from both series are included. This means there isn't a separate answer key for the series your institution uses. However, teachers can find essential questions and answers for revision or preparing question papers here. This saves teachers' time, enabling them to engage students in various activities as per the NEP guidelines.

Q-3 What should we do if a question isn't found in this resource?

A-3 If the question and answer from any series of Ideal aren't available here, so email a photo of the question with standard, semester, subject, chapter number, page no. to production@ideal.ind.in . You will receive a response within 72 hours.

Q-4 Will there be no errors in the answers provided in this resource?

A-4 The answers provided here are for teachers' reference. Teachers should carefully review them, correct it any errors (mostly typographical or any other), and share accurate information with their students. If you identify any error or have suggestion, share on production@ideal.ind.in .

Q-5 Should we provide the same answers given here to the students?

A-5 No, these answers are solely for teachers' reference. Before you provide answer to student Review it once. Teachers can explain or write answers for their students in their own way.

Q-6 Are these questions and answers useful to us in other ways?

A-6 The questions are given according to question type, which helps teachers conduct chapter-wise oral or written tests.

Q-7 Here, answer of many question are not given, instead a blank line is provided; what does it mean ?

A-7 The Blank lines indicates that teachers should guide students to write their own answers based on their understanding, environment, or the information they've gathered. For these, in some questions, blank lines are provided instead of direct answers. Answer for Discuss/Activity is not given.

Q-8 What does it mean when some answers are labelled as 'Sample Answers'?

A-8 A question marked as having a 'Sample Answers' means it is only a suggested response. Teachers can modify it and write their own version if they wish.

Q-9 Here, some questions are marked with '✦', what does it mean?

A-9 '✦' mark means that the answer of the question is already provided in the workbook, thus, it is not provided here.

Scan the QR code to access information about changes or updates to the curriculum or this book. Also, you can find answer of those questions which are not given here.

Scan this QR code to access a soft copy of the material beneficial for teachers and students, in accordance with NEP-2020 guidelines.

Note: Starting from July 1, 2024, It will be updated gradually.

Note :

It is a better method for teachers to write the answers in their own workbook (Teacher's Copy - Specimen Copy), using the answers provided in this Teacher Support Material and making any necessary changes. This allows it to be effectively used in the classroom.

INDEX

1 Knowing our Numbers

1.1 Introduction

1. Add :

Example **5348 + 495 + 2316**

$$\begin{array}{r} {}^{1\,1\,1} \\ 5348 \\ +\ \ 495 \\ +\ 2316 \\ \hline 8159 \end{array}$$

(1) 3000 + 2050 + 150

$$\begin{array}{r} {}^{1} \\ 3000 \\ +2050 \\ +\ \ 150 \\ \hline 5200 \end{array}$$

(2) 2749 + 749 + 1349

$$\begin{array}{r} {}^{1\,1\,2} \\ 2749 \\ +\ \ 749 \\ +1349 \\ \hline 4847 \end{array}$$

2. Subtract :

Example **1306 – 308**

$$\begin{array}{r} {}^{12} \\ {}^{0\ \ 2\ \ 9\ 16} \\ \not{1}\,\not{3}\,\not{0}\,\not{6} \\ -\ \ 308 \\ \hline 998 \end{array}$$

(1) 3470 – 1254

$$\begin{array}{r} {}^{6\ 10} \\ 34\not{7}\,\not{0} \\ -1254 \\ \hline 2216 \end{array}$$

(2) 7006 – 5998

$$\begin{array}{r} {}^{6\ \ 9\ \ 9\ 16} \\ \not{7}\,\not{0}\,\not{0}\,\not{6} \\ -\ 5998 \\ \hline 1008 \end{array}$$

3. Multiply :

Example **324 × 27**

$$\begin{array}{r} {}^{1\,2} \\ 324 \\ \times\ \ 27 \\ \hline {}^{1} \\ 2268 \\ +6480 \\ \hline 8748 \end{array}$$

(1) 205 × 40

$$\begin{array}{r} {}^{2} \\ 205 \\ \times\ \ 40 \\ \hline 8200 \\ +\ 000 \\ \hline 8200 \end{array}$$

(2) 45 × 45

$$\begin{array}{r} {}^{2} \\ 45 \\ \times 45 \\ \hline 1800 \\ +\ 225 \\ \hline 2025 \end{array}$$

4. Divide and find the quotient and the remainder :

Example **806 ÷ 4**

$$\begin{array}{r|l} & 201 \\ \hline 4 & 806 \\ & 8 \\ \hline & 006 \\ & \ \ \ 4 \\ \hline & \ \ \ 2 \end{array}$$

quotient = 201
remainder = 2

(1) 1227 ÷ 12

$$\begin{array}{r|l} & 102 \\ \hline 12 & 1227 \\ & -12 \\ \hline & 002 \\ & -\ 0 \\ \hline & \ \ 27 \\ & -24 \\ \hline & \ \ 03 \end{array}$$

quotient = 102
remainder = 3

(2) 999 ÷ 13

$$\begin{array}{r|l} & \ 76 \\ \hline 13 & 999 \\ & -91 \\ \hline & 089 \\ & -\ 78 \\ \hline & \ \ 11 \end{array}$$

quotient = 76
remainder = 11

1.2 Comparing Numbers

- **Numbers**
  - **Numbers** are mathematical values used for counting, measuring and comparing amounts. They are formed of digits.

- **Comparing Numbers**
  - **If the number of digits in the numbers to be compared is different**
    - The number with the most number of digits is the largest number, while the number with the least number of digits is the smallest number.

      E.g. 93, 8, 124, 6000

      Here, the largest number is **6000 (4 digits)** and the smallest number is **8 (1 digit)**
  - **If the number of digits in the numbers to be compared is the same**
    - The number with the greatest leftmost digit is the greatest number.

      E.g. 580, 240, 804, 473

      Here, the greatest number is **804 (the leftmost digit is 8)**

      and the smallest number is **240 (the leftmost digit is 2).**
    - If the first digit in the numbers is the same, we check the next leftmost digit and so on.

      E.g. 9399 and 9700

      Here, the digits at the thousands place are the same in both.

      We move to the next digit. The digit at the hundreds place is greater in 9700 than in 9399.

      Therefore, **9700** is greater than **9399**.

Remember

- 0 cannot be considered if it is placed as the first digit from the left.

  E.g. 012 = 12, 00134 = 134, 00054 = 54

  Thus, 012, 0012, 00012 are the same numbers, i.e. equal to 12.

1. Find out the greatest and the smallest number in each row :

Sr. No.	Numbers	Greatest Number	Smallest Number
(1)	1981; 2437; 4675; 3802	4675	1981
(2)	8017; 8108; 8810; 8801; 8028	8810	8017
(3)	380512425; 300040700; 93245; 67205602	380512425	93245
(4)	017; 8108; 8810; 8801; 8028	8810	017
(5)	3423; 89423; 200; 4000; 310	89423	200

1.2.1 How Many Numbers can you Make?

- **Making the greatest possible number with the given digits**
  - **Without Repetition**

    Write the digits in descending order.

    E.g., the greatest number formed with the digits **5**, **7**, **9** and 2 is **9752**.
  - **With Repetition**

    If any digit can be repeated - Repeat the greatest digit as many times allowed, followed by the smaller digits in the descending order.

    E.g., the greatest number formed with the digits **5**, **7** and **9** where any one digit can be repeated twice is **9975**.

    If a particular digit can be repeated – Arrange the given digits in descending order. Write the digit to be repeated consecutively as many times allowed.

    E.g., the greatest number formed with the digits **5**, **7** and **9** if **7** can be repeated twice is **9775**.
- **Making the smallest possible number with the given digits**
  - **Without Repetition**

    Write the digits in ascending order

    E.g., the smallest number formed with the digits **5**, **7**, **9** and **2** is **2579**.
  - **With Repetition**

    If any digit can be repeated - Repeat the smallest digit as many times allowed, followed by the greater digits in the ascending order.

    E.g., the smallest number formed with the digits **5**, **7** and **9** where any one digit can be repeated twice is **5579**.

    If a particular digit can be repeated – Arrange the given digits in ascending order. Write the digit to be repeated consecutively as many times allowed.

    E.g., the smallest number formed with the digits **5**, **7** and **9** if **7** can be repeated twice is **5779**.

Note

- If 0 is one of the digits, then to form the smallest number, the digit just greater than 0 is placed at the left most place followed by 0 and then rest of the digit in ascending order.

Remember

- **Ascending order :** Ascending order means arrangement from the smallest to the greatest.
- **Descending order :** Descending order means arrangement from the greatest to the smallest.

Example **Use the given digits without repetition and make the possible greatest and smallest 4-digit numbers. 1, 8, 7, 5**

Greatest number = **8751** Smallest number = **1578**

2. Use the given digits to make the possible greatest and smallest 4-digit numbers by using any one digit twice : 9, 0, 6

A. Smallest 4 digit number – 6009 Greatest 4 digit number – 9960

3. **Arrange the following numbers in ascending and descending order :**

Numbers	Ascending Order	Descending Order
874; 9754; 8320; 572	572, 874, 8320, 9754	9754, 8320, 874, 572
3454; 5978; 10050; 3445	3445, 3454, 5978, 10050	10050, 5978, 3454, 3445
7950; 7905; 9507; 7059	7059, 7905, 7950, 9507	9507, 7950, 7905, 7059
3247; 743; 2470; 3473	743, 2470, 3247, 3473	3473, 3247, 2470, 743

4. Heights of four students are given as : Hari (168 cm), Meena (154 cm), Rahul (153 cm), Rizwana (160 cm). Arrange their heights in ascending and descending order.

Ascending Order : Rahul (153 cm), Meena (154 cm), Rizwana (160 cm), Hari (168 cm)

Descending Order : Hari (168 cm), Rizwana (160 cm), Meena (154 cm), Rahul (153 cm)

1.2.2 Shifting Digits

Example **How many 3-digit numbers can be formed using the digits 1, 2 and 3 ? Find the greatest and the smallest number from the numbers formed.**

Following 6 numbers can be formed using the digits 1, 2 and 3.

123, 132, 213, 231, 312, 321

The greatest number formed is **321.**

The smallest number formed is **123.**

---

5. How many 3-digit numbers can be formed using the digits 7, 8 and 9 without repetition ? Find the greatest and the smallest number from the numbers formed.

A. Following 6 numbers can be formed using the digits 1, 2 and 3. without Repetition

123, 132, 213, 231, 312, 321

The greatest number formed is 321.

The smallest number formed is 123.

1.2.3 Introducing 10,000

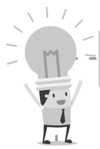
✦ On adding 1 to the greatest 4-digit number, we would get the smallest 5-digit number, that is 9999 + 1 = 10000.

The greatest 1-digit number	The smallest 2-digit number	The greatest 2-digit number	The smallest 3-digit number
9	**10**	**99**	**100**

The greatest 3-digit number	The smallest 4-digit number	The greatest 4-digit number
999	**1000**	**9999**

Note

- To write the largest number of given digits, we write 9 as many times the number of digits. **E.g.** the largest number of 8 digits will be **99,999,999**.
- To write the smallest number of given digits, we write 1 followed by 0s one less than as many times the number of digits.
  E.g. the smallest number of 8 digits will be **10,000,000**.



Remember

- Greatest single digit number + 1 = Smallest 2-digit number
- Greatest 2-digit number + 1 = Smallest 3-digit number
- Greatest 3-digit number + 1 = Smallest 4-digit number

6. A 5-digit number has 4 at its tens place, one fourth of the tens digit at its ones place, 0 at its hundreds place, five times of ones digit at its thousands place and double of tens digit at its ten thousands place.

   Write the number **85041**

7. What will you get on adding 1 to the greatest 3-digit number ? **1,000**

8. Write the greatest and the smallest 4-digit numbers using 4 different non-repeating digits keeping 5 at the hundreds place.

   Greatest Number : **9587** **Smallest Number :** **1502**

1.2.4 Revisiting Place Value

- **Number Expansion**

Example 257

Hundreds	Tens	Ones
2	5	7

Expansion 2 × 100 + 5 × 10 + 7 × 1

Example 2902

Thousands	Hundreds	Tens	Ones
2	9	0	2

Expansion 2 × 1000 + 9 × 100 + 0 × 10 + 2 × 1

9. **Complete the following table.**

Number	Number Name	Expansion
58400	fifty eight thousand four hundred	5 × 10000 + 8 × 1000 + 4 × 100
30000	Thirty thousand	3 × 10000
67510	Sixty seven thousand five hundred ten	6 × 10000 + 7 × 1000 + 5 × 100 + 1 × 10
32105	thirty two thousand one hundred five	3 × 10000 + 2 × 1000 + 1 × 100 + 0 × 10 + 5

1.2.5 Introducing 1,00,000

✦ Adding 1 to the greatest 5-digit number gives the smallest 6-digit number.
99,999 + 1 = **1,00,000** is the **smallest 6-digit number** and is read as **one lakh**.

10. Write the following numbers in words and expand them.

Number	In Words	Expansion
500000	Five lakh	5 × 1,00,000 + 0 × 10,000 + 0 × 1000 + 0 × 100 + 0 × 10 + 0
439576	Four lakh thirty nine thousand five hundred seventy six	4 × 1,00,000 + 3 × 10,000 + 9 × 1000 + 5 × 100 + 7 × 10 + 6
329010	Three lakh twenty nine thousand and ten	3 × 1,00,000 + 2 × 10,000 + 9 × 1000 + 0 × 100 + 1 × 10 + 0
300999	three lakh nine hundred nine	3 × 1,00,000 + 0 × 10,000 + 0 × 1000 + 9 × 100 + 9 × 10 + 9

11. Which is the greatest 5-digit number ? ______________________

1.2.6 Larger Number

Remember

✦ 1 hundred = 100 = 10 tens
✦ 1 thousand = 1000 = 10 hundreds = 100 tens
✦ 1 lakh = 1,00,000 = 100 thousands = 1000 hundreds
✦ 1 crore = 100,00,000 = 100 lakhs = 10,000 thousands

12. Starting from the greatest 7-digit number write five numbers just before it in descending order.
A. 9999999, 9999998, 9999997, 9999996, 9999995, 9999994

13. Starting from the greatest 5-digit number write five numbers just after it in ascending order.
A. 99999, 1,00,000, 1,00,001 1,00,002, 1,00,003, 1,00,004

14. 1 thousand = **10** hundreds = **100** tens

15. 1 lakh = **100** thousands = **1000** hundreds = **10000** tens

16. 1 crore = **100** lakhs = **10000** thousands = **100000** hundreds = **1000000** tens

17. Write the answers without doing any calculation :

(1) 99999 + 1 = **1,00,000** (2) 999999 + 1 = **10,00,000**

(3) 9999 + 1 = **10,000** (4) 9999999 + 1 = **1,00,00,000**

(5) 10000 – 1 = **9999** (6) 100000 – 1 = **99999**

(7) 10000000 – 1 = **9999999** (8) 1000000 – 1 = **999999**

1.2.7 An Aid in Reading and Writing Large Numbers

✦ **Use of Commas**

✤ **Indian system of numeration**

In this system, commas are placed after 3 digits starting from the right and thereafter every 2 digits.

The commas after the 3rd, 5th and 7th digits separate thousands, lakhs and crores respectively.

E.g. (1) 7,27,05,062

(2) 5,08,01,592

✤ **International system of numeration**

In this system, commas are placed after every 3 digits starting from the right.

The commas after the 3rd and 6th digits separate thousands and millions respectively.

E.g. (1) 801,592

(2) 50,801,592

Note

✦ If system of numeration is not mentioned, always use the Indian system of Numeration for writing numbers.

18. Write the digits of the following number at their places. Also write the number name and the number in its expanded form :

Number – 435729						
Ten Lakhs	**Lakhs**	**Ten Thousands**	**Thousands**	**Hundreds**	**Tens**	**Ones**
0	4	3	5	7	2	9
Number Name :	Four lakh thirty five thousand seven hundred twenty nine					
Expanded form :	4 × 1,00,000 + 3 × 10,000 + 5 × 1,000 + 7 × 100 + 2 × 10 + 9 × 1					

19. Read the following numbers and write them in words. Write the greatest and the smallest numbers of the given numbers. Also place commas correctly according to Indian System of Numeration and rewrite them :

Number	Number Name	Number in Indian System
475320	Four lakh seventy-five thousand three hundred twenty.	4,75,320
9847214	Ninety-eight lakh forty-seven thousand two hundred fourteen	98,47,214
97645210	Nine crore seventy six lakh forty-five thousand two hundred ten	9,76,45,210
30458094	Three crores four lakh fifty-eight thousand ninety-four	3,04,58,094

20. Place commas correctly and write the numerals :

(1) Five crore twenty six lakh four hundred three **5,26,00,403**

(2) Twenty four million five hundred twenty three thousand four hundred four

24,523,404

(3) Eight lakh eight thousand eight **8,08,008**

(4) Seventy four lakh sixty eight thousand five hundred thirty four **74,68,534**

21. Rewrite the numbers by inserting commas according to International System of Numeration :

(1) 78291023 – **78,291,023**

(3) 9785432 – **4,725,328**

(2) 4725328 – **9,785,432**

(4) 23459678 – **23,459,678**

22. Using the digits 3, 4, 5, 6, 7, 8 and 9 make any three 8-digit numbers. To make them easy to read place commas and write them.

(1) **8,79,65,439** (2) **9,87,65,438** (3) **7,65,43,897**

23. Write 78921093 in numbers and words according to the International System of Numeration.

A. Seventy eight million nine hundred twenty one thousand ninety three

24. How is 50,801,592 read in International System of Numeration ?

A. Fifty million eight hundred one thousand five hundred ninety two.

1.3 Large Numbers in Practice

Remember

- 1 million = 10,00,000
- 1 billion = 1000 million

Units of Length

- 10 millimetres = 1 centimetre
- 100 centimetres = 1 metre
- 1000 millimetres = 1 metre
- 1000 metres = 1 kilometre
- 1 kilometre = 10,00,000 millimetres

Units of Mass

- 1 kilogram = 1000 grams
- 1 gram = 1000 milligrams

Units of Volume

- 1 litre = 1000 millilitres

Do you know?

- Among these units **kilo** is the greatest and **milli** is the smallest.
- kilo shows 1000 times greater
- milli shows 1000 times smaller

Worth Knowing

- 1 centimetre is 100^{th} part of a metre.
- 1 kilogram is 1000 times of 1 gram.

Example **4 m 30 cm cloth is required to make one costume of an actor in a mythological T.V serial. How much cloth is required to make 200 such costumes?**

Cloth required to make one costume = 4 m + 30 cm

= 400 cm + 30 cm ($\because$ 1 m = 100 cm)

= 430 cm

$\therefore$ Cloth required to make 200 costumes = 200 × 430 cm

= 86000 cm

= 86000 cm ÷ 100 ($\because$ 100 cm = 1 m)

= 860 m

$\therefore$ 860 m cloth is required to make 200 costumes.

Example **Distance between two villages is 2 kilometre 380 metre. Find the total distance covered if a person goes both ways for six times from one village to another.**

Distance between two villages = 2 km + 380 m

= 2000 m + 380 m ($\because$ 1 km = 1000 m)

= 2380 m

Total distance covered by the person is 12 times of the distance between the villages as he goes both ways for 6 times.

$\therefore$ Total distance = 12 × 2380 m

= 28560 m

= (28560 ÷ 1000) km ($\because$ 1000 m = 1 km)

= 28 km 560 m

So, the total distance covered by the person is 28 km 560 m.

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1. Sameer has made 7582 runs till now. He wishes to complete 10,000 runs. How many more runs are needed ?

A. Number of runs Sameer wishes to complete = 10,000

Number of runs Sameer has made = – 7,582

More runs needed = 2,418

Sameer needs 2418 more runs.

2. Find the difference between the greatest and the least 5-digit numbers that can be written using the digits 3,4,5,6,7 each only once.

A. greatest number = 76543 ; Smallest number = 34567

$$\begin{array}{r} 76543 \\ -34567 \\ \hline 41976 \end{array}$$

(The difference is 41976)

3. A cloth merchant sold shirts and trousers of worth ₹ 3,56,580 and ₹ 5,37,440 respectively in the year 2015. Find his total sales of that year. The amount of which item is more and by how many rupees ?

A. Total sales = ₹ 3,56,580 + ₹ 5,37,440 = ₹ 8,94,020

Trousers were sold more = ₹ 5,37,440 – ₹ 3,56,580 = ₹ 1,80,860

So, Trousers were sold more by ₹ 1,80,860

4. Out of ₹ 6,10,000, Chinmay gave ₹ 87500, ₹ 1,26,380 and ₹ 3,50,000 to Jyoti, Javed and Rohan respectively. How many rupees are left with him?

A. Amount given to Jyoti = ₹ 87,500 Amount given to Javed = ₹ 1,26,380

Amount given to Rohan = ₹ 3,50,000

Total amount Chinmay gave = ₹ 87,500 + ₹ 1,26,380 + ₹ 3,50,000 = ₹ 5,63,880

∴ Amount left with Chinmay = ₹ 6,10,000 – ₹ 5,63,880 = ₹ 46,120

₹ 46,120 left with Chinmay.

5. 1354 instead of 43 is multiplied by 34. By how much is the answer smaller than the correct answer ? (**Hint :** Find the product with the difference of multipliers.)

A. Difference between the correct multiplier and the wrong multiplier = 43 – 34 = 9

Difference between the correct answer and the wrong answer = 1354 × 9 = 12,186

$$\begin{array}{r} 1354 \\ \times 9 \\ \hline 12{,}186 \end{array}$$

Difference 12,186

The answer is 12,186 smaller than the correct answer.

---

6. A sack contains 52 kg 250 g of wheat. From this wheat small bags are to be filled such that each bag contains 150 g of wheat. How many such bags can be filled and how much wheat will be left in the sack?

A. 52 kg and 250 g

= 52250 gm

$$\begin{array}{r|l} & 348 \\ \hline 150 & 52250 \\ & -450 \\ \hline & 725 \\ & 600 \\ \hline & 1250 \\ & 1200 \\ \hline & 0050 \end{array}$$

348 such bags can be filled and 50 g wheat will be left.

---

7. A vessel has 10 litres and 750 mL of milk. In how many glasses, each of 250 mL capacity, can it be filled ?

A. Vessel capacity = 10 litres and 750 *ml*

= (10,000 + 750) *ml* (∵ 1 litre = 100 *ml*)

= 10,750 *ml*

Capacity of each glass = 250 *ml*

Number of the glasses required $= \dfrac{10{,}750}{250}$

= 43

∴ Number of the glasses required is 43

Objective Questions

1. Choose the correct option.

(1) Which is the smallest of the given numbers ? **B**

(A) 2414 (B) 918 (C) 999 (D) 4213

(2) Which is the greatest of the given numbers ? **B**

(A) 5005 (B) 5500 (C) 5050 (D) 0550

(3) Read the statements given below for the numbers 9345, 9359, 3995, 9593 and choose the correct option. **C**

1 : All of the given four numbers are equal.
2 : 9359 is the greatest number.
3 : 3995 is the smallest number.
4 : 9593 is the greatest number.

(A) The statements 1, 2 and 3 are correct.
(B) The statements 2, 3 and 4 are correct.
(C) The statements 3 and 4 are correct.
(D) The statements 1 and 2 are correct.

(4) Prices of four T.V. sets are given as : T.V. 1 - ₹ 35000, T.V. 2 - ₹ 37500, T.V. 3 - ₹ 75300, T.V. 4 - ₹ 3500. Which T.V. set has the maximum price and which one has the minimum price ? **C**

(A) T.V. 2, T.V. 3 (B) T.V. 1, T.V. 4 (C) T.V. 3, T.V. 4 (D) T.V. 3, T.V. 1

(5) The smallest 3-digit number formed using the digits 5, 6 and 4 is ____________. **C**

(A) 564 (B) 654 (C) 456 (D) 465

(6) Which of the following is the greatest possible 5-digit number using any three digits each atleast once ? **C**

(A) 98978 (B) 99897 (C) 99987 (D) 98799

(7) Which of the following is the smallest 4-digit number formed by using any three different digits each atleast once ? **D**

(A) 1021 (B) 1012 (C) 1020 (D) 1002

(8) The product of the numbers just before and after 999 is ____________. **B**

(A) 999000 (B) 998000 (C) 989000 (D) 1998

(9) Which of the given numbers is equal to $3 \times 10000 + 7 \times 1000 + 9 \times 100 + 0 \times 10 + 4$? **C**

(A) 3794 (B) 37940 (C) 37904 (D) 379409

(10) Expansion of 9578 is ____________. **B**

(A) $9 \times 10000 + 5 \times 1000 + 7 \times 10 + 8 \times 1$
(B) $9 \times 1000 + 5 \times 100 + 7 \times 10 + 8 \times 1$
(C) $9 \times 1000 + 57 \times 100 + 8 \times 1$
(D) $9 \times 100 + 5 \times 100 + 7 \times 10 + 8 \times 1$

(11) Which of the following numbers comes just before one lakh ? **B**

(A) 99000 (B) 99999 (C) 999999 (D) 100001

(12) In Indian System of Numeration 58695376 is written as ____________. **C**

(A) 58,69,53,76 (B) 58,695,376 (C) 5,86,95,376 (D) 586,95,376

(13) Which of the following numbers comes just after 1 million ? **B**

(A) 2 million (B) 1000001 (C) 100001 (D) 10001

(14) How many 4 digit numbers can be formed by shifting the digits of the number 2546 at different places ? **D**

(A) 8 (B) 10 (C) 16 (D) 24

2. **Fill in the blanks.**

(1) On interchanging the digits of the number 478 from one place to another the greatest number formed is **874**.

(2) The number just after 9999 is **10,000**.

(3) 1 hundred = **10** tens

(4) On reversing the order of the digits of the greatest 5-digit number formed by any five digits other than 0 we get the **smallest** 5-digit number that can be formed by using the same digits.

(5) We get 10 lakh on adding 1 to the greatest **6** -digit number.

(6) The smallest 6-digit natural number having 5 at the ones place is **1,00,005**

(7) 1 million = **10** lakhs.

(8) 1 billion = **1000** million.

(9) 1 lakh = **10** ten thousand.

(10) 1 million = **10** hundred thousand.

(11) 1 crore = **10** ten lakh.

(12) 1 crore = **10** million.

(13) 1 kilometre = **1,00,000** centimetres.

(14) **1000** millimetres = 1 metre.

(15) **10,00,000** millimetres = 1 kilometre.

(16) 1 kg = **1,000** grams = **10,00,000** milligrams.

(17) The length of a river is 1290 kilometres. So, its length in metres is **12,90,000**.

(18) **Descending** order is arranging numbers from greater to smaller.

(19) Out of 1971, 45321 and 9999 the greatest number is **45321** and the smallest number is **1971**.

(20) The greatest 5-digit number that can be formed without repeating any digit and keeping 2 at the thousands place is **92,876**.

3. **Mark as '✓' or '✗'.**

(1) Of the given two numbers the number having more digits is greater than the other. ✓

(2) On interchanging the digits of the number 593 from one place to another the smallest number formed is 395. ✗

(3) The greatest 4-digit number formed using the digits 6, 7, 0 and 9 without repeating any digit is 9760. ✓

(4) A natural number having more digits is greater than the one having less number of digits. ✓

(5) 30746 = 3 × 10000 + 9 × 1000 + 7 × 100 + 4 × 10 + 6 ✗

(6) On adding 1 to the smallest 5-digit number we get the greatest 6-digit number. ✗

(7) The smallest 3-digit number is the number that comes just before the greatest 3-digit number. ✗

(8) Out of kilometre, millimetre and centimetre the smallest unit is centimetre. ✗

(9) Ascending order is arranging numbers from smaller to greater. ✓

4. Match the following :

(1)

Number	Expansion	Answer
(1) 26640	(A) 2 × 10,000 + 6 ×1000 + 6 × 100 + 4 × 10	(1) → **A**
(2) 24640	(B) 2 × 10,000 + 4 × 100 + 6 × 10	(2) → **C**
(3) 24460	(C) 2 × 10,000 + 4 × 1000 + 6 × 100 + 4 × 10	(3) → **D**
(4) 20460	(D) 2 × 10,000 + 4 × 1000 + 4 × 100 + 6 × 10	(4) → **B**

(2)

A	B	Answer
(1) 5 kg and 500 gm	(A) 5750 gm	(1) → **D**
(2) 5 kg and 750 gm	(B) 6200 gm	(2) → **A**
(3) 5 kg and 1200 gm	(C) 6500 gm	(3) → **B**
(4) 5 kg and 1500 gm	(D) 5500 gm	(4) → **C**

✦ ❄ ✦ ❄ ✦

2 Whole Numbers

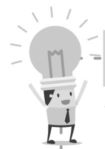
2.1 Introduction

- **Natural Number**
  - The numbers 1, 2, 3,... which we use for counting are known as **natural numbers**.
- **Predecessor**
  - By subtracting 1 from any natural number, we get its **predecessor**.
- **Successor**
  - By adding 1 to any natural number, we get its **successor**.

E.g. 25

Predecessor of 25 = 25 – 1 = 24

Successor of 25 = 25 + 1 = 26



Remember
- Every natural number has a successor.
- Every natural number except 1 has a predecessor.

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1. **Define :** Natural numbers

A. The numbers 1, 2, 3, 4,... that come naturally when we start counting are called natural numbers.

2. Which natural number does not have a natural numbers as its predecessor ? **1**

3. **Write the successor of :**

(1) 345699 **345700** (2) 1000000 **1000001**

(3) 20765439 **20765440** (4) 1999999 **2000000**

4. **Write the natural numbers which are the predecessor of the following :**

(1) 6543211 **6543210** (2) 1 **Does not exist**

(3) 1000000 **999999** (4) 24536789 **24536788**

2.2 Whole Numbers

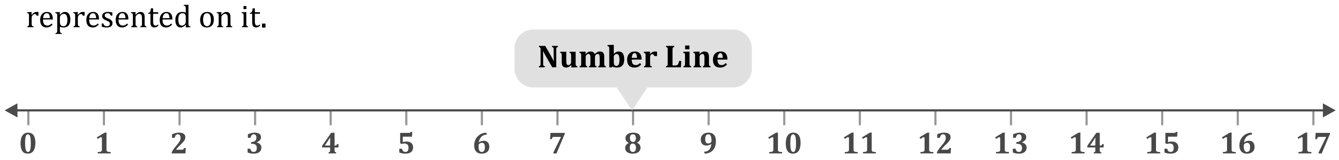
- **Whole Number**
  - If we add the number zero to the collection of natural numbers, we get the collection of **whole numbers.**
  - The numbers 0, 1, 2, 3,... are whole numbers.
  - Every whole number has a successor. Every whole number except zero has a predecessor.
  - All natural numbers are whole numbers, but all whole numbers are not natural numbers.

---

1. Write the three whole numbers occurring just before 10001. **10000, 9999, 9998**

The Number Line

- Take a line, mark a point on it and label it 0. Then mark out points to the right of 0, at equal intervals. Label them as 1, 2, 3,.... Thus, we have a number line with the whole numbers represented on it.



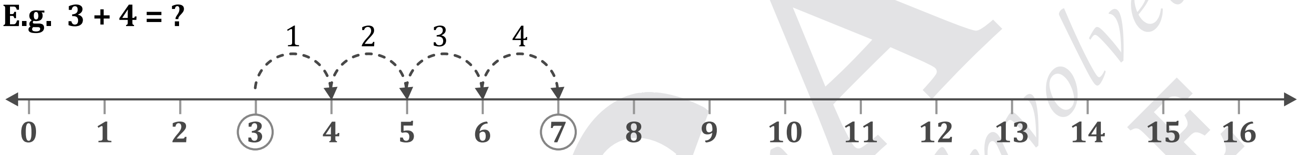
Remember

- Distance between any two consecutive numbers on the number line is a unit distance.
- Of any two numbers on the number line, the one which is to the right is greater than the one which is to the left.

Addition on the number line

- Addition corresponds to moving to the right on the number line.

E.g. 3 + 4 = ?

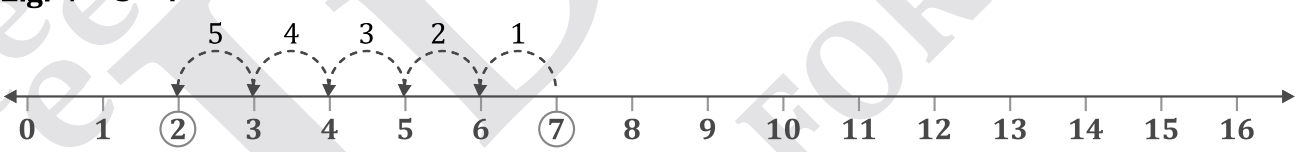


∴ 3 + 4 = 7

Subtraction on the number line

- Subtraction corresponds to moving to the left on the number line.

E.g. 7 – 5 = ?

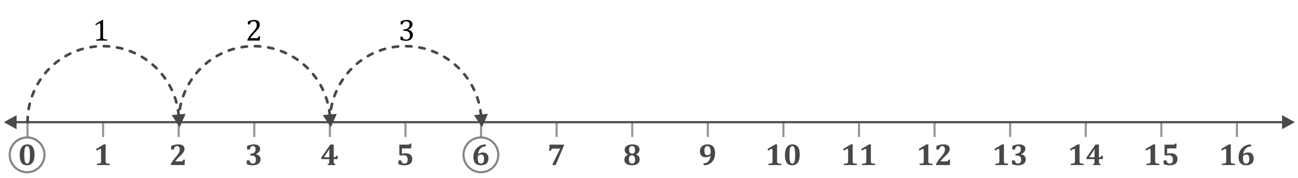


∴ 7 – 5 = 2

Multiplication on the number line

- Multiplication corresponds to making jumps of equal distance starting from zero on the number line.

E.g. 3 × 2 = ?

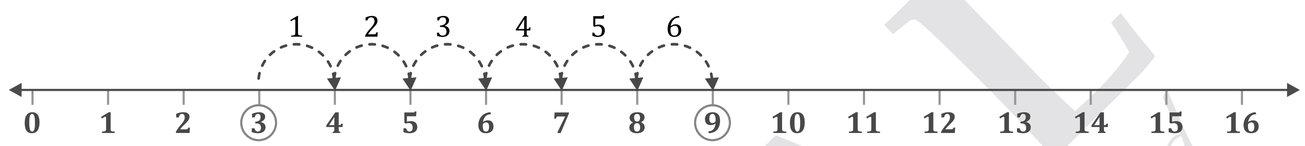


∴ 3 × 2 = 6

1. **In each of the following pairs of numbers, state which of the given whole numbers is on the left of the other number on the number line. Also write them with the appropriate sign (>, <) between them.**

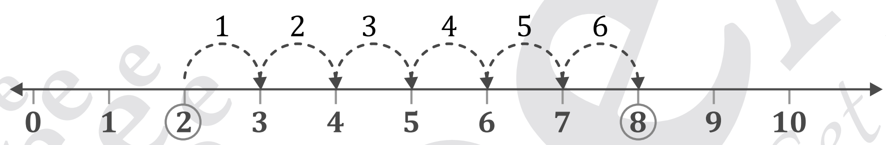
Pair of Numbers	Number to the left	Number to the right	Comparison of Number
98766; 46789	**46789**	**98766**	**98766 > 46789**
84; 503	**84**	**503**	**84 < 503**
25759; 3241056	**25759**	**3241056**	**25759 < 3241056**
345610; 42345	**42345**	**345610**	**345610 > 42345**

Example **Find 3 + 6 using the number line.**



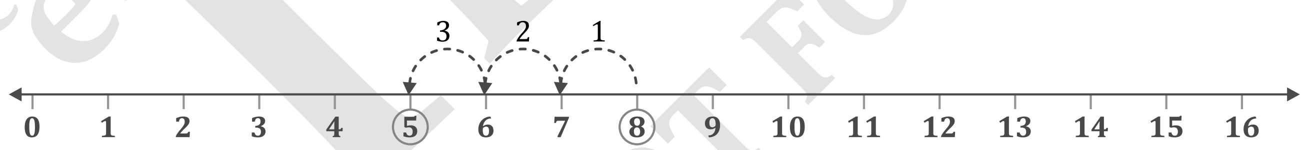
∴ 3 + 6 = 9

2. Find 2 + 6 using the number line.



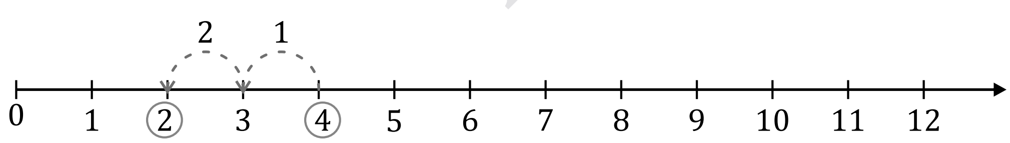
∴ 2 + 6 = 8

Example **Find 8 – 3 using the number line.**



∴ 8 – 3 = 5

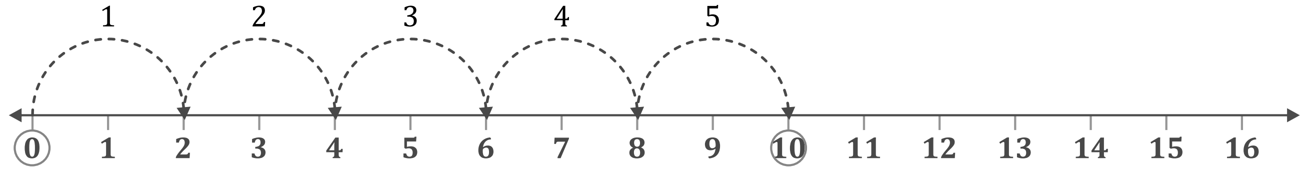
3. Find 4 – 2 using the number line.



Start from 4 move 2 unit to the left get 2 on number line.

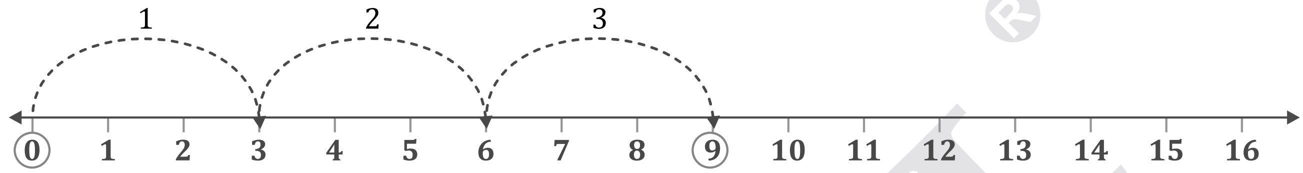
∴ 4 – 2 = 2

Example Find 5 × 2 using the number line.



∴ 5 × 2 = 10

4. Find 3 × 3 using the number line.



∴ 3 × 3 = 9

Objective Questions

1. Choose the correct option.

(1) ________ is the smallest whole number, and ________ is the smallest natural number. **D**

(A) 1; 1 (B) 0; 0 (C) 1; 0 (D) 0; 1

(2) How many whole numbers are there between 38 and 68 ? **B**

(A) 31 (B) 29 (C) 19 (D) 28

(3) ________ of whole numbers corresponds to moving to the ________ on the number line. **C**

(A) Addition; left (B) Subtraction; Right

(C) Subtraction; left (D) Multiplication; left

(4) Which of the statements is true ? (i) 1 is the smallest whole number (ii) 2 is the smallest natural number. **D**

(A) Only (i) (B) Only (ii)

(C) Both (i) and (ii) (D) None of (i) and (ii)

(5) The whole number ________ has no predecessor. **B**

(A) 1 (B) 0 (C) 1000000 (D) 5

(6) ________ is a natural number, which does not have a natural number as its predecessor. **A**

(A) 1 (B) 0 (C) 1000000 (D) 5

2. Fill in the blanks.

(1) Predecessor of 13000 is **12999** and its successor is **13001**.

(2) Predecessor of 2 is **1**.

(3) Successor of 7499 is **7500**.

(4) There are **7** natural numbers between 5 and 13.

(5) The natural numbers along with **0** form the collection of whole numbers.

(6) There are **4** whole numbers between 5 and 10.

(7) There are **9** whole numbers between 50 and 60.

(8) On the number line, 370 is on the **right** side of 307.

(9) **12** is a natural number that lies between 11 and 13.

(10) The distance between any two consecutive points on a number line is called a **Unit** distance.

(11) On the number line, out of any two whole numbers, the number on the right of the other number is the **greater** number. (greater / smaller)

3. Mark as '✓' or '✗'.

(1) Natural numbers are infinite. ✓

(2) Every natural number except 1 has a natural number as its predecessor. ✓

(3) The successor of a two digit number is always a two digit number. ✗

(4) 540 is the predecessor of 499. ✗

(5) 399 is predecessor of 400. ✓

(6) All natural numbers are whole numbers. ✓

(7) Whole numbers are not infinite. ✗

(8) The number of whole numbers and natural numbers between 1 and 10 are the same. ✓

(9) There are 4 natural numbers between 0 and 5. ✓

(10) On the number line, the number 7 lies to the right of 4. ✓

(11) 0 is the smallest whole number. ✓

(12) Every whole number has a successor. ✓

(13) Every natural number has a predecessor. ✗

(14) The whole number 23, lies between 21 and 22. ✗

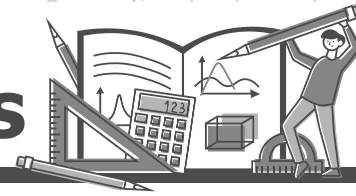
(15) The predecessor of a two digit whole number is never a single digit number. ✗

4. Match the following :

A	B	Answer
(1) 0	(A) Predecessor of 4	(1) → **B**
(2) 1	(B) Smallest whole number	(2) → **C**
(3) 1 + 1	(C) Smallest natural number	(3) → **D**
(4) 4 – 1	(D) Successor of 1	(4) → **A**

✦ ❉ ✦ ❉ ✦

3 Playing with Numbers



3.2 Factors and Multiples

✦ **Factors**

✤ A factor of a number is an exact divisor of that number. Thus, a factor of a given number divides it exactly, leaving no remainder.

E.g. Factors of 30 are 1, 2, 3, 5, 6, 10, 15 and 30 because each of these numbers divides 30 leaving no remainder.

✦ **Multiples**

✤ The product of a number with natural numbers gives multiples of that number.

E.g. Multiples of 2 are 2, 4, 6, 8, 10,…

Note

✦ The number of factors of a given number is finite, while the number of multiples of a given number is infinite.

Do you know?

5 × 1 = **5** 5 × 6 = **30**
5 × 2 = **10** 5 × 7 = **35**
5 × 3 = **15** 5 × 8 = **40**
5 × 4 = **20** 5 × 9 = **45**
5 × 5 = **25** 5 × 10 = **50**

✦ 5, 10, 15, 20, ….. are multiples of 5 and 5 is a factor of 5, 10, 15, 20, …..

✦ **Points to remember about factors and multiples :**

✤ 1 is a factor of every number.
✤ Every number is a factor of itself.
✤ Every factor of a number is an exact divisor of that number.
✤ Every factor is less than or equal to the given number.
✤ Number of factors of a given number are finite.
✤ Every multiple of a number is greater than or equal to that number.
✤ The number of multiples of a given number is infinite.
✤ Every number is a multiple of itself.

✦ **Perfect Number**

✤ A number for which sum of all its factors is equal to twice the number is called a **perfect number.**

E.g. Factors of 6 are 1, 2, 3 and 6. Also, 1 + 2 + 3 + 6 = 12 = 2 × 6

Thus, 6 is a perfect number.

1. **Define :**

(1) Factors : Numbers which exactly divide a number are called factors of the given number. For eg. factors of 6 are 1, 2, 3 and 6.

(2) Multiples : Product of a number with any other number is called the multiple of that number. For e.g. multiple of 2 are 2, 4, 6, 8 etc.

(3) A perfect number : A number for which sum of all its factors is equal to twice the number is called a perfect number.

2. **Write all the factors of the following numbers :**

Example 32

32 = 1 × 32

32 = 2 × 16

32 = 4 × 8

∴ Factors of 32 are 1, 2, 4, 8, 16 and 32

(1) 90

90 = 90 × 1

90 = 45 × 2

90 = 30 × 3

90 = 18 × 5

90 = 15 × 6

90 = 9 × 10

∴ Factors of 90 are 1, 2, 3, 5, 6, 9, 10, 15, 18, 30, 45, 90

(2) 381

381 = 381 × 1

381 = 127 × 3

Factors of 381 are : 1, 3, 127, 381

Example 154

154 = 1 × 154

154 = 2 × 77

154 = 7 × 22

154 = 11 × 14

∴ Factors of 154 are 1, 2, 7, 11, 14, 22, 77 and 154

(3) 140

140 = 140 × 1

140 = 70 × 2

140 = 35 × 4

140 = 28 × 5

140 = 20 × 7

140 = 14 × 10

∴ Factors of 40 are 1, 2, 4, 5, 7, 10, 14, 20, 28, 35, 70, 140

(4) 420

420 = 420 × 1

420 = 210 × 2

420 = 140 × 3

420 = 105 × 4

420 = 84 × 5

420 = 70 × 6

420 = 60 × 7

420 = 42 × 10

420 = 21 × 20

420 = 14 × 30

∴ Factors of 420 are 1, 2, 3, 4, 5, 6, 7, 10, 14, 20, 21, 30, 42, 60, 70, 84, 105, 140, 210, 420

3. **Write first five multiples of :**

(1) 7 : **7, 14, 21, 28, 35** (2) 24 : **24, 48, 72, 96, 120**

(3) 9 : **9, 18, 27, 36, 45** (4) 100 : **100, 200, 300, 400, 500**

(5) 12 : **12, 24, 36, 48, 50** (6) 18 : **18, 36, 54, 72, 90**

4. Find all multiples of 8 upto 100. **8, 16, 24, 32, 40, 48, 56, 64, 72, 80, 88, 96**

5. Find all multiples of 10 less than 125. **10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110**

6. Write first five multiples of 2. **2, 4, 6, 8, 10**

3.3 Prime and Composite Numbers

- **Prime Numbers**
  - The numbers other than 1 whose only factors are 1 and the number itself are called **Prime numbers.**

    E.g. 2, 3, 5, 7, 11,.. are prime numbers.
- **Twin Primes**
  - Two prime numbers whose difference is 2 are called **twin primes.**
- **Composite Numbers**
  - Numbers having more than two factors are called **Composite numbers.**

    E.g. 4, 6, 8, 9, 10, etc. are composite numbers.

Remember

- 1 is neither a prime nor a composite number.

- **Even Numbers**
  - A number that is divisible by 2 is called an **even number**.

    Every number with 0, 2, 4, 6, or 8 at the ones place is an even number.

    E.g. 330, 4922, 52136, etc. are even numbers.
- **Odd Numbers**
  - A number which is not divisible by 2 is called an **odd number**.

    Every number with 1, 3, 5, 7, or 9 at the ones place is an odd number.

    E.g. 331, 4923, 52135, etc. are even numbers.

Note

- The number 2 is the smallest prime number and is even.
- Every prime number other than 2 is odd.

1. **Define :** Composite numbers

A. Numbers having more than two factors are called composite numbers.

2. **Define :** Prime numbers

A. The numbers other than 1 whose only factors are 1 and the number itself are called prime numbers.

3. Write down all the composite numbers between 60 and 70.

62, 63, 64, 65, 66, 68, 69

4. **Classify the following numbers as prime and composite numbers.**

4, 7, 26, 37, 58, 34, 33, 31, 51, 53

Prime numbers : **7, 37, 31, 53**

Composite numbers : **4, 26, 58, 34, 33, 51**

5. **Write the smallest and the greatest prime numbers that lie between the given pairs of numbers.**

Number	Greatest Prime Number	Smallest Prime Number
1 to 10	**7**	**2**
30 to 40	**37**	**31**
50 to 60	**59**	**53**

6. Give two pairs of prime numbers such that the difference between the numbers in each pair is 2.

A (19, 17) and (13, 11)

Example **Express 30 as the sum of two odd primes.**

30 = 13 + 17

30 = 19 + 11

30 = 23 + 7

3.4 Tests for Divisibility of Numbers

Number	Rule
10	If a number has 0 in the ones place then it is divisible by 10.
5	A number which has either 0 or 5 in its ones place is divisible by 5.
2	A number is divisible by 2 if it has any of the digits 0, 2, 4, 6 or 8 in its ones place.
3	If the sum of the digits of a number is a multiple of 3, then the number is divisible by 3.
6	If a number is divisible by 2 and 3 both then it is divisible by 6 also.
4	A number with 3 or more digits is divisible by 4 if the number formed by its last two digits (i.e. ones and tens) is divisible by 4.
8	A number with 4 or more digits is divisible by 8, if the number formed by the last three digits is divisible by 8.

Number	Rule
9	If the sum of the digits of a number is divisible by 9, then the number is divisible by 9.
11	If the difference between the sum of the digits at odd places (from the right) and the sum of the digits at even places (from the right) of the number is either 0 or divisible by 11, then the number is divisible by 11.

Remember

- The product of three consecutive numbers is always divisible by 6.
- The sum of two consecutive odd numbers is divisible by 4.
- If two numbers are divisible by a number then their sum and difference are also divisible by that number.

1. Using divisibility tests, determine which of the following numbers are divisible by 4 and 8 :

Example **24566**

The last two digits of 24566 form the number 66 and 66 is not divisible by 4.

∴ 24566 is not divisible by 4

The last three digits of 24566 forms the number 566 and 566 is not divisible by 8.

∴ **24566 is not divisible by 8.**

(1) 675344

A. The last two digits of 675344 forms the number 44 and it is divisible by 4.

Thus, 675344 is also divisible by 4

The last three digits of 675344 forms the number 344 and it is divisible by 8.

∴ 675344 is divisible by 8.

2. Using divisibility tests, determine which of the following numbers are divisible by 6 :

Example **34576**

A number is divisible by 6 if it is divisible by 2 and 3.

34576 is divisible by 2 as its units place is an even number.

34576 is not divisible by 3 as the sum of its digits (3 + 4 + 5 + 7 + 6 =25) is not divisible by 3.

∴ **34576 is not divisible by 6.**

(1) 723748

A. A number is divisible by 6 if it is divisible by 2 and 3.

723748 is divisible by 2 as its units place is an even number.

723748 is not divisible by 3 as the sum of its digits (7 + 2 + 3 + 7 + 4 + 8 =31) is not divisible by 3.

∴ 723748 is not divisible by 6.

---

3. Using divisibility tests, determine which of the following numbers are divisible by 9 :

Example **1235340**

Sum of the digits of given number = 1 + 2 + 3 + 5 + 3 + 4 + 0 = 18

18 is divisible by 9 $\left(\because \frac{18}{9} = 2\right)$

∴ **1235340 is divisible by 9.**

---

(1) 668735

A. Sum of the digits of given number = 6 + 6 + 8 + 7 + 3 + 5 = 35

35 is not divisible by 9.

∴ 668735 is not divisible by 9.

---

4. Using divisibility tests, determine which of the following numbers are divisible by 11 :

Example **1678036**

Sum of the digits at odd places from the right = 6 + 0 + 7 + 1 = 14

Sum of the digits at even places from the right = 3 + 8 + 6 = 17

Difference = 17 – 14

= 3 which is not divisible by 11.

∴ **1678036 is not divisible by 11.**

---

(1) 1001001001

A. Sum of the digits at odd places from the right = 1 + 0 + 0 + 1 + 0 = 2

Sum of the digits at even places from the right = 0 + 1 + 0 + 0 + 1 = 2

Difference = 2 – 2

= 0

Thus, 1001001001 is divisible by 11.

5. **Using divisibility tests, determine which of the following numbers are divisible by 3 :**

Example **591213**

Sum of the digits of 591213 = 5 + 9 + 1 + 2 + 1 + 3 = 21

21 is divisible by 3.

∴ **591213 is divisible by 3.**

(1) 41785

A. Sum of the digits of 41785 = 4 + 1 + 7 + 8 + 5 = 25

25 is not divisible by 3.

∴ 41785 is not divisible by 3.

6. **Using divisibility tests check which of the following numbers are divisible by 2, 3, 4, 5, 6, 8, 9, 10 and 11.**

Number	**Divisor**								
	2	**3**	**4**	**5**	**6**	**8**	**9**	**10**	**11**
124	✓	✗	✓	✗	✗	✗	✗	✗	✗
99	✗	✓	✗	✗	✗	✗	✓	✗	✓
1586	✓	✗	✗	✗	✗	✗	✗	✗	✗
345629	✗	✗	✗	✗	✗	✗	✗	✗	✗
4758	✓	✓	✗	✗	✓	✗	✗	✗	✗
33264	✓	✓	✓	✗	✓	✓	✓	✗	✓

7. If a number is divisible by 16, then it is also divisible by which other numbers ?

A. A number is divisible by 16, So it is divisible by Factors of 16.

Factors of 16 are 1, 2, 4, 8 and 16.

Hence, If a number is divisible by 16, then it is also divisible by 1, 2, 4 and 8.

8. **Replace * by the greatest possible digit in the given numbers so that the given statements become true :**

Example **54678* is divisible by 2**

A number is divisible by 2 if its unit digit is even.

Thus, the greatest possible digit here that can replace * is 8.

∴ **The greatest possible digit here that can replace * is 8.**

(1) 6745* is divisible by 5.

A number is divisible by 5 if its last digit is 0 or 5.

Thus, here * can be replaced by 5

3.5 Common Factors and Common Multiples

✦ **Common Factors**

✤ The factors that are common to two or more numbers are the common factors of those numbers.

E.g. Factors of 4 are **1**, **2** and **4**

Factors of 12 are **1**, **2**, 3, **4**, 6 and 12.

Thus, **the Common factors of 4 and 12 are 1, 2 and 4.**

✦ **Co-prime Numbers**

✤ Two numbers having only **1** as their common factor are called co-prime numbers.

E.g. Factors of 4 are **1**, 2 and 4

Factors of 15 are **1**, 3, 5 and 15.

Thus, 4 and 15 have only **1** as their **Common factor**.

So, 4 and 15 are co-prime numbers.

✦ **Common Multiples**

✤ The multiples that are common to a given set of numbers are common multiples of those numbers.

E.g. Multiples of 8 are 8, 16, **24**, 32, 40, **48**, 56, 64, **72**, 80, ...

Multiples of 12 are 12, **24**, 36, **48**, 60, **72**, 84, ...

Thus, the common multiples of 8 and 12 are 24, 48, 72,...........

1. **Find the common factors of :**

Example **18 and 78**

Factors of 18 =

1, 2, 3, 6, 9, 18

Factors of 78 =

1, 2, 3, 6, 13, 26, 39, 78

∴ Common factors of 18 and 78 are 1, 2, 3 and 6.

(1) 30, 35 and 70

Factors of 30 are

1, 2, 3, **5,** 6,10, 15, 30

Factors of 35 are

1, 5, 7, 35

Factors of 70 are

1, 2, **5,** 7, 10, 14, 35, 70

Common factors are : 1, 5

(2) 34, 50, 66

Factors of 34 are

1, 2, 17, 34

Factors of 50 are

1, 2, 5, 10, 25, 50

Factors of 66 are

1, 2, 3, 6, 11, 22, 33, 66

Common factors are : 1, 2

2. **Find the first three common multiples of :**

Example **15 and 75**

Multiples of 15 are 15, 30, 45, 60, **75**, 90, 105, 120, 135, **150**, 165, 180, 195, 210, **225**....

Multiples of 75 are **75**, **150**, **225**, 300.....

Here, 3 common multiples of 15 and 75 are 75, 150, 225

(1) 6, 9, 12

Multiples of 6 : 6, 12, 18, 24, 30, 36, 42, 48, 54, 60, 66, 72, 78, 84, 90, 96, 102, 108, 114...

Multiples of 9 : 9, 18, 27, 36, 45, 54, 63, 72, 81, 90, 99, 108, 117....

Multiples of 12 : 12, 24, 36, 48, 60, 72, 84, 96, 108.......

Common Multiples are : 36, 72, 108

3. **Define :** Co-prime numbers

A. Two numbers having only 1 as the common factor are called co-prime numbers.

4. **Which of the following numbers are co-prime :**

Example **24 and 35**

Factors of 24 : **1**, 2, 3, 4, 6, 8, 12, 24

Factors of 35 : **1**, 5, 7, 35

Common factor : **1**

Thus, 24 and 35 are co-prime numbers.

(1) 27 and 45

Factors of 27 : 1, 3, 9, 27

Factors of 45 : 1, 3, 5, 9, 15, 45

Common factors : 1, 3, 9

Thus, 27 and 45 are not co-prime numbers.

3.6 Prime Factorisation

- When a number is expressed as a product of its factors we say that the number has been **factorised**.

E.g. Factorisation of 20 in different ways

$20 = 1 \times 20$

$20 = 2 \times 10$

$20 = 4 \times 5$

All the above factorisations of 20, ultimately lead to one factorisation **2 × 2 × 5**.

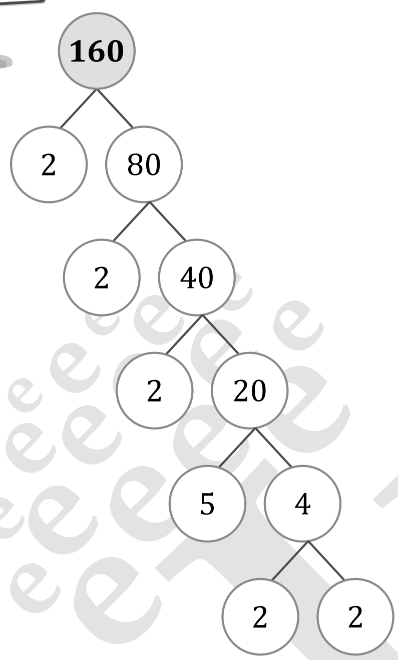
In this factorisation the only factors 2 and 5 are prime numbers.

Thus, **20 = 2 × 2 × 5 is the prime factorisation of 20.**

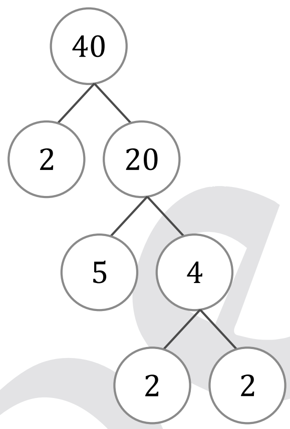
The prime factorisation of a number represents the number as the product of only prime numbers which are also co-prime to one another.

1. Find the missing numbers in the factor tree :

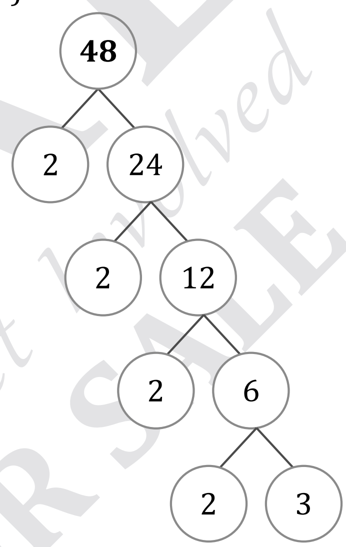
Example 160



(1) 40

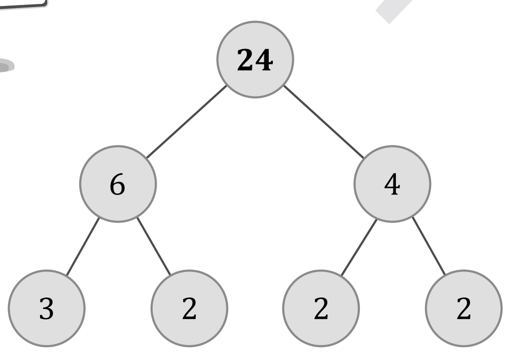


(2) 48

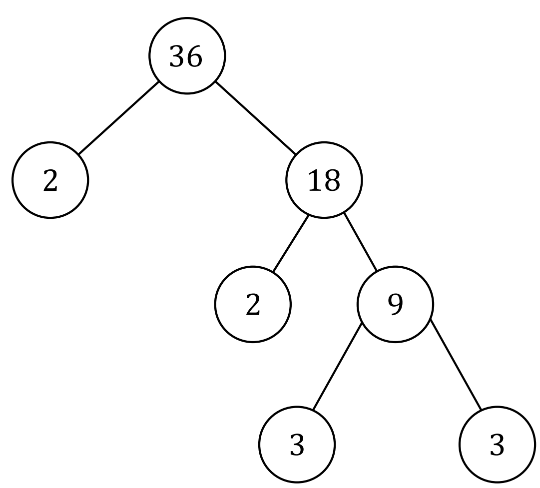


2. Draw the factor trees of :

Example 24



(1) 36



3. **Find the prime factorisation of :**

Example 148

2	148
2	74
37	37
	1

Thus, the prime factorisation of 148 = 2 × 2 × 37

(1) 390

2	390
3	195
5	65
13	13
	1

Thus, the prime factorisation of 390 = 2 × 3 × 5 × 13

(2) 230

2	230
5	115
23	23
	1

Thus, the prime factorisation of 230 = 2 × 5 × 23

(3) 70

2	70
5	35
7	7
	1

Thus, the prime factorisation of 70 = 2 × 5 × 7

3.7 Highest Common Factor

✦ The **Highest Common Factor (HCF)** of two or more given numbers is the highest (or greatest) of their common factors. It is also known as **Greatest Common Divisor (GCD)**.

E.g. The common factors of 12 and 16 are 1, 2 and 4.
The highest of these common factors is 4.
Thus, the HCF of 12 and 16 is 4.

Remember

- ✦ The HCF of two consecutive numbers is 1.
- ✦ The HCF of two consecutive even numbers is 2.
- ✦ The HCF of two consecutive odd numbers is 1.

Example **Find the HCF of 288 and 420 by prime factorisation.**

2	288
2	144
2	72
2	36
2	18
3	9
3	3
	1

2	420
2	210
3	105
5	35
7	7
	1

Prime factorisation of 288 = **2** × **2** × 2 × 2 × 2 × **3** × 3
Prime factorisation of 420 = **2** × **2** × **3** × 5 × 7
∴ **HCF of 288 and 420 = 2 × 2 × 3 = 12**

1. Find the HCF of 8, 12 and 16 by prime factorisation.

A.

2	8
2	4
2	2
	1

2	12
2	6
3	3
	1

2	16
2	8
2	4
2	2
	1

Prime factorisation of 8 = 2 × 2 × 2

Prime factorisation of 12 = 2 × 2 × 3

Prime factorisation of 16 = 2 × 2 × 2 × 2

∴ HCF of 8, 12, and 16 = 2 × 2 = 4

2. Find the HCF of 96, 108 and 132 by prime factorisation.

A.

2	96
2	48
2	24
2	12
2	6
3	3
	1

2	108
2	54
3	27
3	9
3	3
	1

2	132
2	66
3	33
11	11
	1

Prime factorisation of 96
= 2 × 2 × 2 × 2 × 2 × 3

Prime factorisation of 108
= 2 × 2 × 3 × 3 × 3

Prime factorisation of 132 = 2 × 2 × 3 × 11

∴ HCF of 96, 108 and 132 = 12

3.8 Lowest Common Multiple

✦ **Lowest Common Multiple**

The Lowest Common Multiple (LCM) of two or more given numbers is the lowest (or smallest or least) of their common multiples.

E.g. The common multiples of 4 and 6 are 12, 24, 36, ...

The lowest of these is 12.

Thus, **the lowest common multiple (LCM) of 4 and 6 is 12.**

Example **Find LCM of 84, 90 and 252.**

2	84
2	42
3	21
7	7
	1

2	90
3	45
3	15
5	5
	1

2	252
2	126
3	63
3	21
7	7
	1

Prime factorisation of 84 : **2 × 2** × 2 × **7**

Prime factorisation of 90 : 2 × 3 × 3 × **5**

Prime factorisation of 252 : 2 × 2 × 3 × **3** × 7

∴ **LCM of 84, 90 and 252 = 2 × 2 × 3 × 3 × 7 × 5**

= 4 × 9 × 7 × 5

= 36 × 35

= 1260

Alternate Method :

2	84	90	252
2	42	45	126
3	21	45	63
3	7	15	21
5	7	5	7
7	7	1	7
	1	1	1

∴ LCM of 84, 90 and 252 $= 2 \times 2 \times 3 \times 3 \times 7 \times 5$

$= 1260$

---

1. Find LCM of 26, 48 and 128 by prime factorisation.

A.

2	26
13	13
	1

2	48
2	24
2	12
2	6
3	3
	1

2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

⇒ Prime factors of 26 : 2×13

⇒ Prime factors of 48 : $2 \times 2 \times 2 \times 2 \times 3$

⇒ Prime factors of 128 : $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$

LCM $= 2^7 \times 3 \times 13 = 128 \times 3 \times 13 = 4992$

3.9 Some Problems on HCF and LCM

- If one number is a factor of the other, then the smaller number is the HCF of the two numbers and the greater number is their LCM.

  E.g. 16 is a factor of 36.

  Thus, the HCF of 16 and 36 is **16** (the smaller number of the two)

  and their LCM is **36** (the greater number of the two)

- Similarly, if all the numbers in a given set of numbers are the multiples of the smallest of the given numbers, then the smallest number is their HCF.

  E.g. Consider the numbers 15, 30, 45 and 60

  Here, all the numbers are multiples of 15, the smallest of the given numbers is 15

  Thus, the HCF of 15, 30, 45 and 60 is 15.

Example **A merchant has 120 litre of oil of one kind, 180 litre of another kind and 240 litre of third kind. Find the maximum capacity of a container which can hold oil of all three types in exact numbers of containers.**

2	120
2	60
2	30
3	15
5	5
	1

2	180
2	90
3	45
3	15
5	5
	1

2	240
2	120
2	60
2	30
3	15
5	5
	1

Prime factorisation of 120 : **2** × **2** × 2 × **3** × **5**

Prime factorisation of 180 : **2** × **2** × **3** × 3 × **5**

Prime factorisation of 240 : **2** × **2** × 2 × 2 × **2** × **2**

∴ H.C.F = 2 × 2 × 3 × 5 = 4 × 15 = 60

Thus, the maximum capacity of the required container is 60 litres.

---

1. Three brands of biscuits A, B and C are available in packets of 12, 15 and 21 biscuits respectively. If a shopkeeper wants to buy an equal number of biscuits of each brand, what is the minimum number of packets of each brand he should buy ?

A.

2	12
2	6
3	3
	1

3	15
5	5
	1

3	21
7	7
	1

Prime factorisation of 12 : 2 × 2 × 3

Prime factorisation of 15 : 3 × 5

Prime factorisation of 21 : 3 × 7

∴ L.C.M = 2 × 2 × 3 × 5 × 7 = 420

Thus, minimum number of each brand of biscuit= 420

---

2. The traffic lights at three different road crossings change after every 48 seconds, 72 seconds and 108 seconds respectively. If they change simultaneously at 7 am, at what time will they change simultaneously again ?

A. Let us find LCM of 48, 72 and 108

2	48	72	108
2	24	36	54
2	12	18	27
2	6	9	27
3	3	9	27
3	1	3	9
3	1	1	3
	1	1	1

∴ L.C.M = 2 × 2 × 2 × 2 × 3 × 3 × 3 = 432

So, after 432 seconds, they will change simultaneously

432 seconds = 7 min 12 seconds

Hence, the light change simultaneously at 7:07:12 seconds

Example **Find the least number which when divided by 3, 4 and 5 leaves a remainder 2 in each case.**

We first find the LCM of 3, 4, 5

$\therefore$ LCM of 3, 4 and 5 $= 2 \times 2 \times 3 \times 5$

$= 4 \times 3 \times 5$

$\therefore$ LCM $= 60$

60 is the least number which when divided by the given numbers will leave a remainder 0 in each case.

We need the least number that leaves a remainder 2 in each case.

$\therefore$ The required least number $= 60 + 2 = 62$.

3. Find the least number which when divided by 12, 15, 20 and 45 leaves remainder 11 in each case.

A. We first find out LCM of 12, 15, 20, 45

2	12	15	20	45
2	6	15	10	45
3	3	15	5	45
3	1	5	5	15
5	1	5	5	5
	1	1	1	1

For 180 we get remainder 0 in each case but we required remainder 11 in each case.

So, The required least number = 180 + 11 = 191

LCM of 12, 15, 20 and 45 $= 2 \times 2 \times 3 \times 3 \times 5 = 180$

4. Determine the greatest 3-digit number exactly divisible by 11, 22 and 15.

A. Let us find out LCM of 11, 22 and 15

2	11	22	15
3	11	11	15
5	11	11	5
11	11	11	1
	1	1	1

There fore LCM of 11, 22 and 15 $= 2 \times 3 \times 5 \times 11 = 330$

But we required greatest 3 – digit number

So, we multiply LCM of 11, 22 and15 with 1, 2, 3,...

$\therefore$ $330 \times 2 = 660$; $330 \times 3 = 990$; $330 \times 4 = 1320$ (A digit number which is not required)

There fore, greatest 3 digit number exactly divisible by 11, 22 and 15 is 990.

Objective Questions

1. Choose the correct option.

(1) For 24 = 6 × 4, which of the following statements are true ? **B**

(1) 6 and 4 are divisors of 24. (2) 6 and 4 exactly divide 24.

(3) Only 4 exactly divides 24.

(A) Statements (1) and (3) are true. (B) Statements (1) and (2) are true.

(C) Statements (2) and (3) are true. (D) All statements are true.

(2) Except 1, every number has atleast ________ factors. **B**

(A) 0 (B) 2 (C) 3 (D) 4

(3) 36 has ________ factors. **D**

(A) 6 (B) 7 (C) 8 (D) 9

(4) Which of the following is a perfect number ? **C**

(A) 4 (B) 14 (C) 28 (D) All of them

(5) Which of the following are perfect numbers ? **D**

(A) 4, 6 (B) 6, 8 (C) 6, 24 (D) 6, 28

(6) Which of the following expressions is the prime factorisation of the given number ? **A**

(A) 72 = 2 × 2 × 2 × 3 × 3 (B) 45 = 9 × 5

(C) 60 = 2 × 2 × 15 (C) 54 = 2 × 3 × 9

(7) There are ________ common prime factors of 75, 60 and 105. **A**

(A) 2 (B) 3 (C) 4 (C) 5

(8) Which of the following pairs of numbers are not co-prime ? **A**

(A) 8, 10 (B) 11, 12 (C) 1, 3 (C) 31, 33

(9) Which of the following numbers is divisible by 11 ? **C**

(A) 1011011 (B) 1111111 (C) 22222222 (D) 3333333

(10) LCM of 10, 15 and 20 is ________. **B**

(A) 30 (B) 60 (C) 90 (D) 180

(11) There are ________ prime numbers between 1 and 100. **C**

(A) 21 (B) 23 (C) 25 (D) 26

2. Fill in the blanks.

(1) **1** is a factor of every number.

(2) Every factor of a number is **smaller** than or **equal** to the given number.

(3) **1** is neither a prime nor a composite number.

(4) Every prime number except **2** is odd.

(5) The number **4** is the smallest composite number.

(6) **210** is the smallest number having four different prime factors.

(Hint : For the number to be the smallest the prime factors must also be the smallest. i.e., 2, 3, 5 and 7.)

(7) The **HCF** of two or more given numbers is the highest or greatest of their common factors.

(8) HCF of two consecutive odd numbers is **1** and HCF of two consecutive even numbers is **2**.

(9) Every number is a **multiple** of each of its factors.

(10) A prime number has only **2** factors.

(11) The LCM of two or more numbers is the lowest of their common **multiple**.

(12) 1 has **1** factor.

(13) Two prime numbers whose difference is 2 are called **twin primes**.

3. Mark as '✓' or '✗'.

(1) 6 = 2 × 3, thus 3 and 2 are exact divisors of 6. ✓

(2) Every number is a factor of itself. ✓

(3) Every factor of a number is not an exact divisor of that number. ✗

(4) Number of factors of a given number are finite. ✓

(5) The sum of three odd numbers is even. ✗

(6) Addition or subtraction of any two even number or any two odd numbers is always even. ✓

(7) All even numbers are composite numbers. ✗

(8) The product of two even numbers is always even. ✓

(9) Prime numbers do not have any factors. ✗

(10) All prime numbers are even. ✗

(11) The number 1 is the smallest prime number. ✗

(12) All natural numbers have atleast two factors. ✗

(13) The sum of three even numbers is even. ✓

(14) The smallest prime number is 4. ✗

(15) 7 is a factor of itself. ✓

(16) HCF of two consecutive numbers is 1. ✓

(17) Every number is a multiple of itself. ✓

(18) Two consecutive odd numbers are always divisible by 4. ✗

(19) If a number is divisible by 2 and 3 both, then it must be divisible by 12. ✗

(20) LCM of two co-prime numbers is equal to the product of the numbers. ✓

4. **Match the following :**

(1)

A	B	Answer
(1) 15	(A) Factor of 27	(1) → **D**
(2) 70	(B) Factor of 3	(2) → **C**
(3) 24	(C) Factor of 70	(3) → **E**
(4) 9	(D) Multiple of 5	(4) → **A**
(5) 22	(E) Multiple of 8	(5) → **F**
	(F) Factor of 220	

(2)

Number	Divisibility Rule	Answer
(1) 2	(A) Given number must contain 0 in ones place.	(1) → **B**
(2) 3	(B) Given number may have 0, 2, 4, 6 or 8 in ones place.	(2) → **C**
(3) 10	(C) The sum of the digits must be a multiple of 3.	(3) → **A**
(4) 11	(D) The difference between the sum of the digits at odd places (from the right) and the sum of the digits at even places (from the right) of the number is either 0 or divisible by 11.	(4) → **D**

✦ ❄ ✦ ❄ ✦

4 Basic Geometrical Ideas

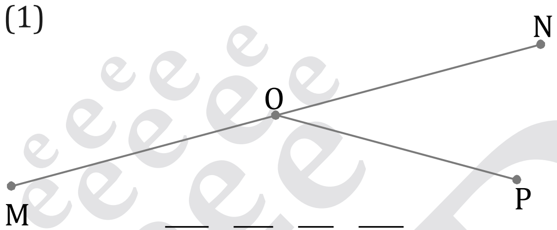
4.2 Points & 4.3 A Line Segment

- **Point**
  - A point determines a location.
  - Points are denoted by capital letters.
- **Line segment**
  - A part of a line that has two endpoints and a fixed length forms a line segment.
  - A line segment corresponds to the shortest distance between two points.

  - The line segment joining points A and B is denoted by $\overline{AB}$ or $\overline{BA}$.

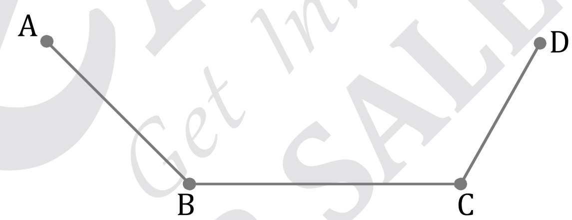
1. What corresponds to the shortest distance between two points ? **line segment**
2. How many endpoints does a line segment have ? **2**
3. **Name the line segments in the given figures.**

(1)



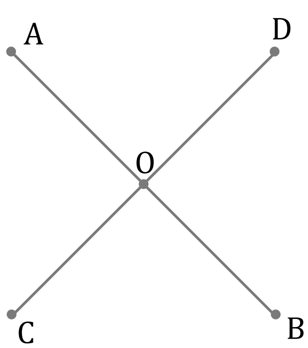
$\overline{MO}$, $\overline{NO}$, $\overline{PO}$, $\overline{MN}$

(2)



$\overline{AB}$, $\overline{BC}$, $\overline{CD}$

4. **Answer the following questions based on the given figure.**



(1) How many line segments are there ?

6

(2) Name all the line segments.

$\overline{OA}$, $\overline{OB}$, $\overline{OC}$, $\overline{OD}$, $\overline{AB}$, $\overline{CD}$

(3) Which line segments have one common endpoint? Name that common endpoint?

$\overline{OA}$, $\overline{OB}$, $\overline{OC}$ and $\overline{OD}$ have a common end point 0.

4.4 A Line

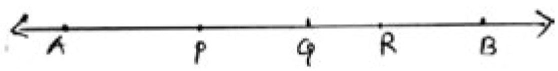
✦ **A line**

- A line is obtained when a line segment is extended on both sides indefinitely.
- A line contains a countless number of points.
- Two points determine a line.

- A line through two points A and B is written as $\overleftrightarrow{AB}$ or $\overleftrightarrow{BA}$ or sometimes by a single small letter like *l*.

---

1. Draw a line $\overleftrightarrow{AB}$ having points P, Q, R lying on it.



---

2. Write thirteen names of the given line.

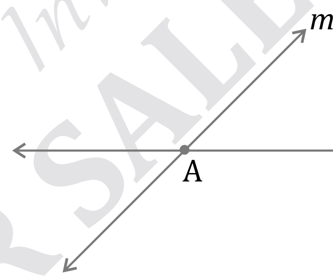
(1) $\overleftrightarrow{PS}$ (2) $\overleftrightarrow{PR}$ (3) $\overleftrightarrow{PQ}$ (4) $\overleftrightarrow{QR}$ (5) $\overleftrightarrow{QS}$ (6) $\overleftrightarrow{RS}$ (7) $\overleftrightarrow{RP}$

(8) $\overleftrightarrow{QP}$ (9) $\overleftrightarrow{SP}$ (10) $\overleftrightarrow{RQ}$ (11) $\overleftrightarrow{SQ}$ (12) $\overleftrightarrow{SR}$ (13) line *m*

4.5 Intersecting Lines

✦ **Intersecting Lines**

- If two lines have one common point, they are called intersecting lines. In other words we can say that two distinct lines meeting at a point are called intersecting lines.
- In the adjoining diagram, the lines *l* and *m* intersect at the point A.



Remember

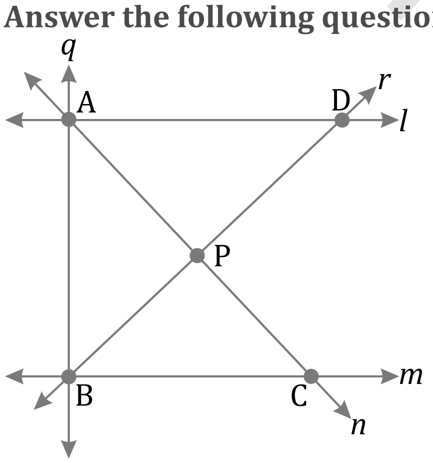
✦ Two lines cannot intersect in more than one point.
✦ More than two lines can intersect in one point.

---

1. **Define :** intersecting lines

A. Two lines that have one common point are called intersecting lines.

2. **Answer the following questions based on the given figure.**



(1) Name the lines intersecting at point D.
line *l* and line *r*

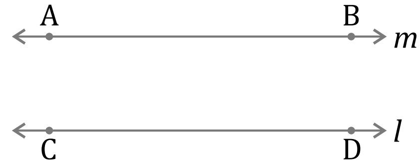
(2) Name the lines intersecting at point B.
line *q* and line *r* and line *m*

(3) Name the lines intersecting at point P.
line *r* and line *n*

(4) At which point do $\overleftrightarrow{AC}$ and line *l* intersect each other ?
At point A

4.6 Parallel Lines

✦ **Parallel Lines**



✤ Two lines in a plane are said to be parallel if they do not meet.

✤ In the adjoining diagram, the lines *l* and *m* are parallel lines.
Symbolically, it is written as $l \parallel m$ or $\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$.

---

1. **Define :** Parallel lines

A. Two lines in a plane are said to be parallel if they do not meet.

2. Give two examples of intersecting lines that you have seen around you.

A. (i) A pair of scissors has two arms that form intersecting lines.
(ii) intersecting lines are formed by two needles passing through a common point in the clock.

4.7 Ray

✦ **Ray**

✤ A ray is a portion of a line. It starts at one point (called starting point or initial point) and goes endlessly in a direction.

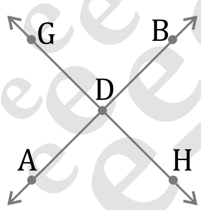
✤ The adjoining diagram shows the ray $\overrightarrow{AB}$.

Here, the point A is the starting point and B is a point on the path of the ray.

✤ A ray contains a countless number of points but it can be extended only in one direction.

---

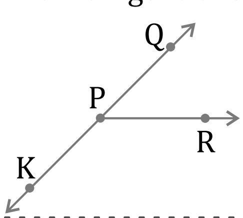
1. Name all the rays given in this figure.



(1) $\overrightarrow{DH}$ (2) $\overrightarrow{DA}$ (3) $\overrightarrow{DB}$ (4) $\overrightarrow{DG}$

---

2. Draw a figure showing ray PQ, PR and PK.



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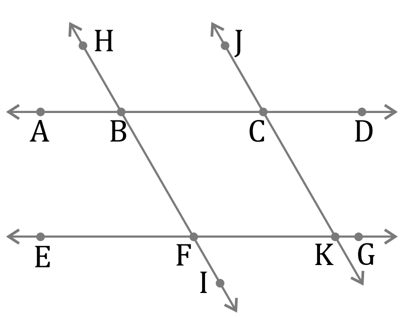
3. **Study the given figure and answer the following questions :**



(1) How many lines are there in the given figure ?
There are 4 lines in the given figure.

(2) How many pairs of parallel lines are there in the given figure ? Name them.
There are 2 pairs of parallel lines in the given figure.
(1) $\overleftrightarrow{HI} \parallel \overleftrightarrow{JK}$ (2) $\overleftrightarrow{AD} \parallel \overleftrightarrow{EG}$

(3) The point 'F' lies on which lines ? $\overleftrightarrow{EG}$ and $\overleftrightarrow{HI}$

(4) Write the names of pairs of intersecting lines.
(1) $\overleftrightarrow{HI}$, $\overleftrightarrow{AD}$, (2) $\overleftrightarrow{HI}$, $\overleftrightarrow{EG}$ (3) $\overleftrightarrow{JK}$, $\overleftrightarrow{AD}$ (4) $\overleftrightarrow{JK}$, $\overleftrightarrow{EG}$

(5) Name all the line segments, the endpoints of which are the points of intersection of two lines.
$\overline{BC}$, $\overline{FK}$, $\overline{BF}$, $\overline{CK}$

(6) Which two rays have 'B' as one of their endpoints ?
$\overrightarrow{BA}$, $\overrightarrow{BH}$

4.8 Curves

- **Curves**
  - Any drawing (straight or non-straight) done without lifting the pencil may be called a curve. In this sense, a line is also a curve.
- **Simple curve**
  - A simple curve is one that does not cross itself.
- **Closed curve**
  - A curve is said to be closed if its ends are joined; otherwise it is said to be open.
  - In a closed curve, there are three parts. (i) interior ('inside') of the curve (ii) boundary ('on') of the curve and (iii) exterior ('outside') of the curve. The interior of a curve together with its boundary is called its 'region'.

---

1. How many parts does a closed curve have ? Which are they ?

A. A closed curve has three parts : (1) Interior of the curve (2) Exterior of the curve (3) Boundary of the curve.

2. **Which of the following curves are open and which are closed curves ?**

(I) (II) (III) (IV) (V) (VI) (VII)

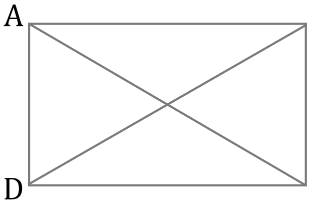
Open curves : I, IV, VI, VII

Closed curves : II, III, V

4.9 Polygons

- **Polygons**
  - A figure is a polygon if it is a simple closed figure made up entirely of line segments.

E.g.

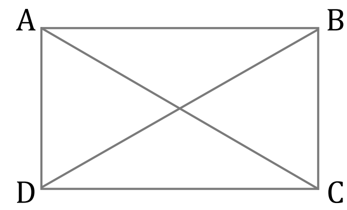


- The line segments are the **sides** of the polygon.
- Any two sides with a common end point are **adjacent sides**.
- The meeting point of a pair of sides is called a **vertex**.

- The end points of the same side are **adjacent vertices**.
- The line segment joining any two non-adjacent vertices is a **diagonal**.

- The adjoining figure shows the polygon ABCD.

  Its sides are : AB, BC, CD and DA



- **Pairs of Adjacent sides :** AB & BC, BC & CD, CD & DA, DA & AB

  Vertices : A, B, C, D

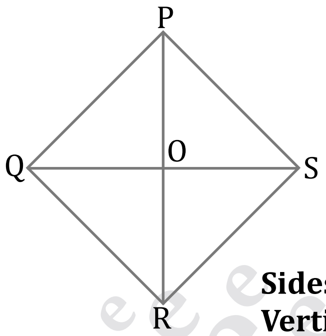
  Pairs of Adjacent vertices : A & B, B & C, C & D, D & A

  Diagonals : AC & BD

Remember

- An open curve made up entirely of line segments is not a polygon.

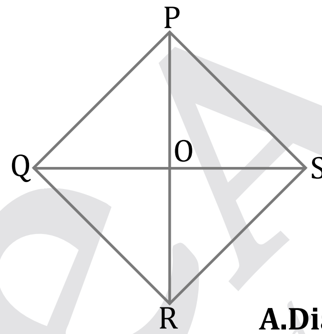
1. Name all the sides and vertices of the given polygon PQRS.



Sides : $\overline{PQ}$, $\overline{QR}$, $\overline{RS}$, $\overline{SP}$

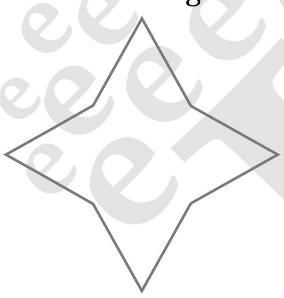
Vertices : P, Q, R, S

2. Write the names of the diagonals in the given polygon.



A.Diagonals : $\overline{PR}$, $\overline{QS}$

3. Consider the given figure and answer the questions :

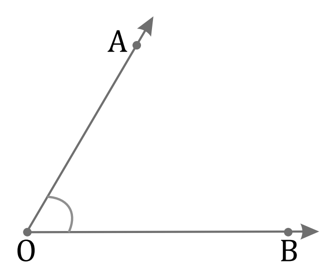


(i) Is it a curve ? **Yes**

(ii) Is it a closed figure ? **Yes**

4.10 Angles

- **Angles**
  - An **angle** is made up of two rays starting from a common initial point.
  - The two rays forming the angle are called the **arms or sides** of the angle.
  - The common initial point is the **vertex** of the angle
  - In the adjoining figure the rays OA and OB form ∠AOB. It can also be named as ∠BOA or just ∠O.
  - An angle leads to three divisions of a region : On the angle, the interior of the angle and the exterior of the angle.

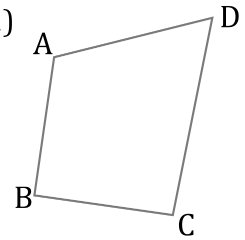


Remember

- While specifying the name of an angle, the vertex is always written as the middle letter.

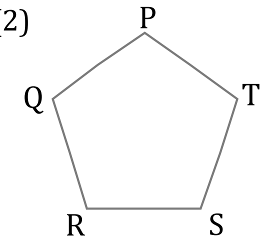
1. Name all the angles in the given polygons.

(1)



∠A, ∠B, ∠C, ∠D,

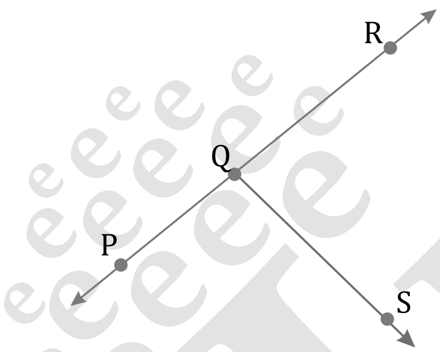
(2)



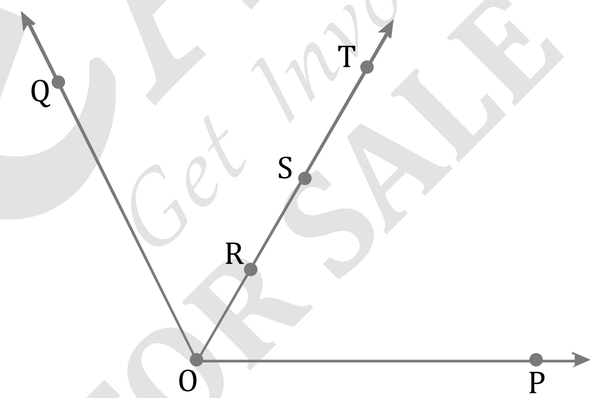
∠P, ∠Q, ∠R, ∠S, ∠T

2. Draw rough diagrams of two angles such that they have

(1) three common points



(2) four common points and one common ray



3. Write answers based on the given figure.

(1) Name of the angle using three points : ∠CAB, ∠BAC

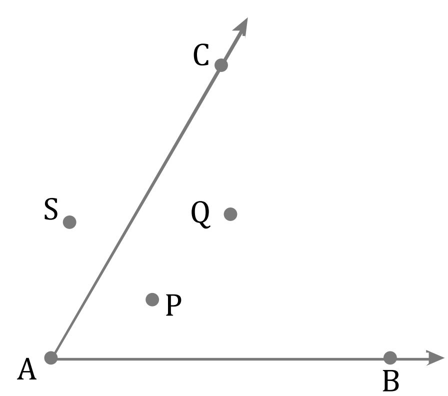
(2) Name of the angle using only one point : ∠A

(3) Vertex of the angle : A

(4) Arms of the angle : $\overrightarrow{AC}, \overrightarrow{AB}$

(5) Points in the interior of the angle : P, Q

(6) Points in the exterior of the angle : S



Objective Questions

1. Choose the correct option.

(1) A line segment has ________ endpoints. **B**

(A) 1 (B) 2 (C) 3 (D) 4

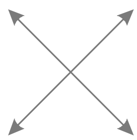
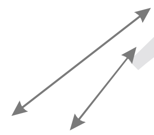
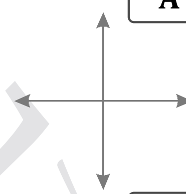
(2) ________ points are enough to fix a line. **B**

(A) 1 (B) 2 (C) 3 (D) infinitely many

(3) Two lines intersect each other at only ________ point. **A**

(A) 1 (B) 2 (C) 3 (D) countless

(4) Which of the following is a pair of parallel lines ? **A**

(A) 
(B) 
(C) 
(D) 

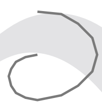
(5) A ray is a part of a ________ . **C**

(A) point (B) line segment (C) line (D) all of these

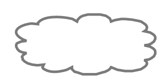
(6) A ray has ________ starting point. **B**

(A) 0 (B) 1 (C) 2 (D) many

(7) Which of the following is a polygon ? **C**

(A) 
(B) 
(C) 
(D) 

(8) Which of the following is a polygon ? **B**

(A) 
(B) 
(C) 
(D) 

(9) An angle divides a plane in ________ regions. **A**

(A) three (B) two (C) one (D) four

(10) Which of the following is a line ? **C**

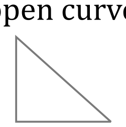
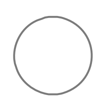
(A) 

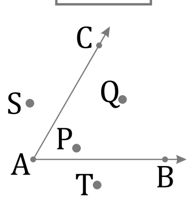
(B) 

(C) 

(D) 

(11) Which of the following is an open curve ? **A**

(A) 
(B) 
(C) 
(D) 

(12) 

Which points are in the interior of $\angle CAB$? **A**

(A) Points P and Q (B) Points S and Q

(C) Points A, B and C (D) Points B and C

2. Fill in the blanks.

(1) A **Point** determines a location.

(2) A **Point** does not have length, width or height.

(3) Generally, points are denoted by **capital** letters.

(4) End points of $\overline{AB}$ are the point **A** and the point **B**.

(5) A line segment having endpoints P and Q is denoted by $\overline{PQ}$ or $\overline{QP}$.

(6) Line AB is denoted by $\overleftrightarrow{AB}$ or $\overleftrightarrow{BA}$.

(7) A line segment is a part of a **line** or **ray**.

(8) A **line** is obtained when a line segment is extended indefinitely on both sides.

(9) A line contains a **countless** number of points.

(10) **two** points are enough to fix a line.

(11) Only **one** line can pass through two points.

(12) Two distinct lines meeting at a point are called **intersecting lines**.

(13) Two lines in a plane which do not meet each other are called **parallel** lines.

(14) Two parallel lines l_1 and l_2 can be written as $l_1 \parallel l_2$.

(15) We denote ray PQ as $\overrightarrow{PQ}$.

(16) The starting point of $\overrightarrow{OA}$ is **O**.

(17) A ray goes endlessly in **One** direction.

(18) Any drawing done without lifting the pencil is called a **curve**.

(19) If a curve does not intersect itself it is called a **simple curve**.

(20) If the ends of the curves are connected, it is called a **closed curve**.

(21) The interior of a curve with its boundary is called its **region**.

(22) A **polygon** is a simple closed figure made up entirely of line segments.

(23) **Line segments** forming a polygon are called its sides.

(24) In a polygon any two sides with a common **endpoint** are adjacent sides.

(25) The meeting point of a pair of sides of a polygon is called its **vertex**.

(26) The endpoints of the same side of a polygon are called the adjacent **vertices**.

(27) The line segments joining any two non-adjacent vertices of a polygon are called the **diagonals** of the polygon.

(28) Two rays starting from a common initial point form an **angle**.

(29) Two rays $\overrightarrow{OA}$ and $\overrightarrow{OB}$ form **∠AOB**.

(30) The two rays forming the angle are called the **arms** or **sides** of the angle.

(31) The angle PQR can be denoted as **∠PQR**.

(32) To name an angle, the **vertex** is always written as the middle letter.

3. Mark as '✓' or '✗'.

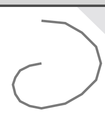
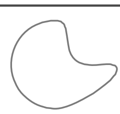
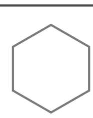
(1)	A point is indicated by a dot on the paper.	✓
(2)	A point is denoted by a capital letter.	✓
(3)	A line has two end points.	✗
(4)	Sometime a line is denoted by letters like *l*, *m*, etc.	✓
(5)	Line $\overleftrightarrow{PQ}$ and $\overleftrightarrow{QP}$ denote the same line.	✓
(6)	Parallel lines do not intersect each other at any point.	✓
(7)	$\overrightarrow{AB}$ and $\overrightarrow{BA}$ are same.	✗
(8)	A simple curve is the one that does not cross itself.	✓

4. Match the following :

(1)

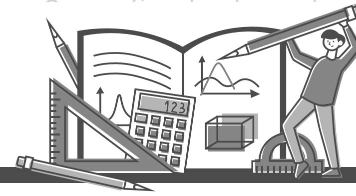
A	B	Answer
(1) Line	(A) It has two end points.	(1) → **C**
(2) Line segment	(B) It has one fixed point and it extends indefinitely in either direction.	(2) → **A**
(3) Point	(C) It extends indefinitely in both directions.	(3) → **D**
(4) Ray	(D) It determines only a location.	(4) → **B**

(2)

A	B	Answer
(1) 	(A) not a simple curve	(1) → **B**
(2) 	(B) open curve	(2) → **D**
(3) 	(C) 6 sided polygon	(3) → **A**
(4) 	(D) closed curve	(4) → **C**

✦ ❄ ✦ ❄ ✦

5 Understanding Elementary Shapes

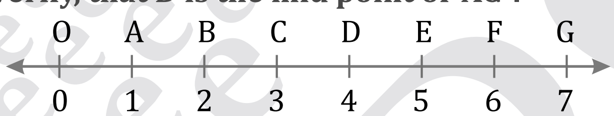


5.2 Measuring Line Segments

- **Length**
  - The distance between the end points of a line segment is its length.
  - A graduated ruler and the divider are useful to compare lengths of line segments.
  - To get correct measure, the eye should be correctly positioned, just vertically above the mark.
- **Comparison of length of line segments**
  - We can compare two line segments, by three methods : (1) Comparison by observation (2) Comparison by tracing (3) Comparison using ruler and divider. Comparison using ruler and divider is easy and gives accurate result.
- **Disadvantage in comparing line segments by mere observation.**
  - There may be chance of error due to improper viewing.

1. Measure the length of line segment MN and write its length. **7 cm**

Example **Verify, that D is the mid point of $\overline{AG}$.**



Here, $\overline{OG} = 7$, $\overline{OA} = 1$, $\overline{OD} = 4$

$\overline{AG} = \overline{OG} - \overline{OA} = 7 - 1 = 6$

$\overline{AD} = \overline{OD} - \overline{OA} = 4 - 1 = 3$

$\overline{DG} = \overline{OG} - \overline{OD} = 7 - 4 = 3$

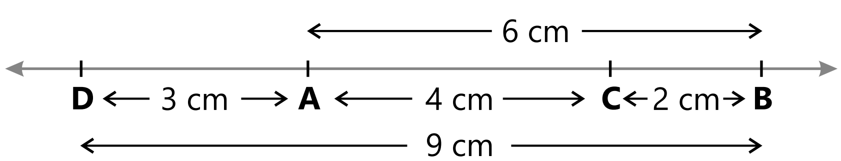
Now, $\overline{AD} = \overline{DG}$ and D lies between A and G.

$\therefore$ A – D – G and $\overline{AD} = \overline{DG} = \dfrac{\overline{AG}}{2}$

Thus, D is the mid-point of $\overline{AG}$.

---

2. Represent points A, B, C and D on a line such that AB = 6 cm, BC = 2 cm, AD = 3 cm and BD = 9 cm and the point C lies between the points A and B. Name all the line segments with their lengths.



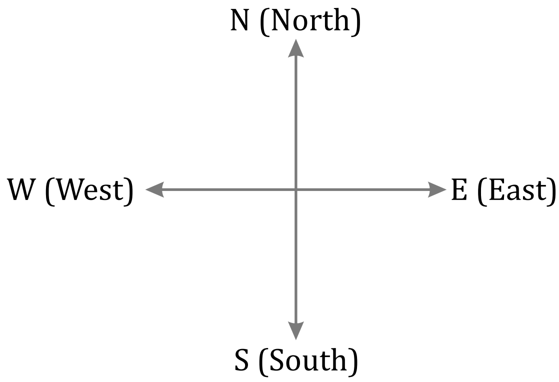
$\overline{DA} = 3$ cm $\quad \overline{AC} = 4$ cm

$\overline{DC} = 7$ cm $\quad \overline{AB} = 6$ cm

$\overline{DB} = 9$ cm $\quad \overline{CB} = 2$ cm

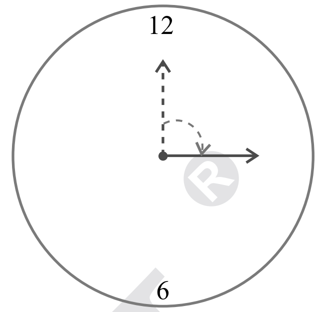
5.3 Angles – 'Right' and 'Straight'

✦ **Directions**



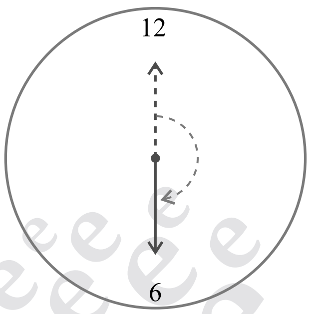
✦ **Right Angle**

Turning clockwise from the north direction to the east direction means turning through a right angle.



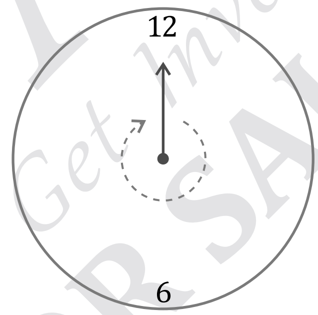
✦ **Straight angle**

The turn from north to south is by two right angles; it is called a straight angle.



✦ **Complete angle**

Turning by two straight angles (or four right angles) in the same direction makes a full turn. This one complete turn is called one revolution. The angle for one revolution is a complete angle.



Remember

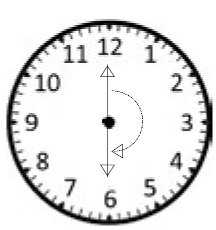
✦ One complete angle has 4 right angles and 2 straight angles.

1. Where will be the minute hand of a clock stop if it starts at 6 and makes 3 right angles ?

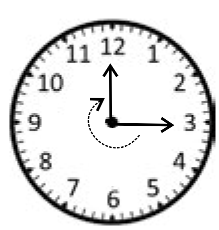
A. It will stop at 3.

2. Draw hands of a clock for each of the following :

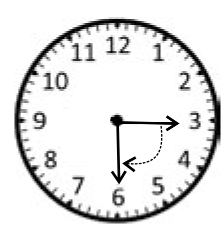
(1) $\frac{1}{2}$ of a revolution



(2) $\frac{3}{4}$ of a revolution



(3) 1 right angle



3. **Find the number of right angles turned and what fraction of a clockwise revolution does the hour hand of a clock turn through when it goes from :**

	Fraction of revolution	No. of Right angles
(1) 6 to 9	$\frac{1}{4}$	1
(2) 2 to 5	$\frac{1}{4}$	1
(3) 7 to 4	$\frac{3}{4}$	3

	Fraction of revolution	No. of Right angles
(4) 12 to 9	$\frac{3}{4}$	3
(5) 2 to 11	$\frac{3}{4}$	3
(6) 8 to 11	$\frac{1}{4}$	1

4. **Where will be the hour hand of a clock, if it**

(1) starts at 3 and makes 1 revolution **at 3**

(2) starts at 3 and makes $\frac{1}{2}$ of a revolution **at 9**

(3) starts at 3 and makes $\frac{3}{4}$ of a revolution, clockwise **at 12**

(4) starts at 7 and turns through 2 straight angles, clockwise **at 7**

5.4 Angles – 'Acute', 'Obtuse' and 'Reflex'

✦ **Acute Angle**

✤ An angle is acute if its measure is smaller than that of a right angle.

✦ **Obtuse Angle**

✤ An angle is obtuse if its measure is greater than that of a right angle and less than a straight angle.

✦ **Reflex Angle**

✤ A reflex angle is larger than a straight angle and smaller than a complete angle.

1. **Define :**

(1) Acute angle : An angle smaller than that of a right angle is called an acute angle.

(2) Obtuse angle : An angle larger than that of a right angle and smaller than that of a straight angle is called an obtuse angle.

(3) Reflex angle : An angle greater than that of a straight angle is called a reflex angle.

5.5 Measuring Angles

✦ **Degree**

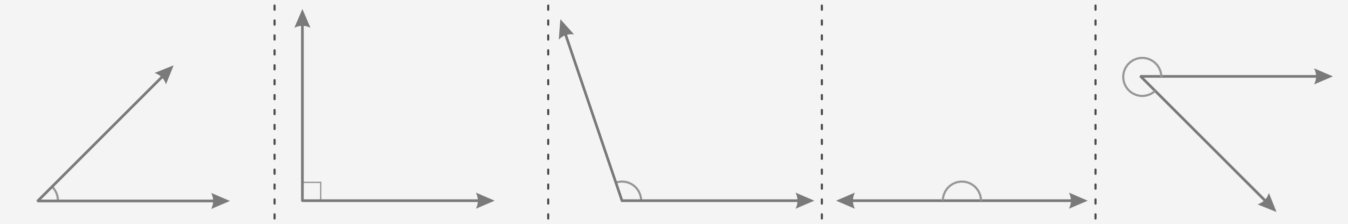
✤ One complete revolution is divided into 360 equal parts. Each part is a degree.

✤ We write 360° to say 'three hundred sixty degrees'.

Note

- ✦ Use a protractor to measure the angles.

Angles



Acute angle	Right angle	Obtuse angle	Straight angle	Reflex angle
0° < angle < 90°	angle = 90°	90° < angle < 180°	angle = 180°	180° < angle < 360°

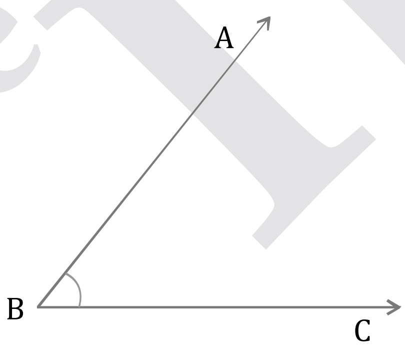
1. Measurements of some angles are given below. Classify them as acute, obtuse, right, straight or reflex angles.

50° | 120° | 218° | 180° | 90° | 45° | 135° | 320° | 95° | 360° | 30° | 201° | 340° | 160°

Acute angle	Right angle	Obtuse angle	Straight angle	Reflex angle
50°, 45°, 30°,	90°	120°, 135°, 95°, 160°	180°	218°, 320°, 201°, 340°

2. Measure the angles given below using a protractor and classify them :

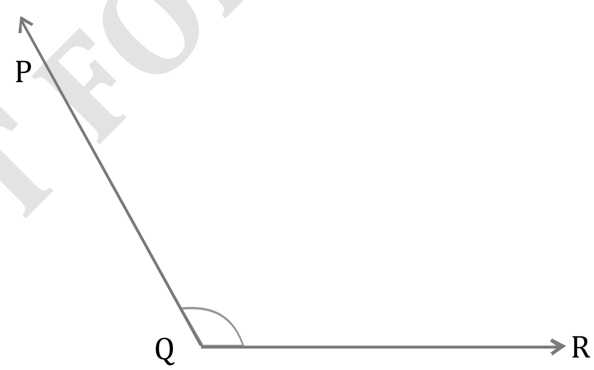
(1)



Measure : **52°**

Type : **acute angle**

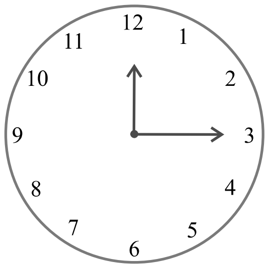
(2)



Measure : **120°**

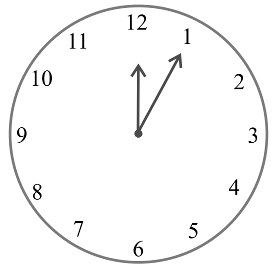
Type : **obtuse angle**

3. **Find the angle measure between the hands of the clock in each figure :**



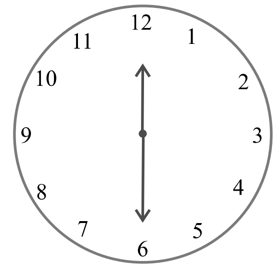
12 : 15 p.m.

(*a*) **90°**



12 : 05 a.m.

(*b*) **30°**



12 : 30 p.m.

(*c*) **180°**

4. What is $\frac{3}{2}$ of a right angle ? **135°**

Example **The wheel of a bicycle has 60 rods. Find the angle between two adjacent rods.**

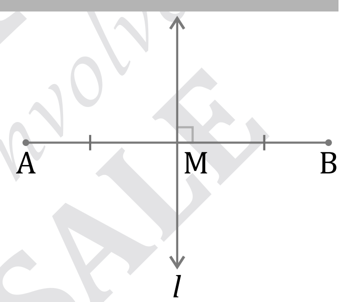
Measure of angle between two adjacent rods $= \frac{360°}{60} = 6°$

5.6 Perpendicular Lines

✦ Two intersecting lines are perpendicular if the angle between them is 90°.

✦ The perpendicular bisector of a line segment is a perpendicular to the line segment that divides it into two equal parts.

✦ In the given figure, the line *l* intersects the line segment AB at M, forming an angle of 90° and AM = MB. Thus, the line *l* is the perpendicular bisector of the line segment AB.



1. **Define :** perpendicular lines **When two lines intersect and the angle between them is a right angle, then the lines are said to be perpendicular.**

2. **Which of the following are models for perpendicular lines ? (Write 'Yes' or 'No'.)**

(1) The adjacent edges of a table top. **Yes**

(2) The lines of a railway track. **No**

(3) Opposite sides of a text-book. **No**

(4) The adjacent sides of a text-book. **Yes**

(5) The line segments forming the letter 'L' **Yes**

(6) The letter 'V' **No**

5.7 Classification of Triangles

✦ **Triangle**

✤ A polygon with three sides is called a triangle.

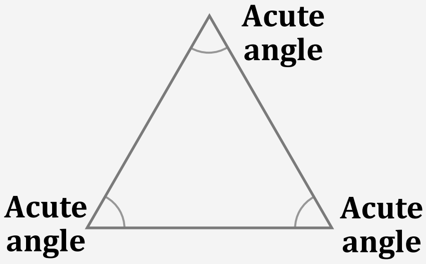
Remember

✦ A triangle is a polygon with the least number of sides.

Classification of Triangles

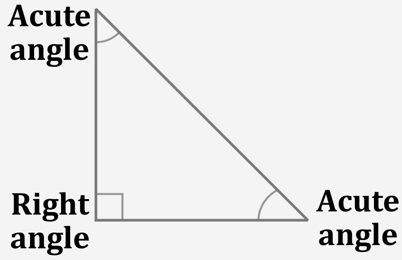
Based on angles

Acute angled triangle



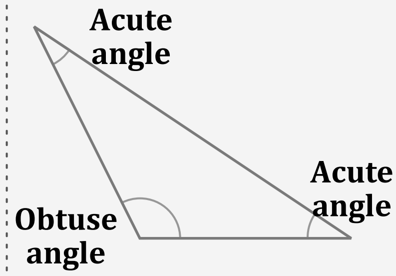
If each angle is less than 90°, then the triangle is called an **acute angled triangle.**

Right angled triangle



If any one angle is a right angle then the triangle is called a **right angled triangle.**

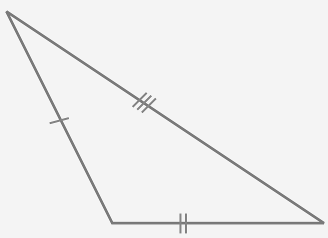
Obtuse angled triangle



If any one angle is greater than 90°, then the triangle is called an **obtuse angled triangle.**

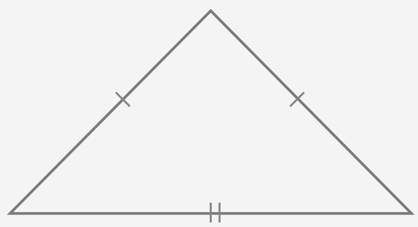
Based on sides

Scalene triangle



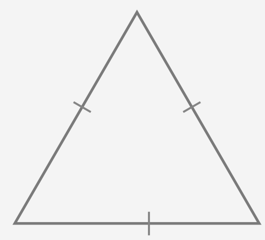
A triangle having all three unequal sides is called a **scalene triangle.**

Isosceles triangle



A triangle having two equal sides is called an **isosceles triangle.**

Equilateral triangle



A triangle having three equal sides is called an **equilateral triangle.**

Note

- ✦ If all the angles in a triangle are equal, then its sides are also equal.
- ✦ If all the sides in a triangle are equal, then its angles are also equal.
- ✦ If two sides of a triangle are equal, then the two angles opposite to the equal sides are also equal.
- ✦ If none of the angles of a triangle are equal then none of the sides are equal.
- ✦ If the three sides of a triangle are unequal then, the three angles are also unequal.

1. On what basis can a triangle be classified ?

A. A triangle can be classified on the basis of sides and angles.

2. How many types of triangles, are there on the basis of sides ? Name them ?

A. There are three types of triangles on the basis of sides, (1) Scalene Triangle, (2) Isosceles Triangle, (3) Equilateral Triangle.

3. Name the types of triangles on the basis of angles ?

A. (1) Acute-angled triangle, (2) Right-angled triangle, (3) Obtuse-angled triangle.

4. **Define :**

(1) Scalene Triangle : **A triangle having all three unequal sides is called a scalene triangle.**

(2) Isosceles Triangle : **A triangle having two equal sides is called an isosceles triangle.**

(3) Equilateral Triangle : **A triangle having three equal sides is called an equilateral triangle.**

(4) Acute angled triangle : **If each angle of a triangle is less than 90°, then the triangle is called an acute-angled triangle.**

(5) Right angled triangle : **If any one angle of a triangle is a right angle then the triangle is called a right-angled triangle**

(6) Obtuse angled triangle : **If any one angle of a triangle is greater than 90°, then the triangle is called an obtuse-angled triangle.**

Example **State the type of triangle having sides of 7.5 cm, 8 cm and 10 cm.**

A triangle having all three unequal sides is called a scalene triangle.

Here, all the three sides are unequal, thus the given triangle is a scalene triangle.

---

5. Name the type of ΔABC with $m\angle B = 90°$ and $AB = BC$.

A. **Right - angled isosceles triangle**

---

6. **Classify the following triangles :**

(1) ΔABC with $AB = BC = AC$ — **Equilateral triangle**

(2) ΔABC with $m\angle B = 90°$ — **Right-angled triangle**

(3) ΔABC with $m\angle A = m\angle B = 40°$ — **Obtuse-angled triangle**

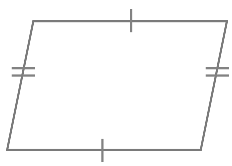
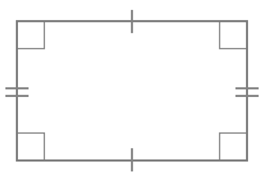
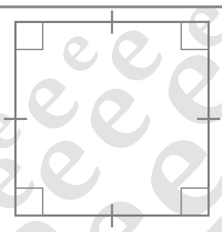
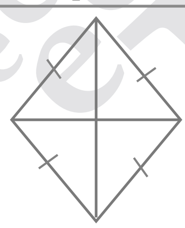
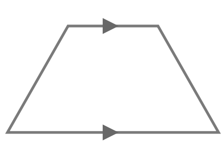
(4) ΔABC with $m\angle A = m\angle B = 60°$ — **Equilateral Triangle**

(5) ΔABC with $\overline{AB} \neq \overline{BC} \neq \overline{CA}$ — **Scalene triangle**

(6) ΔABC with $\overline{AB} \neq \overline{AC}$ but $\overline{BC} = \overline{AC}$ — **Isosceles triangle**

5.8 Quadrilaterals

- **Quadrilaterals**
  - A quadrilateral is a polygon which has four sides.
  - Quadrilaterals are further classified with reference to their properties.

Quadrilateral	Opposite sides		All sides Equal	Opposite Angles Equal	Diagonals	
	Parallel	Equal			Equal	Perpend-icular
 Parallelogram	Yes	Yes	No	Yes	No	No
 Rectangle	Yes	Yes	No	Yes	Yes	No
 Square	Yes	Yes	Yes	Yes	Yes	Yes
 Rhombus	Yes	Yes	Yes	Yes	No	Yes
 Trapezium	Yes	No	No	No	No	No

1. **Define :**

(1) Parallelogram : A quadrilateral in which opposite sides are parallel, equal in length and opposite angles are equal is called a parallelogram.

(2) Rhombus : A quadrilateral in which all sides are of equal length is called a rhombus.

(3) Trapezium : A quadrilateral having one pair of parallel sides is called a trapezium.

2. **Give reasons for the following : (One is done.)**

(1) A square can be thought of as a special rectangle.

A. A square has all the properties of a rectangle, i.e. its opposite sides are parallel and equal and all of its angles are right angles, thus, a square is a special rectangle.

(2) A rectangle can be thought of as a special parallelogram.

A. A rectangle fulfills all the properties of a parallelogram. It has two pairs of parallel opposite sides, thus, a rectangle is a special parallelogram.

(3) A square can be thought of as a special rhombus.

A. A square has all of its four sides equal, thus it is a special rhombus.

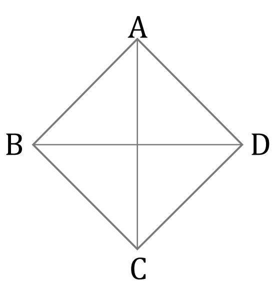
(4) Square, rectangles, parallelograms are all quadrilaterals.

A. Because, these are all four-sided polygons made up of line segments. So, square, rectangles, and parallelogram are all quadrilaterals.

(5) Square is also a parallelogram.

A. Opposite sides of a square are parallel so a square is also a parallelogram.

3. **Look at the given quadrilateral and answer the following :**



(1) Name the sides of the quadrilateral : $\overline{AB}$, $\overline{BC}$, $\overline{CD}$ and $\overline{AD}$

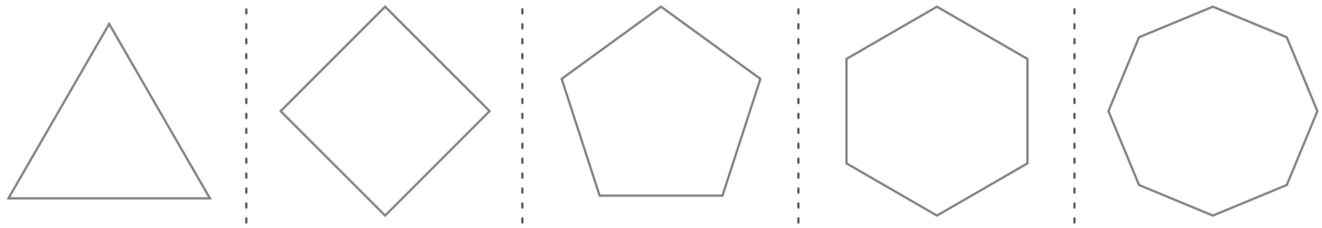
(2) Name the angles of the quadrilateral : $\angle A$, $\angle B$, $\angle C$ and $\angle D$

(3) Name the diagonals : $\overline{AC}$ and $\overline{BD}$

(4) Name the quadrilateral : quadrilateral ABCD

5.9 Polygons

✦ Classification of polygons according to the number of their sides



3 sides	4 sides	5 sides	6 sides	8 sides
Triangle	**Quadrilateral**	**Pentagon**	**Hexagon**	**Octagon**

✦ **Let's understand why triangles instead of quadrilaterals are used to construct a tower.**

✤ A triangle is such a strong shape that it does not change easily by pressing. The construction of buildings requires the shape that doesn't get changed. So, triangles are used instead of quadrilaterals to construct bridges, towers, etc.

1. Name the quadrilateral having eight sides ? Octagon

Objective Questions

1. **Choose the correct option.**

(1) 1 mm = ________ cm. **B**

(A) 0.01 (B) 0.1 (C) 0.001 (D) 1

(2) Which segment is the longest in the given line segments ? **A**

(A) (B) (C) (D)

(3) How many right angles are there in a half of a revolution ? **C**

(A) 0 (B) 1 (C) 2 (D) 3

(4) How much is the angle made by one fourth of a revolution ? **D**

(A) 30° (B) 60° (C) 45° (D) 90°

(5) There is no specific name for ________ of a revolution. **C**

(A) $\frac{1}{4}$ (B) $\frac{1}{2}$ (C) $\frac{3}{4}$ (D) 1

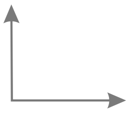
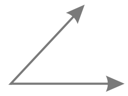
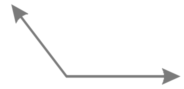
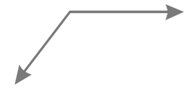
(6) Which direction will you face at if you start facing east and make $\frac{1}{2}$ of a revolution clockwise ? **A**

(A) West (B) North (C) South (D) Can't say

(7) The hour hand of a clock stops at ________ if it starts from 6 and turns through 2 right angles. **C**

(A) 3 (B) 9 (C) 12 (D) 6

(8) Which of the following angles is a right angle ? **A**

(A)  (B)  (C)  (D) 

(9) One complete revolution is divided into ________ degrees. **C**

(A) 45 (B) 30 (C) 360 (D) 120

(10) ________ angle is the largest angle of the given angles. **D**

(A) Acute (B) Obtuse (C) Right (D) Reflex

(11) If the sum of the measures of two equal angles is 90° then what is the measure of each angle ? **B**

(A) 35° (B) 45° (C) 40° (D) 25°

(12) Which of the following statements is true ? If $\overleftrightarrow{AB}$ is the perpendicular bisector of $\overline{MN}$ at point P then ________ . **C**

(A) MP > PN (B) MP < PN (C) MP = PN (D) AP = PB

(13) How many types of triangles are there on the basis of angles ? **C**

(A) One (B) Two (C) Three (D) Four

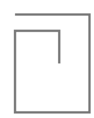
(14) A quadrilateral is a polygon which has ________ sides. **A**

(A) Four (B) Five (C) Six (D) Seven

(15) Which of the following quadrilaterals has equal adjacent sides ? **A**

(A) Rhombus (B) Rectangle (C) Trapezium (D) All of these

(16) Which of the following figures is a polygon ? **B**

(A)  (B)  (C)  (D) 

(17) A triangle having three equal sides is called an ________ . **A**

(A) Equilateral triangle (B) Isosceles triangle (C) Scalene triangle (D) None of these

2. **Fill in the blanks.**

(1) A line segment is a fixed portion of a **line** .

(2) A triangle is made up of **3** line segments.

(3) A quadrilateral is made up of **4** line segments.

(4) The measure of each line segment is a unique number called its **length** .

(5) It is better to use a **divider** than a ruler, while measuring the length of a line segment.

(6) The turn from north to south by two right angles is called a **Straight angle** .

(7) Turning by two straight angles in the same direction make a full turn. This one complete turn is called one **revolution** .

(8) The angle for one revolution is called a **Complete angle** .

(9) The angle for half a revolution is called a **Straight angle**.

(10) The angle for one fourth revolution is called a **right angle**.

(11) You will face **east** if you start facing west and make $\frac{3}{2}$ of a revolution clockwise.

(12) You have turned through $\mathbf{\frac{3}{4}}$ of a revolution if you stand facing east and turn clockwise to face north.

(13) The hour hand of a clock stops at **6** if it starts from 6 and turns through 2 straight angles.

(14) An angle whose measure is less than that of a right angle is called an **acute** angle.

(15) An angle whose measure is greater than that of a right angle and less than that of a straight angle is called an **Obtuse** angle.

(16) An angle larger than a straight angle is called **reflex angle**.

(17) **protractor** is a device to measure angles.

(18) A triangle having three angles of 60° each is called an **acute angled** triangle.

(19) A triangle having one obtuse angle is called an **obtuse angled** triangle.

(20) A triangle having one angle of 90° is called **right angled** triangle.

(21) A triangle having one angle greater than 90° and smaller than **180°** is called an obtuse angled triangle.

(22) The opposite sides of a **parallelogram** are parallel and equal in length.

(23) A quadrilateral having one pair of parallel sides is called **trapezium**.

(24) The opposite sides of a **rhombus** are parallel and all sides are equal in length.

(rhombus, parallelogram)

(25) A **square** is a quadrilateral having all sides equal and all angles of measure 90°.

3. Mark as '✓' or '✗'.

(1) A line segment has only length. ✓

(2) You will face west if you start facing north and make $\frac{1}{2}$ of a revolution anti-clockwise. ✗

(3) You have turned through $\frac{1}{2}$ of a revolution, if you stand facing south and turn clockwise to face West. ✗

(4) A reflex angle is larger than a straight angle. ✓

(5) The angle obtained by adding two acute angles may be acute. ✓

(6) If the line AB is perpendicular to the line CD then it is denoted as $\overleftrightarrow{AB} \perp \overleftrightarrow{CD}$. ✓

(7) A square is also a parallelogram. ✓

(8) A rectangle can be thought of as a special parallelogram. ✓

(9) The diagonals of a square are perpendicular to each other. ✓

(10) The opposite sides of a trapezium are parallel. ✗

(11) The angle between two perpendicular lines is 90°. ✓

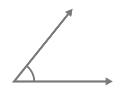
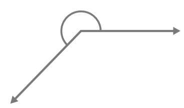
(12) Each angle of a rectangle is a right angle. ✓

(13) The opposite sides of a rectangle are of equal length. ✓

(14) All the sides of a rhombus may not be of equal length. ✗

4. Match the following :

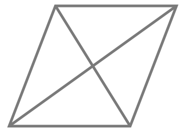
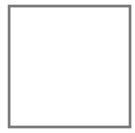
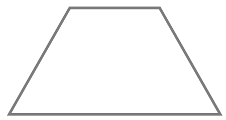
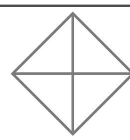
(1)

A	B	Answer
(1) Straight angle	(A) 	(1) → **E**
(2) Reflex angle	(B)	(2) → **C**
(3) Acute angle	(C) 	(3) → **A**
(4) Complete angle	(D) 	(4) → **B**
(5) Obtuse angle	(E) 	(5) → **D**

(2)

A	B	Answer
(1) Acute angled triangle	(A) having one right angle.	(1) → **B**
(2) Obtuse angled triangle	(B) having all angles less than 90°.	(2) → **C**
(3) Right angled triangle	(C) having any one angle greater than 90°.	(3) → **A**

(3)

A	B	Answer
(1) Trapezium	(A) 	(1) $\rightarrow$ **D**
(2) Parallelogram	(B) 	(2) $\rightarrow$ **A**
(3) Rhombus	(C) 	(3) $\rightarrow$ **E**
(4) Square	(D) 	(4) $\rightarrow$ **B**
(5) Rectangle	(E) 	(5) $\rightarrow$ **C**

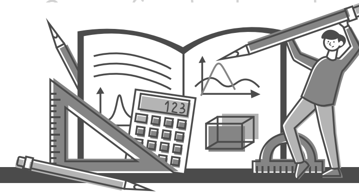
(4)

Sides	Name of polygon	Answer
(1) 3	(A) Quadrilateral	(1) $\rightarrow$ **C**
(2) 4	(B) Hexagon	(2) $\rightarrow$ **A**
(3) 5	(C) Triangle	(3) $\rightarrow$ **D**
(4) 6	(D) Pentagon	(4) $\rightarrow$ **B**
(5) 8	(E) Octagon	(5) $\rightarrow$ **E**

(5)

A	B	Answer
(1) Isosceles triangle	(A) All the three sides are of equal length	(1) $\rightarrow$ **B**
(2) Scalene triangle	(B) Any two of the sides are of equal length	(2) $\rightarrow$ **C**
(3) Equilateral triangle	(C) All the three sides are of unequal length	(3) $\rightarrow$ **A**
(4) Right angled isosceles triangle	(D) One right angle with two sides of equal length	(4) $\rightarrow$ **D**

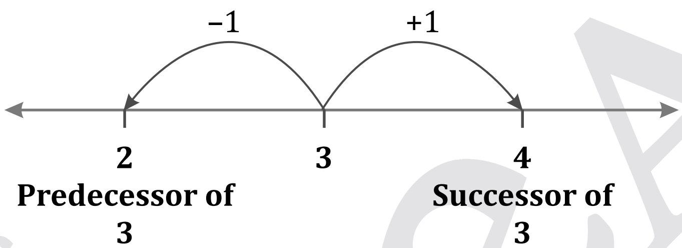
6 Integers



6.1 Introduction

- **Positive Numbers**
  - **Positive numbers** are numbers that are greater than zero. On a number line, they appear to the right of zero.
- **Negative Numbers**
  - **Negative numbers** are numbers that are smaller than zero. A minus sign before the number indicates a negative number. On a number line, negative numbers are represented on the left side of zero.
- One more than the given number is the successor of that number. One less than the given number is the predecessor of that number.

E.g.



1. Write the successor of the following numbers.

(1) 11 – **12**	(4) (−14) – **(−13)**	(7) 19 – **20**
(2) 5 – **6**	(5) 0 – **1**	(8) 99 – **100**
(3) (−3) – **(−2)**	(6) (−9) – **(−8)**	(9) (−1) – **0**

2. Write the predecessor of the following numbers.

(1) 13 – **12**	(4) (−8) – **(−9)**	(7) (−1) – **(−2)**
(2) 25 – **24**	(5) (−35) – **(−36)**	(8) (−49) – **(−50)**
(3) 0 – **(−1)**	(6) 1 – **0**	(9) 48 – **47**

3. Explain and write the following numbers with their appropriate signs :

(1) An increase in weight by 2 kg.

A. + 2 kg **Reason :** An increase in weight is denoted by a '+' sign.

(2) A loss of ₹ 70

A. − ₹ 70 **Reason :** Loss is denoted by a '−' sign.

(3) 500m above sea level

A. + 500 m **Reason :** Above sea level is denoted as '+' sign.

6.2 Integers

✦ **Natural numbers**

1, 2, 3, 4,... are called **natural numbers.**

✦ **Whole numbers**

If we include zero to the collection of natural numbers, we get the collection of **whole numbers**.

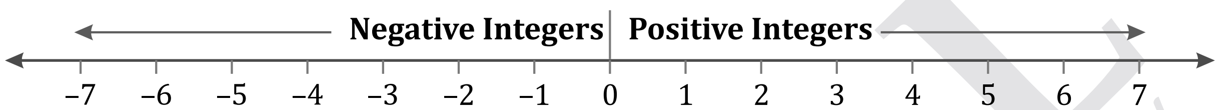
i.e. 0, 1, 2, 3, 4,...

✦ **Integers**

When the whole numbers and the negative numbers are taken together, the new collection of numbers is called **integers**.

i.e. .....–5, –4, – 3, – 2, –1, 0, 1, 2, 3, 4, 5,...,

✦ **Representation of integers on a number line**



✤ Points to the right of zero are positive integers and are marked 1, 2, 3 etc.

✤ Points to the left of zero are negative integers and are marked – 1, – 2, – 3 etc.

✦ **Ordering of integers**

✤ If integers are represented on a number line, then
farther a number from zero on the right, larger is its value.
farther a number from zero on the left, smaller is its value.

✤ Thus, on a number line the number increases as we move to the right and decreases as we move to the left.

✤ Therefore, $-3 < -2$, $-2 < -1$, $-1 < 0$, $0 < 1$, $1 < 2$, $2 < 3$

Remember

✦ Zero is neither a negative nor a positive integer.

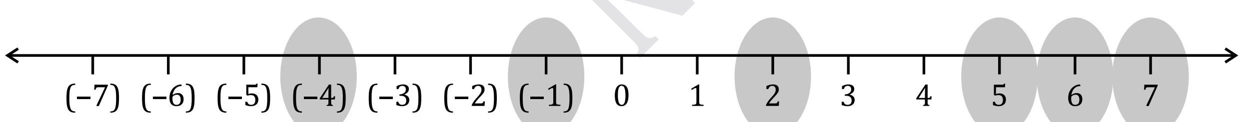
✦ Zero is less than every positive integer and greater than every negative integer.

1. What are integers ?

A. The collection of positive numbers, zero and negative numbers are called integers.

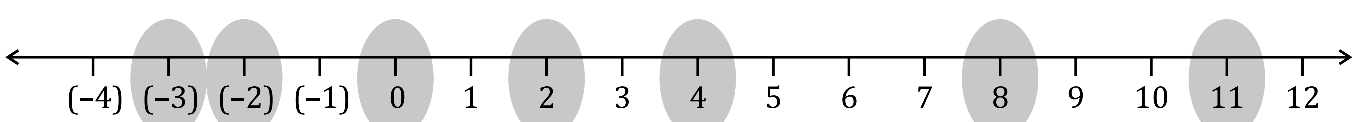
2. Represent (–4), 7, 2, 6, (–1) and 5 on a number line.

A.



3. Represent 0, 8, 11, (–3), 2, 4 and (–2) on a number line.

A.



4. **Fill in the blanks using (< or >) signs.**

(1) 3 __<__ 8
(2) (– 4) __>__ (–7)
(3) 0 __<__ 5
(4) (–15) __<__ 25
(5) 0 __>__ (–5)
(6) 15 __>__ (–25)
(7) 3 __>__ (–3)
(8) (–100) __>__ (–101)
(9) 9 __>__ (–9)

Example **Write the integers between (–7) and (–13) in increasing order.**
(–12), (–11), (–10), (–9), (–8)

5. Arrange the given integers in decreasing order : 7, (–3), 4, (–4), 0, (–10), (–5)

A. 7, 4, 0, (–3), (–4), (–5), (–10)

6. **In each of the following pairs, which number is to the right of the other on the number line ?**

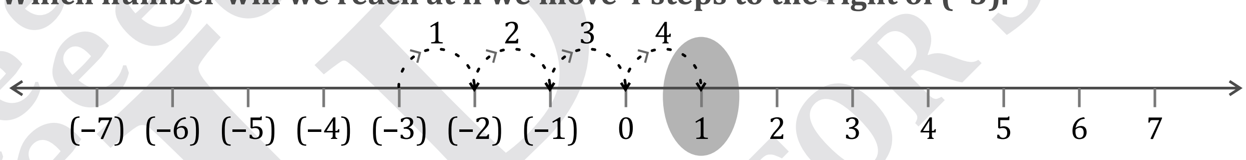
(1) (–11), 10; Number on the right side : **10**
(2) 0, (–1); Number on the right side : **0**
(3) 21, (–105), Number on the right side : **21**
(4) 7, 14; Number on the right side : **14**

7. Write four negative integers greater than (–30). **(–29), (–28), (–27), (–26)**

8. Write four negative integers less than (–20). **(–21), (–22), (–23), (–24)**

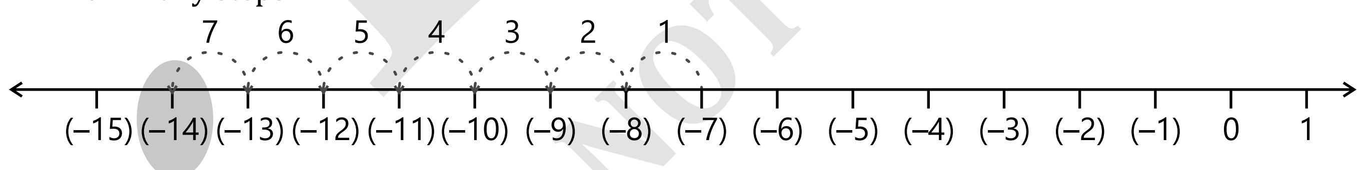
9. **Draw a number line and answer the following :**

Example **Which number will we reach at if we move 4 steps to the right of (–3).**



(1) If we are at (–7) on the number line, in which direction should we move to reach at (–14) ? How many steps ?

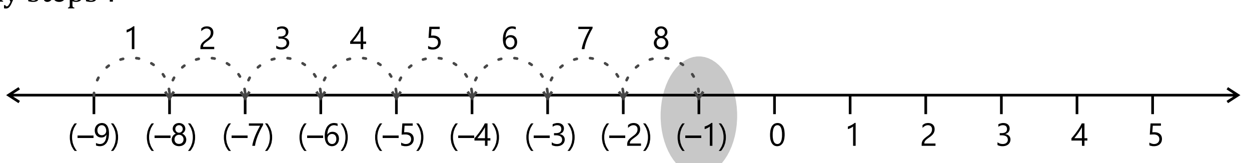
A.



We should move 7 steps to the left of (-7) to reach at (-14).

(2) If we are at (–9) on the number line, in which direction should we move to reach at (–1) ? How many steps ?

A.



We should move 8 steps to the right of (-9) to reach at (-1).

6.3 Addition of Integers

✦ **Opposite Numbers**

A number is called the opposite number of a given number if their sum is zero.

E.g. $5 + (-5) = 0$

Here, 5 and (−5) are opposite numbers.

✦ **In order to add two integers,**

✤ If both of them are of the same sign, then add the integers considering them as whole numbers and put the same sign.

- ✧ When two positive integers are added, the sum is a positive integer.
  e.g. $(+3) + (+2) = +5$
- ✧ When two negative integers are added, the sum is a negative integer.
  e.g. $(-2) + (-1) = (-3)$

✤ If one of them is positive and other is negative, we subtract them as whole numbers by considering the numbers without their sign and then put the sign of the bigger number with the difference obtained. (The bigger integer is decided by ignoring the signs of the integers.)

e.g. $(+4) + (-3) = +1$ and $(-4) + (+3) = (-1)$.

Remember

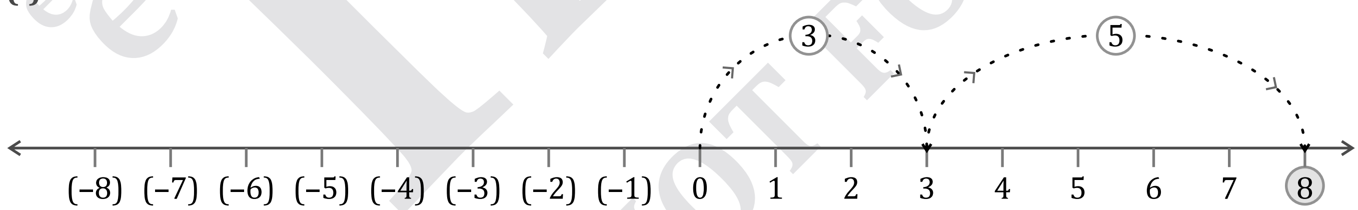
✦ The subtraction of an integer is the same as the addition of its additive inverse.

✦ **Addition of integers on a number line**

Remember

✦ On a number line, for a positive integer we move to the right and for a negative integer we move to the left.

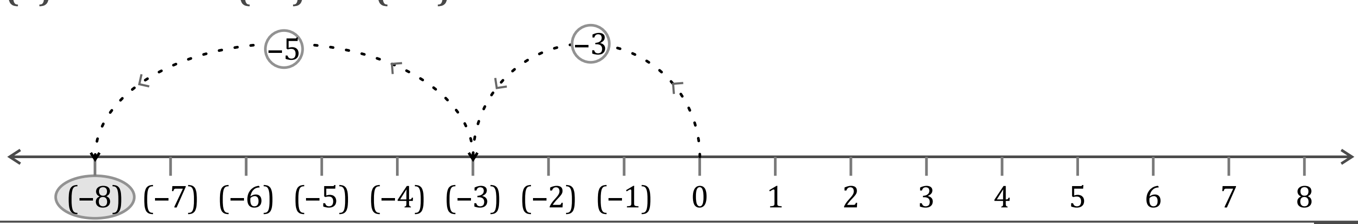
(i) Let us add 3 and 5 on number line.



Step 1 : On the number line, we first move 3 steps to the right from 0 (as 3 is a positive integer) reaching 3.

Step 2 : Now, we move 5 steps to the right of 3 (as 5 is also a positive integer) and reach 8. Thus, $3 + 5 = 8$

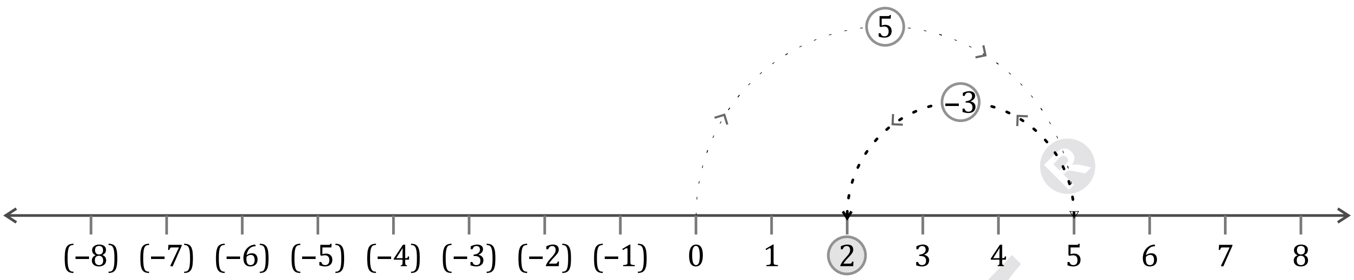
(ii) Let us add (− 3) and (− 5) on the number line.



Step 1 : On the number line, we first move 3 steps to the left of 0 (as (–3) is a negative integer) reaching (– 3).

Step 2 : Now, we move 5 steps to the left of (– 3) (as (– 5) is also a negative integer) and reach (–8). Thus, (– 3) + (– 5) = (– 8).

(iii) Let us add (+ 5) and (– 3) on the number line.

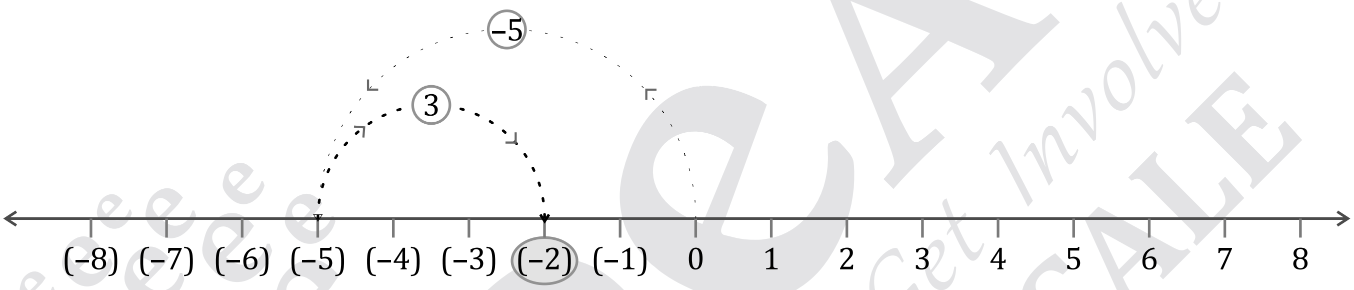


Step 1 : First we move to the right of 0 by 5 steps (as 5 is a positive integer) reaching 5.

Step 2 : Now, we move 3 steps to the left of 5 (as (–3) is a negative integer) reaching 2.

Thus, (+ 5) + (– 3) = 2

(iv) Let us find the sum of (– 5) and (+ 3) on the number line.



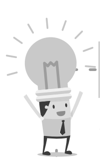
Step 1 : First we move 5 steps to the left of 0 (as (–5) is a negative integer) reaching (– 5).

Step 2 : Now, from (-5) we move 3 steps to the right (as (3) is a positive integer) reaching the point (– 2).

Thus, (– 5) + (+3) = (– 2).

Note

- ✦ In the above additions, even if step 2 is performed before step 1, the sum remains the same.

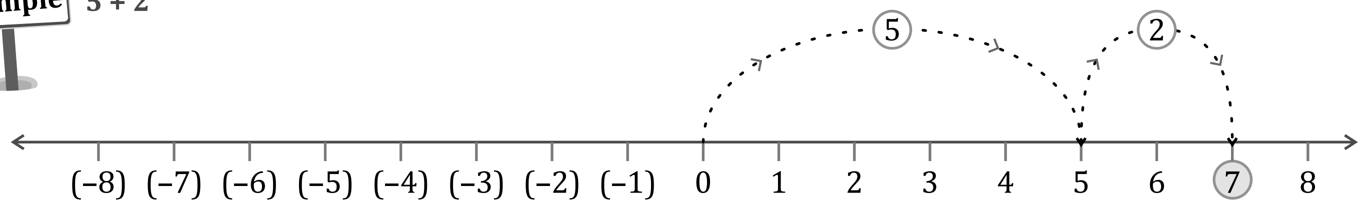


Remember

- ✦ When a positive integer is added to an integer, the resulting integer becomes greater than the given integer.
- ✦ When a negative integer is added to an integer, the resulting integer becomes less than the given integer.

1. Find the solution of the following additions using a number line :

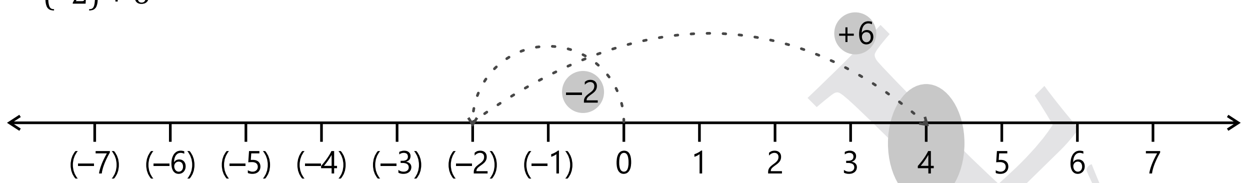
Example 5 + 2



First we move 5 steps to the right of 0, reaching at 5.
Then we move 2 steps to the right of 5 reaching at 7.
∴ 5 + 2 = 7

(1) (−2) + 6

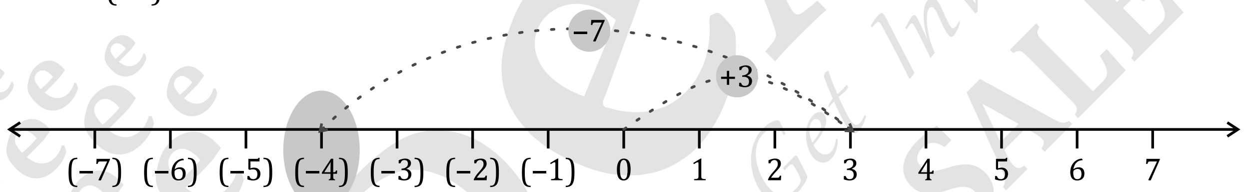
A.



First we move to the left of 0 by 2 steps reaching (−2).
Then we move 6 steps to the right of (−2) reaching 4
∴ (−2) + 6 = 4

(2) 3 + (−7)

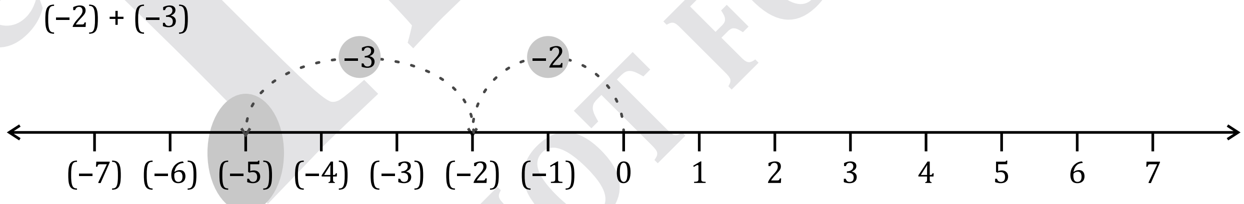
A.



First we move 3 steps to the right of 0 reaching 3.
Then we move 7 steps to the left of 3 reaching (−4).
∴ 3 + (−7) = (−4)

(3) (−2) + (−3)

A.



First we move 2 steps to the left of 0 reaching (−2).
Then we move 3 steps to the left of (−2) reaching (−5).
∴ (−2) + (−3) = (−5)

2. Find the answers of the following additions :

Example **(−2541) + 3003**
= 3003 − 2541
= 462

(1) (−340) + (−236)
= −340 −236
= −576

(2) 456 + (−1783)
= 456 − 1783
= −1327

Example **4567 + (–6234) + 76 + (–345) + 74**

= 4567 + 76 + 74 – 6234 – 345

= 4567 + 76 + 74 – 6579

= 4717 – 6579

= (–1862)

(3) 4 + 12 + (–7) + (–8)

= 4 + 12 + (–7) + (–8)

= 4 + 12 – 7 – 8

= 16 – 7 – 8

= 9 – 8

= 1

6.4 Subtraction of Integers with the help of a Number Line

✦ To subtract an integer from another integer we add the additive inverse of the integer that is being subtracted, to the other integer.

E.g. Subtract (– 3) from (– 7)

(– 7) – (– 3) = (– 7) + (additive inverse of – 3)

= (–7) + 3

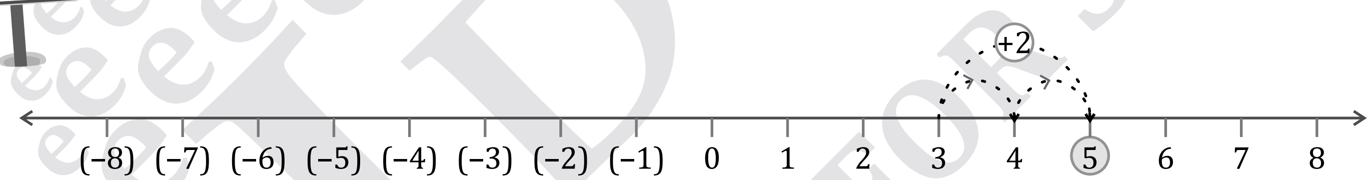
= (– 4)

Note

✦ Subtraction on the number line can be done in the same way as addition, by adding the additive inverse of the integer that is being subtracted.

1. Find the solution of the following subtractions using a number line :

Example 3 – (–2)

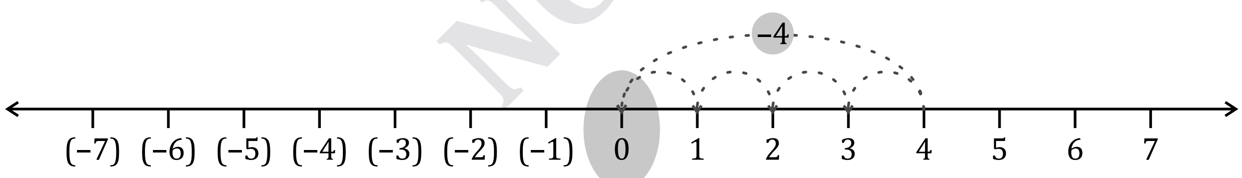


On moving 2 steps to the right of 3, we reach at 5.

∴ 3 – (–2) = 3 + 2 = 5

(1) 4 – 4

A.



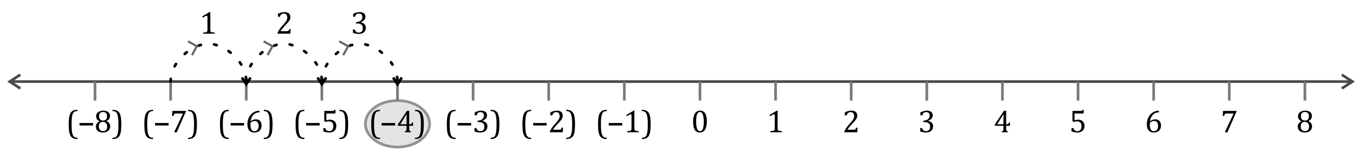
On moving 4 steps to the left of 4, we reach at 0.

∴ + 4 – 4 = 0

2. **Using the number line write the integer which is :**

Example **3 more than (–7)**

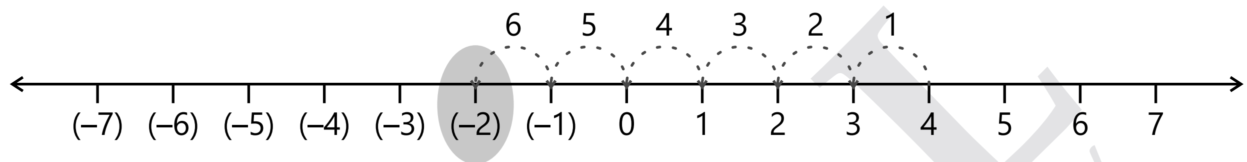
We start from (–7) and proceed 3 steps to the right of (–7), we reach at (–4).



∴ (–7) + 3 = (–4)

(1) 6 less than 4

A. We start from 4 and move to left by 6 steps. We reach at –2.



∴ 4 – 6 = –2

3. **Subtract without using number line :**

Example **12 – 9**

= 12 –9

= 3

(1) (– 985) – (–347)

= – 985 + 347

= – 638

(2) (– 227) – (–135)

= –227 + 135

= –92

Example **[–987 –(–5770) – (–324) – (–85)]**

= (–987) + 5770 + 324 + 85

= 5770 + 324 + 85 – 987

= 6179 + (–987)

= 5192

(3) [756 – (–821) – 234 + (–420)]

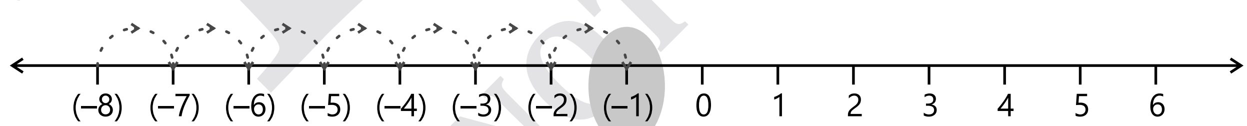
= 756 + 821 – 234 – 420

= 1577 – 654

= 923

4. Solve using a number line. (– 8) – (– 7).

A.



We start from (–8) and move 7 steps to its right. We reach at (–1).

∴ –8 – (–7) = –8 + 7 = – 1

5. **Fill in the blanks using <, > or =**

(1) (–3) + (–5) ____<____ (–3) – (–5)

(2) (–31) – (–10) ____>____ (–31) + (–11)

(3) 45 – (–5) ____<____ 57 + (–3)

(4) (–35) – (–42) ____>____ (–42) – (–35)

Objective Questions

1. Choose the correct option.

(1) The ________ of an integer is the same as the addition of its additive inverse. **C**

(A) multiplication (B) division (C) subtraction (D) addition

(2) Successor of (−5) is ________ . **B**

(A) (−6) (B) (−4) (C) (−7) (D) (−3)

(3) Predecessor of (−10) is ________ . **B**

(A) (−9) (B) (−11) (C) (−8) (D) (−12)

(4) Sum of (−2) and 6 is ________. **C**

(A) (−4) (B) 2 (C) 4 (D) (−6)

(5) Subtracting 4 from (−2) gives ________. **D**

(A) (−5) (B) 6 (C) (−5) (D) (−6)

(6) (−30) + ________ = 0. **B**

(A) (−30) (B) 30 (C) 60 (D) 15

2. Fill in the blanks.

(1) The numbers with a negative sign are less than zero. These numbers are called **negative** numbers.

(2) On a number line, a movement to the right is made if the number by which we have to move is **positive**.

(3) On a number line if a movement of only 1 to the right of a number is made we get the, **successor** of the number.

(4) On a number line if a movement of only 1 is made to the left of a number we get the **predecessor** of the number.

(5) When we include zero in the collection of natural numbers we get a new collection of numbers known as **whole** numbers.

(6) (−1), (−2), (−3).... are said to be **negative** integers.

(7) Every **positive** integer is larger than every **negative** integer.

(8) Zero is less than every **positive** integer.

(9) Zero is larger than every **negative** integer.

(10) When two positive integers are added, we get a **positive** integer.

(11) When two negative integers are added, we get a **negative** integer.

(12) (−7) + **7** = 0

(13) 12 + (−12) + **0** = 0

(14) 19 + **(−19)** = 0

(15) (−5) + **23** = 18

(16) **15** (− 25) = (−10)

(17) (−13) − **(−13)** = 0

3. **Mark as '✓' or '✗'.**

(1) 0, 1, 2, 3, 4, ... etc. are whole numbers. ✓

(2) All negative integers are greater than zero. ✗

(3) Farther a number from zero on the right, larger is its value. ✓

(4) (−78) is greater than (−77). ✗

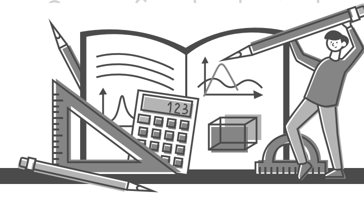
(5) Zero is neither a negative integer nor a positive integer. ✓

(6) On moving two steps to the left of (−7), we get (− 5). ✗

4. **Match the following :**

(1)

A	B	Answer
(1) (− 120) + (− 40)	(A) 160	(1) → **B**
(2) (− 120) − (− 40)	(B) (− 160)	(2) → **C**
(3) (120) + (− 40)	(C) (− 80)	(3) → **D**
(4) (120) − (− 40)	(D) 80	(4) → **A**

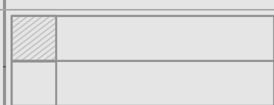


7 Fractions

7.2 A Fraction

- A **fraction** is a number representing a part of a whole.
- When expressing a situation of counting parts to write a fraction, it must be ensured that all parts are **equal**.
- A fraction is written in the form of $\frac{\text{numerator}}{\text{denominator}}$.
  - $\frac{5}{7}$ is a fraction. It is read as "**five- sevenths**". Here, 7 is the number of equal parts into which the whole has been divided and 5 is the number of equal parts which have been taken out.
  - Here 5 is called the **numerator** and 7 is called the **denominator**.

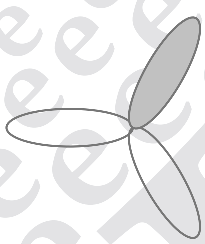
Note



Here, the shaded portion doesn't represent $\frac{1}{4}$ as the figure is not divided into equal parts.

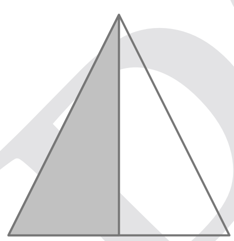
1. Write the fraction representing the shaded portion :

(1)



$\frac{1}{3}$

(2)

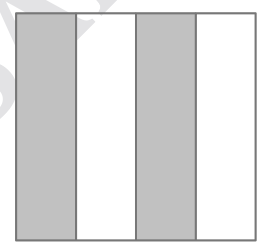


$\frac{1}{2}$

(3)

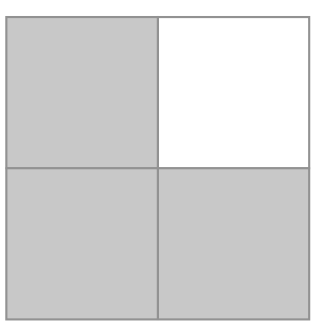
$\frac{13}{20}$

(4)

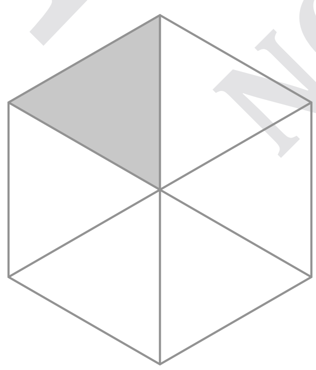


$\frac{2}{4}$

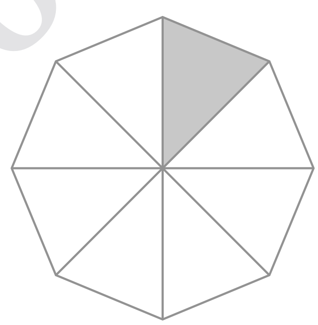
2. Colour the part according to the given fraction :



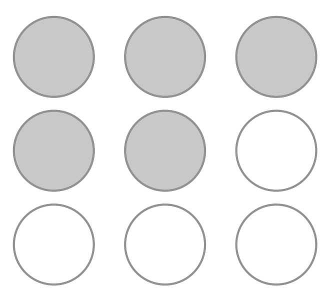
$\frac{3}{4}$



$\frac{1}{6}$



$\frac{1}{8}$



$\frac{5}{9}$

Example **Write the natural numbers from 2 to 12. What fraction of them are composite numbers ?**

Natural numbers from 2 to 12 are 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

Composite numbers from 2 to 12 are **4, 6, 8, 9, 10, 12**

Fraction of composite numbers = $\mathbf{\frac{6}{11}}$

Example **What fraction of an hour is 54 minutes ?**

$$\frac{54 \text{ minutes}}{1 \text{ hour}} = \frac{54 \text{ minutes}}{60 \text{ minutes}} \quad (\because \ 1 \text{ hour} = 60 \text{ minutes})$$

$$= \frac{54}{60}$$

$$= \frac{9 \times 6}{10 \times 6}$$

$$= \frac{9}{10}$$

$\therefore$ **54 minutes is $\frac{9}{10}$ of 1 hour.**

---

3. **Find the fraction :**

(1) What fraction of a day is 8 hours ?

$$= \frac{8}{24}$$

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

(2) What fraction of a foot is 7 inches ?

1 foot = 12 inch

$$\frac{7 \text{ inch}}{1 \text{ foot}} = \frac{7 \text{ inch}}{12 \text{ inch}}$$

$$= \frac{7}{12}$$

---

4. Salman answers 5 questions out of a total of 15 questions. What fraction of questions does he answer ?

A. Number of questions Salman answer = 5

Number of total questions = 15

$\therefore$ Fraction of questions Salman answers = $\frac{5}{15} = \frac{5 \times 1}{5 \times 3} = \frac{1}{3}$

7.3 Fraction on the Number Line

✦ To show **fractions** on the **number line**, follow the steps given below :

E.g. Let us show $\frac{2}{3}$ on a number line.

Step 1 Draw a number line of a suitable length.

Step 2 Mark points 0 and 1 on the number line.

Mark points 0 and 1.

Step 3 Divide the gap between 0 and 1 into equal parts. The number of parts must be equal to the denominator of the fraction.

Divide the gap between 0 and 1 into 3 equal parts. (Because the denominator is 3)

Step 4 Starting from 0, count forward the number of parts shown by the numerator. Mark the point ⊗ on the line.

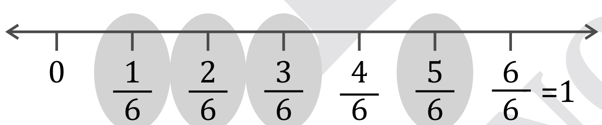
Starting from 0, count 2 steps (Because the numerator is 2) forward and mark the point as $\frac{2}{3}$

Note

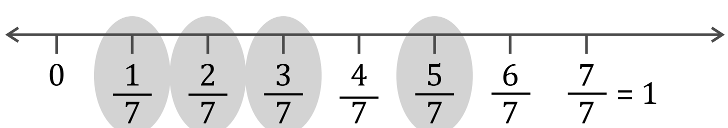
✦ $\frac{2}{3}$ shows two parts taken from 3 equal parts.

1. Locate the given fractions on a number line :

Example $\frac{1}{6}, \frac{3}{6}, \frac{5}{6}, \frac{2}{6}$



(1) $\frac{1}{7}, \frac{2}{7}, \frac{3}{7}, \frac{5}{7}$



2. **Into how many equal parts does the gap between 0 and 1 have to be divided to show the following fractions on the number line ?**

(1) $\frac{4}{9}$: **9** (2) $\frac{3}{8}$: **8** (3) $\frac{8}{13}$: **13** (4) $\frac{2}{5}$: **5** (5) $\frac{4}{7}$: **7**

7.4 Proper Fractions

- A fraction, whose numerator is less than the denominator is called a **proper fraction**.

  E.g. : $\frac{5}{7}$

---

1. **Give a proper fraction :**

(1) Whose numerator is 3 and denominator is 5. $\frac{3}{5}$

(2) Whose denominator is 9 and numerator is 7. $\frac{7}{9}$

(3) Whose numerator and denominator add upto 11. How many fractions of this kind can you make ?
$\frac{1}{10}, \frac{2}{9}, \frac{3}{8}, \frac{4}{7}, \frac{5}{6}$

---

2. **Fill in the blanks using <, > or =.**

(1) $\frac{1}{3}$ **<** 1 (2) $\frac{3}{7}$ **<** 1 (3) 1 **>** $\frac{7}{8}$ (4) $\frac{5}{5}$ **=** 1 (5) $\frac{2007}{2007}$ **=** 1

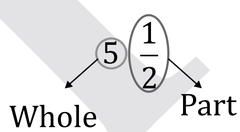
7.5 Improper and Mixed Fractions

- **Improper Fraction :**
  - A fraction, whose numerator is greater than the denominator is called an **improper fraction**.

    E.g : $\frac{7}{5}$

- **Mixed Fraction :**
  - An improper fraction can be written as a combination of a whole and a part, and such fraction then called a **mixed fraction**.

    E.g : $5\frac{1}{2}$



  - We can express an improper fraction as a mixed fraction by dividing the numerator by denominator to obtain the quotient and the remainder. Then the mixed fraction will be written as

    $\text{Quotient}\frac{\text{Remainder}}{\text{Divisor}}$

    We can express a mixed fraction as an improper fraction as $\frac{(\text{whole} \times \text{denominator}) + \text{Numerator}}{\text{Denominator}}$

Remember :

- An improper fraction is greater than 1 thus, it lies to the right of 1 on the number line while a proper fractions lies between 0 and 1 as it is smaller than 1.

Note:

- In the mixed fraction $p\frac{q}{r}$, p is the whole part and $\frac{q}{r}$ is the fractional part.
- We cannot express proper fractions as mixed fractions.
- The mixed fraction $p\frac{q}{r}$ can be expressed as improper fraction as $\frac{pr+q}{r}$.
- The grip-sizes of tennis racquets are often in mixed numbers. For example one size is $3\frac{7}{8}$ inches and $4\frac{3}{8}$ inches is another.

1. Classify the following as proper and improper fractions :

$\frac{2}{3}, \frac{5}{6}, \frac{31}{13}, \frac{10}{17}, \frac{8}{3}, \frac{41}{11}, \frac{4}{9}, \frac{5}{7}, \frac{15}{5}, \frac{5}{16}, \frac{22}{44}, \frac{43}{21}, \frac{3}{5}, \frac{7}{9}, \frac{17}{7}$

(i) Proper Fractions : $\frac{2}{3}, \frac{5}{6}, \frac{10}{17}, \frac{4}{9}, \frac{5}{7}, \frac{5}{16}, \frac{22}{44}, \frac{3}{5}, \frac{7}{9}$

(ii) Improper Fractions : $\frac{31}{13}, \frac{8}{3}, \frac{41}{11}, \frac{15}{5}, \frac{43}{21}, \frac{17}{7}$

2. Express the following as mixed fractions :

Example $\frac{179}{11}$

```
     16
11 | 179
   | -11
      69
     -66
      03
```

So, we get 16 as the whole number part and $\frac{3}{11}$ as the fractional part. $\therefore \frac{179}{11} = 16\frac{3}{11}$

(1) $\frac{70}{9}$

```
    7
9 | 70
  | 63
  | 07
```

So, we get 7 as the whole number part and $\frac{7}{9}$, as the fractional part.

$\therefore \frac{70}{9} = 7\frac{7}{9}$

(2) $\frac{29}{5}$

```
    5
5 | 29
  | -25
     4
```

So, we get 5 as the whole number part and $\frac{4}{5}$ as 9 the fractional part. $\therefore \frac{29}{9} = 5\frac{4}{5}$

(3) $\frac{87}{11}$

```
     7
11 | 87
   | 77
   | 10
```

$\therefore \frac{87}{11} = 7\frac{10}{11}$

3. **Express the following mixed fractions as improper fractions :**

Example $3\frac{5}{8}$

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

$$= \frac{24 + 5}{8}$$

$$= \frac{29}{8}$$

(1) $3\frac{13}{28}$

$$= \frac{28 \times 3 + 13}{28}$$

$$= \frac{84 + 13}{28}$$

$$= \frac{97}{28}$$

(2) $12\frac{5}{7}$

$$= \frac{7 \times 12 + 5}{7}$$

$$= \frac{84 + 5}{7}$$

$$= \frac{89}{7}$$

(3) $7\frac{17}{21}$

$$= \frac{21 \times 7 + 17}{21}$$

$$= \frac{147 + 17}{21}$$

$$= \frac{164}{21}$$

7.6 Equivalent Fractions

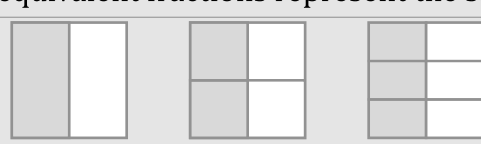
- Fractions that have different numerators and denominators but represent the same value are called **equivalent fractions.**

E.g. $\frac{1}{2}, \frac{2}{4}, \frac{3}{6}$... are equivalent fractions.

Note:

- The equivalent fractions represent the same part of a whole.

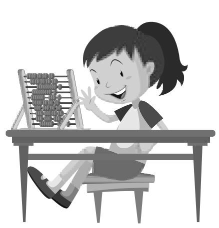
E.g.



$\frac{1}{2}$ $\frac{2}{4}$ $\frac{3}{6}$

- To find an equivalent fraction of a given fraction, we may multiply both the numerator and the denominator of the given fraction by the same number.

E.g. Equivalent fractions of $\frac{1}{3}$ are : $\frac{1 \times 2}{2 \times 2} = \frac{2}{4}, \frac{1 \times 3}{2 \times 3} = \frac{3}{6}, \frac{1 \times 4}{3 \times 4} = \frac{4}{12}, \frac{1 \times 5}{3 \times 5} = \frac{5}{15}$ etc.



Note:

- To find an equivalent fraction, we may divide both the numerator and the denominator by the same number.
  One equivalent fraction of $\frac{12}{15}$ is $\frac{12 \div 3}{15 \div 3} = \frac{4}{5}$

- **Cross products :**

  For any two equivalent fractions, the product of the numerator of the first and the denominator of the second is equal to the product of denominator of the first and the numerator of the second. These two products are called **cross products.**

- Thus, if $\frac{a}{b}$ and $\frac{c}{d}$ are two equivalent fractions then $ad = cb$.

---

1. Find five equivalent fractions of each of the following :

Example $\frac{3}{4}$

i. $\frac{3 \times 4}{4 \times 4} = \frac{12}{16}$ ii. $\frac{3 \times 8}{4 \times 8} = \frac{24}{32}$ iii. $\frac{3 \times 16}{4 \times 16} = \frac{48}{64}$ iv. $\frac{3 \times 32}{4 \times 32} = \frac{96}{128}$ v. $\frac{3 \times 5}{4 \times 5} = \frac{15}{20}$

---

(1) $\frac{36}{42}$

[1] $\frac{36 \times 2}{42 \times 2} = \frac{72}{84}$ [2] $\frac{36 \times 3}{42 \times 3} = \frac{108}{126}$ [3] $\frac{36 \times 5}{42 \times 5} = \frac{180}{210}$ [4] $\frac{36 \times 10}{42 \times 10} = \frac{360}{420}$ [5] $\frac{36 \times 20}{42 \times 20} = \frac{720}{840}$

---

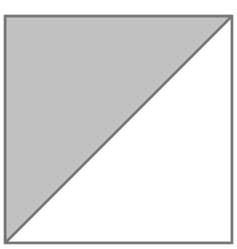
(2) $\frac{60}{90}$

[1] $\frac{60 \times 2}{90 \times 2} = \frac{120}{180}$ [2] $\frac{60 \times 5}{90 \times 5} = \frac{300}{450}$ [3] $\frac{60 \times 7}{90 \times 7} = \frac{420}{630}$ [4] $\frac{60 \times 9}{90 \times 9} = \frac{540}{810}$ [5] $\frac{60 \times 10}{90 \times 10} = \frac{600}{900}$

---

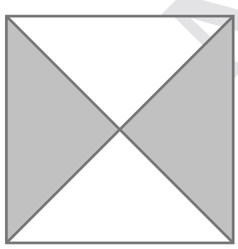
2. Identify the fractions in each. Are these fractions equivalent ?

(1) (a)



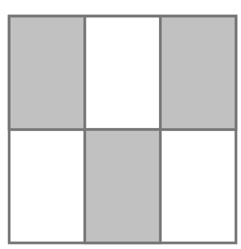
$\frac{1}{2}$

(b)



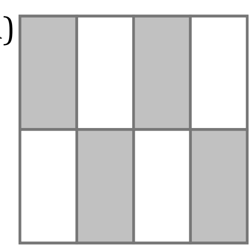
$\frac{2}{4}$

(c)



$\frac{3}{6}$

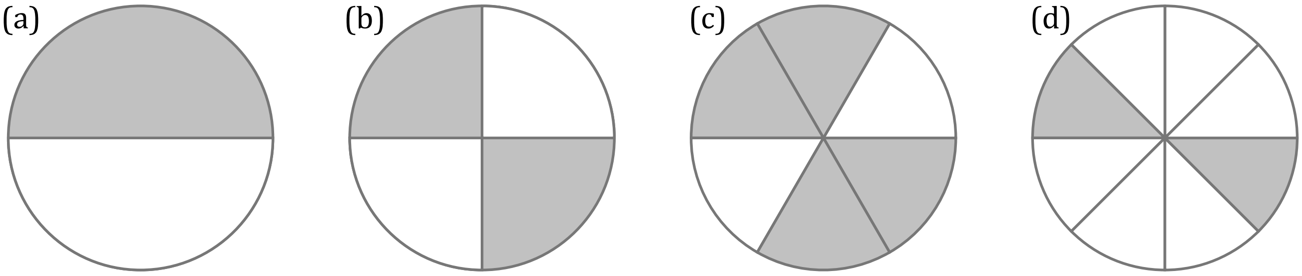
(d)



$\frac{4}{8}$

Here, $\frac{1}{2}, \frac{2}{4}, \frac{3}{6}$ and $\frac{4}{6}$ are equivalent fractions

(2) (a) (b) (c) (d)



(a) $\frac{1}{2}$ (b) $\frac{2}{4}$ (c) $\frac{4}{6}$ (d) $\frac{2}{8}$

Here, $\frac{1}{2} = \frac{2}{4} + \frac{4}{6} + \frac{2}{6}$ so, these are not equivalent fraction.

Example **Find the equivalent fraction of $\frac{3}{5}$ having denominator 15.**

We have, $\frac{3}{5} = \frac{\square}{15}$

For this, we should have,

$15 \times 3 = 5 \times \square$

$\therefore \square = \frac{15 \times 3}{5}$

$\therefore \square = 9$

$\therefore \frac{3}{5} = \frac{\boxed{9}}{15}$

3. Find the equivalent fraction of $\frac{24}{36}$ having numerator 6.

We have, $\frac{24}{36} = \frac{6}{\square}$

For this, we should have,

$24 \times \square = 36 \times 6$

$\therefore \square = \frac{36 \times 6}{24}$

$\therefore \square = 9$

$\therefore \frac{24}{36} = \frac{6}{\boxed{9}}$

---

4. Check whether the given fractions are equivalent :

Example $\frac{3}{9}$ **and** $\frac{27}{81}$

$\frac{3}{9} = \frac{3 \times 1}{3 \times 3} = \frac{1}{3}$

$\frac{27}{81} = \frac{27 \times 1}{27 \times 3} = \frac{1}{3}$

$\therefore$ **Thus, $\frac{3}{9}$ and $\frac{27}{81}$ are equivalent fractions.**

(1) $\frac{9}{12}$ and $\frac{72}{156}$

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

$\frac{72}{156} = \frac{12 \times 6}{12 \times 13} = \frac{6}{13}$

$\frac{3}{4} \neq \frac{6}{13}$

Thus, $\frac{9}{12}$ and $\frac{72}{156}$ are not equivalent fractions.

Example $\frac{12}{19}$ **and** $\frac{76}{114}$

$\frac{12}{19} = \frac{12 \times 1}{19 \times 1} = \frac{12}{19}$

$\frac{76}{114} = \frac{19 \times 4}{19 \times 6} = \frac{4}{6} = \frac{2 \times 2}{2 \times 3} = \frac{2}{3}$

$\frac{12}{19} \neq \frac{2}{3}$

$\therefore$ **Thus,** $\frac{12}{19}$ **and** $\frac{76}{114}$ **are not equivalent fractions.**

(2) $\frac{13}{18}$ and $\frac{26}{126}$

$\frac{13}{18} = \frac{13 \times 1}{18 \times 1} = \frac{13}{18}$

$\frac{26}{126} = \frac{13 \times 2}{63 \times 2} = \frac{13}{63}$

$\frac{13}{18} \neq \frac{13}{63}$

Thus, $\frac{13}{18}$ and $\frac{26}{126}$ are not equivalent fractions.

5. Replace $\square$ in each of the following by the correct number.

Example $\frac{2}{5} = \frac{14}{\square}$

$\therefore$ $2 \times \square = 14 \times 5$

$\therefore$ $\square = \frac{14 \times 5}{2}$

$\therefore$ $\square = \frac{7 \times \cancel{2} \times 5}{\cancel{2}} = 35$

$\therefore$ $\frac{2}{5} = \frac{14}{\boxed{35}}$

(1) $\frac{8}{9} = \frac{56}{\square}$

$8 \times \square = 56 \times 9$

$\therefore$ $\square = \frac{56 \times 9}{8}$

$\therefore$ $\square = 7 \times 9 = 63$

$\therefore$ $\frac{8}{9} = \frac{56}{\boxed{63}}$

(2) $\frac{108}{126} = \frac{12}{\square}$

$\therefore 108 \times \square = 12 \times 126$

$\therefore$ $\square = \frac{12 \times 126}{108}$

$\therefore$ $\square = 14$

$\therefore$ $\frac{108}{126} = \frac{12}{\boxed{14}}$

(3) $\frac{45}{75} = \frac{\square}{15}$

$45 \times 15 = \square \times 75$

$\therefore$ $\square = \frac{45 \times 15}{75}$

$\therefore$ $\square = 9$

$\therefore$ $\frac{45}{75} = \frac{\boxed{9}}{15}$

7.7 Simplest Form of a Fraction

- A fraction is said to be in the simplest (or lowest) form if its numerator and the denominator have no common factor except 1.

  E.g. : $\frac{5}{6}, \frac{1}{2}, \frac{2}{7}, \ldots$

- The shortest way to find the equivalent fraction in the simplest form is to find the HCF of the numerator and denominator, and then divide both of them by the HCF.

1. Write the simplest form of the following.

Example $\frac{48}{60}$

HCF of 48 and 60 is 12.

$\therefore \quad \frac{48 \div 12}{60 \div 12} = \frac{4}{5}$

Simplest form of $\frac{48}{60}$ is $\frac{4}{5}$.

(1) $\frac{126}{210}$

$= \frac{\cancel{2} \times 3 \times \cancel{21}}{\cancel{2} \times 5 \times \cancel{21}}$

$= \frac{3}{5}$

(2) $\frac{175}{245}$

$\frac{175}{245} = \frac{\cancel{5} \times 5 \times \cancel{7}}{\cancel{5} \times 7 \times \cancel{7}} = \frac{5}{7}$

(3) $\frac{100}{180}$

$= \frac{10 \times 10}{10 \times 18}$

$= \frac{10}{18}$

$= \frac{2 \times 5}{2 \times 9}$

$= \frac{5}{9}$

7.8 Like Fractions

- **Like Fractions:**
  - Fractions with same denominators are called **like fractions.**

    E.g. : $\frac{5}{7}, \frac{6}{7}, \frac{1}{7}, \frac{2}{7}$, etc.

- **Unlike Fractions :**
  - Fractions with different denominators are called **unlike fractions.**

    E.g. : $\frac{5}{7}, \frac{7}{20}, \frac{5}{3}, \frac{9}{7}$, etc.

1. **Classify the following as like and unlike fractions :**

$\frac{3}{5}, \frac{6}{7}, \frac{3}{4}, \frac{6}{5}, \frac{8}{9}, \frac{3}{7}, \frac{1}{4}, \frac{7}{9}, \frac{1}{5}, \frac{2}{4}, \frac{4}{7}, \frac{2}{9}$

(i) Like Fractions : $\frac{3}{5}, \frac{6}{5}, \frac{1}{5}; \frac{6}{7}, \frac{3}{7}, \frac{4}{7}; \frac{3}{4}, \frac{1}{4}, \frac{2}{4}$

(ii) Unlike Fractions : $\frac{3}{5}, \frac{6}{7}, \frac{3}{4}; \frac{6}{5}, \frac{8}{6}, \frac{3}{7}; \frac{1}{4}, \frac{7}{9}, \frac{1}{5}; \frac{2}{4}, \frac{4}{7}, \frac{2}{9}$

7.9 Comparing Fractions

✦ **Comparing Like Fraction :**

✤ For two fractions with the same denominator, the fraction with the greater numerator is greater.

E.g. Between $\frac{4}{5}$ and $\frac{3}{5}$, $\frac{4}{5}$ is greater.

✦ **Comparing Unlike fractions with the same numerator :**

✤ If the numerator is the same in two fractions, the fraction with the smaller denominator is greater of the two.

E.g. Between $\frac{3}{5}$ and $\frac{3}{7}$, $\frac{3}{5}$ is greater.

✦ **Comparing Unlike fractions with different numerators :**

✤ To compare such fractions we first convert them into like fractions. For this purpose, we use the method of equivalent fractions.

Note:

✦ The LCM of the denominators of the unlike fractions is preferred as the common denominator to make them like fractions.

Example **Write the given fractions in ascending order :**

$\frac{6}{7}, \frac{6}{14}, \frac{1}{7}, \frac{5}{7}, \frac{8}{7}, \frac{12}{21}$

First we write all the fractions into their simplest form :

$\frac{6}{14} = \frac{2\times3}{2\times7} = \frac{3}{7}, \frac{12}{21} = \frac{2\times2\times3}{3\times7} = \frac{4}{7}$

$\therefore$ We have, $\frac{6}{7}, \frac{3}{7}, \frac{1}{7}, \frac{5}{7}, \frac{8}{7}, \frac{4}{7}$

All of them are like fractions so, we can write them in ascending order as : $\frac{1}{7} < \frac{3}{7} < \frac{4}{7} < \frac{5}{7} < \frac{6}{7} < \frac{8}{7}$

$\therefore$ Thus, ascending order is $\frac{1}{7} < \frac{6}{14} < \frac{12}{21} < \frac{5}{7} < \frac{6}{7} < \frac{8}{7}$

1. Which is the greater fraction in each of the given pairs of fractions ?

(1) $\frac{7}{10}$ or $\frac{9}{10}$: $\frac{9}{10}$ (2) $\frac{12}{25}$ or $\frac{14}{25}$: $\frac{14}{25}$ (3) $\frac{17}{103}$ or $\frac{12}{103}$: $\frac{17}{103}$

---

2. Arrange the following in ascending order :

(1) $\frac{6}{11}, \frac{10}{11}, \frac{1}{11}, \frac{8}{11}$ $\frac{1}{11}, \frac{6}{11}, \frac{8}{11}, \frac{10}{11}$

(2) $\frac{1}{5}, \frac{12}{5}, \frac{4}{5}, \frac{3}{5}, \frac{8}{5}$ $\frac{1}{5}, \frac{3}{5}, \frac{4}{5}, \frac{8}{5}, \frac{12}{5}$

---

3. Arrange the following in descending order :

Example $\frac{3}{7}, \frac{3}{14}, \frac{3}{5}, \frac{3}{12}, \frac{6}{8}, \frac{12}{36}$

$\frac{6}{8} = \frac{3 \times \cancel{2}}{4 \times \cancel{2}} = \frac{3}{4}$; $\frac{12}{36} = \frac{3 \times \cancel{4}}{9 \times \cancel{4}} = \frac{3}{9}$

Thus, numerators of all the fractions are now 3.

If two fractions have the same numerator, then the fraction having the greater denominator is the smaller one.

Thus, descending order is

$\frac{6}{8} > \frac{3}{5} > \frac{3}{7} > \frac{12}{36} > \frac{3}{12} > \frac{3}{14}$

(1) $\frac{4}{7}, \frac{4}{14}, \frac{4}{5}, \frac{8}{24}, \frac{4}{9}$

$\frac{8}{24} = \frac{4 \times 2}{2 \times 12} = \frac{4}{12}$

Thus, numerator of all the fraction is now 4.

in descending order

$\frac{4}{5} > \frac{4}{7} > \frac{4}{9} > \frac{4}{12} > \frac{4}{14}$

Thus, descending order is

$\frac{4}{5}, \frac{4}{7}, \frac{4}{9}, \frac{8}{24}, \frac{3}{14}$

---

4. Compare $\frac{3}{5}$ and $\frac{2}{7}$.

Here $\frac{3}{5}$ and $\frac{2}{7}$ are unlike fractions.

- To make them like fraction we have to make their denominators equal.
- For that we have to take *L.C.M.* of the denominators.

5	5	7
7	1	7
	1	1

$\therefore$ LCM = 5 × 7 = 35

$\frac{3}{5} = \frac{3 \times 7}{5 \times 7} = \frac{21}{35}$, $\frac{2}{7} = \frac{2 \times 5}{7 \times 5} = \frac{10}{35}$

Now, $\frac{21}{35} > \frac{10}{35}$

$\therefore \frac{3}{5} > \frac{2}{7}$

5. Arpit played for $2\frac{3}{7}$ of an hour and Pulkit played for $2\frac{4}{9}$ of an hour. Who played for a longer time ?

Time for which Arpit played

$= 2\frac{3}{7}$ of an hour

$= \frac{2 \times 7 + 3}{7}$

$= \frac{14 + 3}{7} = \frac{17}{7}$ of an hour

Time for which Pulkit played

$= 2\frac{4}{9}$ of an hour

$= \frac{2 \times 9}{9} + \frac{4}{9}$

$= \frac{18 + 4}{9} = \frac{22}{9}$ of an hour

$\therefore \frac{17 \times 9}{7 \times 9} = \frac{153}{63}, \frac{22 \times 7}{9 \times 7} = \frac{154}{63}$ ($\because$ L.C.M. of 7 and 9 = 63)

$\therefore \frac{154}{63} > \frac{153}{63} \Rightarrow 2\frac{4}{9} > 2\frac{3}{7}$

$\therefore$ Pulkit played for a longer time.

7.10 Addition and Subtraction of Fractions

✦ **Addition and Subtraction of Like Fractions :**

Step 1 Add / Subtract the numerators.

Step 2 Retain the (common) denominator.

Step 3 Write the fraction as : $\frac{\text{Result of Step 1}}{\text{Result of Step 2}}$

✦ **Addition and Subtraction of Unlike Fractions :**

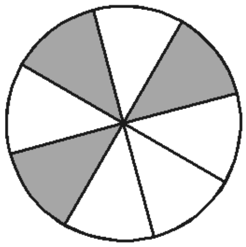
Step 1 Find the LCM of the denominators.

Step 2 Convert the given fractions into like fractions with their LCM as the common denominator.

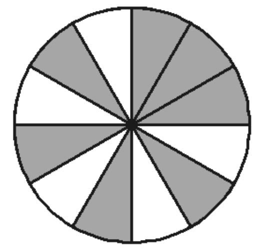
Step 3 Follow the steps to add/ subtract the like fractions.

1. **Represent each of the following fractions by a diagram :**

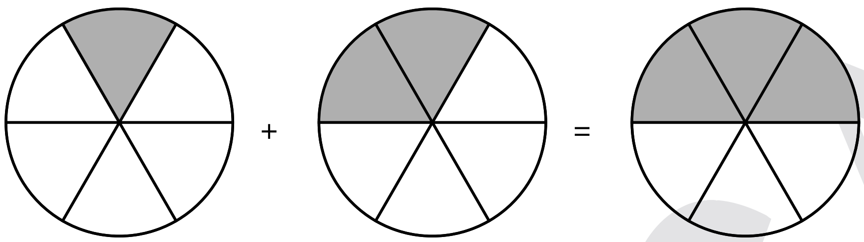
(1) $\frac{3}{8}$



(2) $\frac{7}{12}$



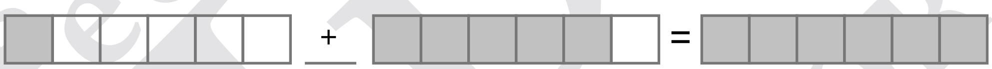
2. Add fraction $\frac{1}{6}$ and $\frac{2}{6}$ with the help of a diagram.



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

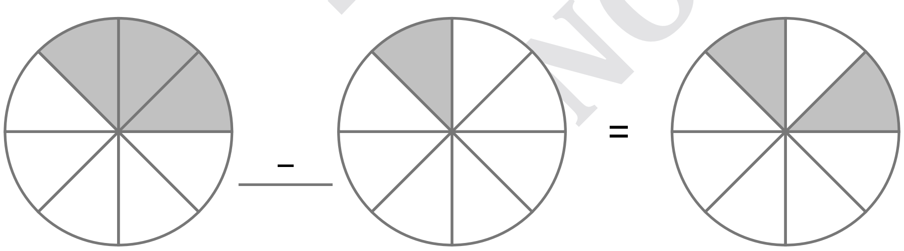
3. **Write these fractions appropriately as additions or subtractions :**

(i)



$\frac{1}{6} + \frac{5}{6} = 1$

(ii)



$\frac{3}{8} - \frac{1}{8} = \frac{2}{8}$

4. Find :

Example $\frac{1}{23}+\frac{5}{23}$

$\frac{1}{23}+\frac{5}{23}=\frac{1+5}{23}$

$=\frac{6}{23}$

(1) $\frac{12}{37}+\frac{7}{37}$

$\frac{12}{37}+\frac{7}{37}=\frac{12+7}{37}$

$=\frac{19}{37}$

(2) $\frac{1}{7}+\frac{0}{7}$

$\frac{1}{7}+\frac{0}{7}=\frac{1+0}{7}$

$=\frac{1}{7}$

5. Solve :

Example $\frac{5}{9}-\frac{2}{9}$

$\frac{5}{9}-\frac{2}{9}=\frac{5-2}{9}$

$=\frac{3}{9}$

$=\frac{1}{3}$

(1) $\frac{7}{13}-\frac{3}{13}$

$\frac{7}{13}-\frac{3}{13}=\frac{7-3}{13}$

$=\frac{4}{13}$

(2) $\frac{6}{8}-\frac{3}{8}$

$\frac{6}{8}-\frac{3}{8}=\frac{6-3}{8}$

$=\frac{3}{8}$

6. Fill in the missing fractions :

Example $\frac{7}{11}-\square=\frac{4}{11}$

$\frac{7}{11}-x=\frac{4}{11}$

$\therefore \frac{7}{11}-\frac{4}{11}=x$

$\therefore x=\frac{3}{11}$

Thus, $\frac{7}{11}-\boxed{\frac{3}{11}}=\frac{4}{11}$

(1) $\square-\frac{5}{28}=\frac{13}{28}$

$\therefore \square=\frac{13}{28}+\frac{5}{28}$

$\therefore \square=\frac{13+5}{28}$

$\therefore \square=\frac{18}{28}$

Thus, $\boxed{\frac{18}{28}}-\frac{5}{28}=\frac{13}{28}$

7. Abhijeet and Anita coloured $\frac{3}{8}$ and $\frac{1}{8}$ part of a picture respectively. Total how much fraction of the picture did they colour ?

Abhijeet coloured $\frac{3}{8}$ part

Anita coloured $\frac{1}{8}$ part

$\therefore \frac{3}{8}+\frac{1}{8}=\frac{3+1}{8}=\frac{4}{8}=\frac{1}{2}$

$\therefore$ They have coloured $\frac{1}{2}$ part of the picture.

---

8. Add :

Example $\frac{12}{28}+\frac{2}{8}$

LCM of 28 and 8 is 56

$\therefore \frac{12}{28}+\frac{2}{8}=\frac{12\times2}{28\times2}+\frac{2\times7}{8\times7}$

$=\frac{24}{56}+\frac{14}{56}$

$=\frac{24+14}{56}$

$=\frac{38}{56}$

$=\frac{19}{28}$

(1) $\frac{3}{5}+\frac{4}{3}$

L.C.M. of 5 and 3 is 15

$\therefore \frac{3}{5}+\frac{4}{3}=\frac{3\times3+4\times5}{15}$

$=\frac{9+20}{15}=\frac{29}{15}$

$=1\frac{14}{15}$

---

(2) $\frac{2}{3}+\frac{1}{7}$

L.C.M. of 7 and 3 is 21.

$\therefore \frac{2}{3}+\frac{1}{7}=\frac{2\times7}{3\times7}+\frac{1\times3}{7\times3}$

$=\frac{14}{21}+\frac{3}{21}$

$=\frac{14+3}{21}$

$=\frac{17}{21}$

9. **Add the following mixed fractions :**

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

$2\frac{1}{4}+1\frac{1}{3}=\frac{2\times4+1}{4}+\frac{1\times3+1}{3}$

$=\frac{8+1}{4}+\frac{3+1}{3}$

$=\frac{9}{4}+\frac{4}{3}$

$=\frac{9\times3+4\times4}{12}$

(LCM of 4 and 3 is 12)

$=\frac{27+16}{12}$

$=\frac{43}{12}$

$=3\frac{7}{12}$

(1) $3\frac{2}{5}+2\frac{1}{4}$

$=\frac{5\times3+2}{5}+\frac{4\times2+1}{4}$

$=\frac{15+2}{5}+\frac{8+1}{4}$

$=\frac{17}{5}+\frac{9}{4}$

[L.C.M of 5 and 4 is 20]

$\frac{17}{5}+\frac{9}{4}=\frac{17\times4+9\times5}{20}$

$=\frac{68+45}{20}$

$=\frac{113}{20}$

$=5\frac{13}{20}$

10. **Subtract :**

Example $5\frac{10}{15}-3\frac{2}{16}$

$5\frac{10}{15}-3\frac{2}{16}=\frac{5\times15+10}{15}-\frac{3\times16+2}{16}$

$=\frac{75+10}{15}-\frac{48+2}{16}$

$=\frac{85}{15}-\frac{50}{16}$

$=\frac{85\times16-50\times15}{15\times16}$

$=\frac{1360-750}{240}$

$=\frac{610}{240}$

$=\frac{61}{24}$

$=2\frac{13}{24}$

(1) $3\frac{2}{5}-2\frac{1}{4}$

$=\frac{5\times3+2}{5}-\frac{4\times2+1}{4}$

$=\frac{15+2}{5}-\frac{8+1}{4}$

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

[L.C.M of 5 and 4 is 20]

$\frac{17}{5}-\frac{9}{4}=\frac{17\times4-5\times9}{5\times4}$

$=\frac{68-45}{20}=\frac{23}{20}=1\frac{3}{20}$

11. Solve :

Example $\frac{2}{6}+\frac{3}{6}+\frac{1}{6}$

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

$=\frac{6}{6}$

$=$ **1**

(1) $\frac{2}{7}+\frac{3}{8}+\frac{1}{4}$

[L.C.M of 7, 8 and 4 is 56]

$\frac{2}{7}+\frac{3}{8}+\frac{1}{4}=\frac{16+21+14}{56}$

$=\frac{51}{56}$

(2) $2+\frac{3}{4}+1\frac{5}{8}$

$=\frac{2}{1}+\frac{3}{4}+\frac{13}{8}$

[L.C.M of 1, 4 and 8 is 8]

$=\frac{16+6+13}{8}$

$=\frac{35}{8}=4\frac{3}{8}$

Example **A piece of wire $\frac{7}{8}$ metre long was cut into two pieces. One piece was $\frac{1}{4}$ metre long. How long is the other piece ?**

Let the other piece be x metre long.

$\therefore \frac{7}{8}$ = length of one piece + length of other piece

$\therefore \frac{7}{8}=\frac{1}{4}+x \Rightarrow \frac{7}{8}-\frac{1}{4}=x$

$\Rightarrow \frac{7}{8}-\frac{1\times 2}{4\times 2}=x$ (LCM of 8 and 4 is 8)

$\Rightarrow \frac{7}{8}-\frac{2}{8}=x$

$\Rightarrow x=\frac{5}{8}$

∴ The length of the other piece is $\frac{5}{8}$ metre.

12. Seema bought $5\frac{1}{2}$ metres of cloth for her kurta and $3\frac{2}{3}$ metres of cloth for her pajamas. What is the total length of the cloth she had bought ?

A. Length of cloth bought for kurta $=5\frac{1}{2}$ m

Length of cloth bought for pajamas $=3\frac{2}{3}$ m

∴ Total length of the cloth she had bought $=\left(5\frac{1}{2}+3\frac{2}{3}\right)$m

$=\left(\frac{11}{2}+\frac{11}{3}\right)$m

$=\left(\frac{11\times 3+11\times 2}{6}\right)$m

$=\left(\frac{33+22}{6}\right)\text{m}=\frac{55}{6}\text{ m}=9\frac{1}{6}\text{ m}$

∴ Seema bought $9\frac{1}{6}$ metre of cloth in all.

13. Nandini's house is $\frac{9}{10}$ km from her school. She walked some distance and then took a bus for $\frac{1}{2}$ km to reach the school. How far did she walk ?

A. Distance walked by Nandini = (Distance between home and school) – (Distance travelled by bus)

$= \frac{9}{10}\text{ km} - \frac{1}{2}\text{ km}$

$= \frac{9}{10} - \frac{1}{2}$ (L.C.M. of 10 and 2 is 10)

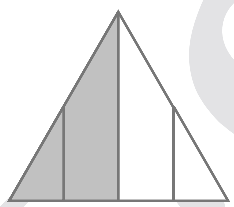
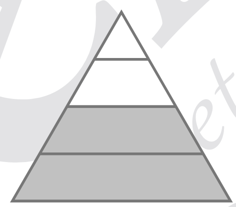
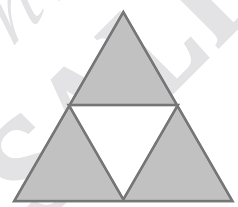
$= \frac{9 - 1 \times 5}{10} = \frac{9-5}{10} = \frac{4}{10} = \frac{2}{5}$

$\therefore$ Nandini walked $\frac{2}{5}$ k.m.

Objective Questions

1. **Choose the correct option.**

(1) The shaded part of which of the following figures represents the fraction $\frac{1}{2}$? **B**

(A)  (B)  (C)  (D) 

(2) In a proper fraction the numerator is always ____________ than the denominator. **B**

(A) greater (B) less (C) equal (D) none of these

(3) To find an equivalent fraction of a given fraction, you may ____________ the numerator and the denominator of the given fraction by the same number. **D**

(A) multiply (B) divide (C) add (D) both (A) and (B)

(4) Which of the following is a proper fraction ? **C**

(A) $\frac{7}{6}$ (B) $\frac{76}{51}$ (C) $\frac{51}{76}$ (D) $\frac{150}{17}$

(5) A fraction is said to be in the simplest form if its numerator and denominator have no common factor except ____________. **B**

(A) 0 (B) 1 (C) 2 (D) 3

(6) $\frac{0}{5}$ represents the point ____________ on the number line. **A**

(A) 0 (B) 1 (C) 5 (D) none of these

(7) $\frac{5}{5}$ on the number line can be shown by the point ______. **B**

(A) 0 (B) 1 (C) 5 (D) 10

(8) To represent $\frac{3}{10}$ on a number line, divide 0 to 1 in ______ equal parts **B**

(A) 3 (B) 10 (C) 4 (D) 0

(9) $\frac{5}{7}$ can be represented on a number line between ______ and ______. **A**

(A) 0 and 1 (B) 1 and 2 (C) 5 and 7 (D) 0 and 5

(10) A ______ is smaller than 1. **C**

(A) mixed fraction (B) improper fraction

(C) proper fraction (D) all of these

(11) We can find out ______ number of equivalent fractions of a given fraction. **B**

(A) two (B) infinite (C) one (D) only one

(12) A mixed fraction is a combination of a ______ and a ______. **A**

(A) whole, part (B) part, part (C) zero, part (D) fraction, part

2. Fill in the blanks.

(1) A **fraction** is a number representing a part of a whole.

(2) In $\frac{3}{4}$ **3** is called the numerator and **4** is called the denominator.

(3) Fraction can be shown on a **number line**.

(4) The fractions, where the numerator is greater than the denominator are called **improper** fractions.

(5) The HCF of the numerator and denominator of a fraction in the simplest form is **1**. (1, 2, 3)

(6) Fractions with same denominators are called **like** fractions.

(7) Fractions with different denominators are called **unlike** fractions.

3. Mark as '✓' or '✗'.

(1) $\frac{2}{9}$ is an equivalent fraction of $\frac{14}{63}$. ✓

(2) To represent $\frac{3}{7}$ on a number line, divide 0 to 1 in 7 equal parts. ✓

(3) $\frac{6}{7}$ is a proper fraction. ✓

(4) $\frac{10}{3}$ is a proper fraction. ✗

(5) $\frac{15}{2}$ is an improper fraction. ✓

(6) An equivalent fraction of $\frac{2}{10}$ is $\frac{4}{20}$. ✓

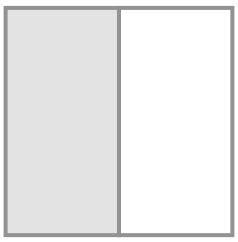
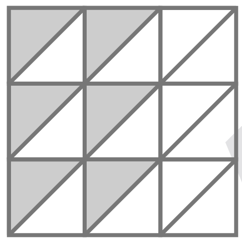
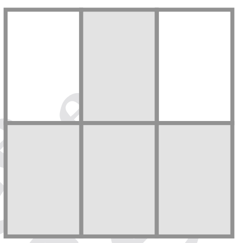
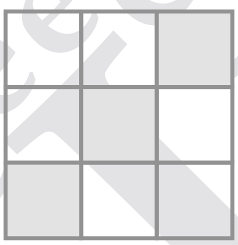
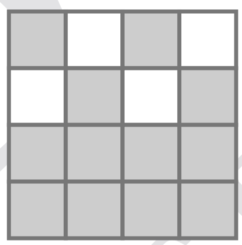
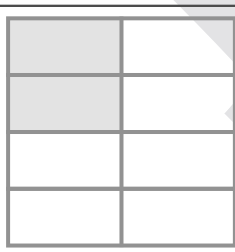
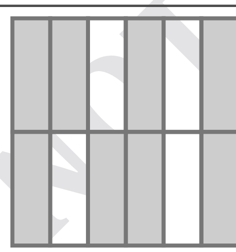
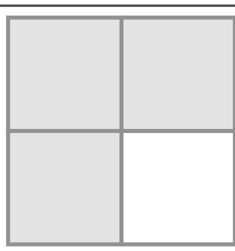
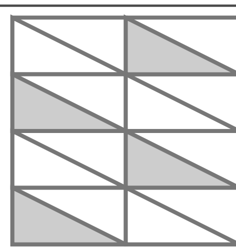
(7) Simplest form of $\frac{7}{14}$ is $\frac{1}{4}$. ✗

(8) $\frac{1}{2}$ and $\frac{3}{2}$ are like fractions. ✓

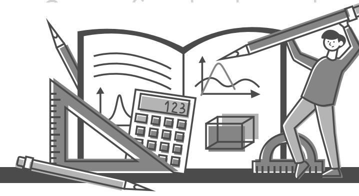
(9) $\frac{3}{2}$ is the smallest fraction among $\frac{3}{4}, \frac{3}{2}, \frac{3}{7}, \frac{3}{10}, \frac{3}{12}$. ✗

4. Match the following fractions with their equivalent fractions.

(1)

A (Fractions)	B (Equivalent fractions)	Answer
(1) 	(A) 	(1) → **B**
(2) 	(B) 	(2) → **D**
(3) 	(C) 	(3) → **A**
(4) 	(D) 	(4) → **E**
(5) 	(E) 	(5) → **C**

8 Decimals



8.2 Comparing Decimals

✦ **Decimals :**

✤ **Decimals** are the numbers, which consist of two parts namely, a **whole number part** and a **fractional part** separated by a **decimal point**.

E.g. 12.5 is a decimal number, where 12 is the whole number part and $\frac{5}{10}$ is the fractional part and these two parts are separated by a dot, known as the decimal point.

Similarly, 3.5, 33.5, 0.5, 0.006, etc. are also decimal numbers.

✦ **Comparing Decimals :**

✤ To compare decimal numbers, first compare the whole parts. If the whole parts are equal then compare the tenth parts and if they are equal then compare the hundredth parts and so on.

E.g. Let us compare 32.55 and 32.5

Here, the whole part for both the numbers is 32 and, hence, equal.

Now, compare the tenth part. The tenth part is also equal. Thus, we compare the hundredth part.

$32.55 = 32 + \frac{5}{10} + \frac{5}{100}$ and $32.5 = 32 + \frac{5}{10} + \frac{0}{100}$

Therefore, 32.55 > 32.5 as the hundredth part of 32.55 is more.

---

1. Put '=', '>' or '<' symbols in the following statements :

(1) 5.3 __>__ 5.03	(4) 10.32 __>__ 1.023	(7) 90.06 __<__ 90.60
(2) 0.45 __>__ 0.045	(5) 0.064 __=__ 0.064	(8) 12.345 __<__ 12.435
(3) 3.9 __=__ 3.90	(6) 8.91 __>__ 0.0891	(9) 1 __>__ 0.99

8.3 Using Decimals

✦ **Using Decimals :**

✤ Decimals are used in many ways in our lives. For example, in representing units of money, length and weight.

✦ **For representing units of Money :** 100 paise = ₹ 1

Therefore, 1 paise = ₹$\frac{1}{100}$ = ₹ 0.01

So, 65 paise = ₹ $\frac{65}{100}$ = ₹ 0.65

and 105 paise = ₹ 1.05

✦ **For representing units of Length :** $1 \text{ cm} = \frac{1}{100} \text{ m or } 0.01 \text{ m}$

E.g. 156 cm $= 100 \text{ cm} + 56 \text{ cm}$

$= 1 \text{ m} + \frac{56}{100} \text{ m}$

$= 1 \text{ m} + 0.56 \text{ m}$

$= \mathbf{1.56 \text{ m}}$

✦ **For representing units of Weight :** 1000g = 1 kg

Therefore, $1 \text{ g} = \frac{1}{1000} \text{ kg} = 0.001 \text{ kg}$

E.g. 2350 g $= 2000 \text{ g} + 350 \text{ g}$

$= 2 \text{ kg} + \frac{350}{1000} \text{ kg}$

$= 2 \text{ kg} + 0.350 \text{ kg}$

$= \mathbf{2.350 \text{ kg}}$

Example **Write 3 rupees 5 paise in decimals.**

100 paise = ₹ 1

∴ 1 paise = ₹ $\frac{1}{100}$ = ₹ 0.01

Now, 3 rupees 5 paise = ₹ 3 + ₹ $\frac{5}{100}$

= ₹ (3 + 0.05)

= **₹ 3.05**

1. Write 25 rupees 75 paise in decimals.

100 paise = ₹ 1

1 paise = ₹ $\frac{1}{100}$

Now, 25 rupees 75 paise

= ₹ 25 + ₹ $\frac{75}{100}$

= ₹ (25 + 0.75)

= ₹ 25.75

2. **Express as rupees using decimals :**

(1) 75 paise = ₹ **0.75**

(2) 5000 paise = ₹ **50.00**

(3) 9500 paise = ₹ **95.00**

(4) ₹ 25 and 50 paise = ₹ **25.50**

(5) ₹ 500 and 50 paise = ₹ **500.50**

(6) ₹ 800 and 20 paise = ₹ **800.20**

3. **Express as metres using decimals :**

(1) 25 cm = **0.25** m

(2) 100 cm = **1.00** m

(3) 1000 cm = **10.00** m

(4) 35 m 35 cm = **35.35** m

(5) 90 m 10 cm = **90.10** m

(6) 500 m 50 cm = **500.50** m

4. **Express as cm using decimals :**

(1) 50 mm = **5** cm

(2) 160 mm = **16** cm

(3) 5 cm 8 mm = **5.8** cm

(4) 97 mm = **9.7** cm

5. **Express as km using decimals :**

(1) 530 m = **0.530** km

(2) 890 m = **0.890** km

(3) 5 km 5 m = **5.005** km

(4) 16 km 160 m = **16.160** km

(5) 900 km 900 m = **900.900** km

(6) 70 km 750 m = **70.750** km

6. **Express as kg using decimals :**

(1) 50 g = **0.050** kg

(2) 250 g = **0.250** kg

(3) 800 g = **0.800** kg

(4) 2000 g = **2** kg

(5) 300 kg 300 g = **300.300** kg

(6) 1000 kg 500 g = **100.500** kg

8.4 Addition of Numbers with Decimals

✦ **Step 1 :** Write one number on top of the other, such that the decimal points line up vertically.

Step 2 : Check if the decimal numbers have the same number of digits to the right of the decimal point. If not, add zeros to the right of the number till the number of digits are same.

Step 3 : Add as we add whole numbers.

Step 4 : Put the decimal in the answer directly below the other decimal points.

E.g. 280.69 + 25.2 + 38 = ?

	Hundred	Ten	Ones	Tenths	Hundredths
	1	1			
	2	8	0 •	6	9
+		2	5 •	2	0
+		3	8		
	3	**4**	**3 •**	**8**	**9**

← Start addition from here

∴ 280.69 + 25.2 + 38 = **343.89**

1. **Find the sum of the following decimals :**

Example 0.5 + 0.9

$$\begin{array}{r} \overset{1}{0}\,.\,5 \\ +\;0\,.\,9 \\ \hline 1\,.\,4 \end{array}$$

∴ **0.5 + 0.9 = 1.4**

(1) 0.6 + 0.06

$$\begin{array}{r} 0.60 \\ +\;0.06 \\ \hline 0.66 \end{array}$$

∴ 0.6 + 0.06 = 0.66

(2) 1.9 + 2.05

$$\begin{array}{r} 1.90 \\ +\;2.05 \\ \hline 3.95 \end{array}$$

∴ 1.9 + 2.05 = 3.95

(3) 2.005 + 1.009

$$\begin{array}{r} 2.0\overset{1}{0}5 \\ +\;1.009 \\ \hline 3.014 \end{array}$$

∴ 2.005 + 1.009 = 3.014

2. **Find the sum of the following decimals :**

Example **34.50 + 40.50 + 2.50**

$$\begin{array}{r} \overset{1}{3}4.50 \\ +\ 40.50 \\ +\ \ 2.50 \\ \hline 77.50 \end{array}$$

$\therefore$ **34.50 + 40.50 + 2.50 = 77.50**

(1) 5.980 + 3.490 + 2.500

$$\begin{array}{r} 5.980 \\ +\ 3.490 \\ +\ 2.500 \\ \hline 11.970 \end{array}$$

$\therefore$ 5.980 + 3.490 + 2.500 = 11.970

(2) 125.25 + 4.50 + 95.00

$$\begin{array}{r} 125.25 \\ +\ \ \ 4.50 \\ +\ 95.00 \\ \hline 224.75 \end{array}$$

$\therefore$ 125.25 + 4.50 + 95.00 = 224.75

Example **Bijal walked 5 km and Mohini walked 4.5 km in the morning. How much distance did they walk in all ?**

Distance covered by Bijal = 5.0 km

Distance covered by Mohini = 4.5 km

$\therefore$ Distance covered by both = Distance covered by Bijal + Distance covered by Mohini

$$\begin{array}{r} 5.0 \\ +\ 4.5 \\ \hline 9.5 \end{array}$$

Hence, **the total distance they cover is 9.5 km.**

---

3. Mohsin spent ₹ 125.75 for notebooks, ₹ 30.75 for pencils and ₹ 100.00 for books. Find the total amount spent by Mohsin.

Rupees spent by Mohsin for notebooks :	₹125.75
Rupees spent by Mohsin for pencils :	+ ₹ 30.75
Rupees spent by Mohsin for books :	+ ₹ 100.00
Total rupees spent by Mohsin :	= ₹ 256.50

Mohsin spent a total of ₹ 256.50

4. Meera bought 3 m 20 cm of a red cloth, 10 m 25 cm of a yellow cloth and 7 m 65 cm of a blue cloth. Find the total length of cloth bought by her.

Length of red cloth purchased

$= 3 \text{ m } 20 \text{ cm}$

$= 3 \text{ m} + 20 \times \frac{1}{100} \text{ m}$

$= 3 \text{ m} + \frac{20}{100} \text{ m}$

$= 3.20 \text{ m}$

Length of blue cloth purchased

$= 7 \text{ m } 65 \text{ cm}$

$= 7 \text{ m} + 65 \times \frac{1}{100} \text{ m}$

$= 7 \text{ m} + \frac{65}{100} \text{ m}$

$= 7.65 \text{ m}$

Length of yellow cloth purchased

$= 10 \text{ m } 25 \text{ cm}$

$= 10 \text{ m} + 25 \times \frac{1}{100} \text{ m}$

$= 10 \text{ m} + \frac{25}{100} \text{ m}$

$= 10.25 \text{ m}$

Total length of cloth bought by Meera is

3.20 m
+ 10.25 m
+ 7.65 m
21.10 m

Therefore, total cloth purchased = 21.10 m

5. If a shopkeeper sold 320 kg 400 g of wheat, 200 kg 320 g of rice and 20 kg 700 g of millet in one month, then how much grain did he sell in all ?

$1000 \text{ g} = 1 \text{ kg}$

$\therefore \quad 1 \text{ g} = \frac{1}{1000} \text{ kg}$

Quantity of wheat sold $= 320 \text{ kg} + \frac{400}{1000} \text{ kg} = 320.400 \text{ kg}$

Quantity of rice sold $= 200 \text{ kg} + \frac{320}{1000} \text{ kg} = 200.320 \text{ kg}$

Quantity of millet sold $= 20 \text{ kg} + \frac{700}{1000} \text{ kg} = 20.700 \text{ kg}$

The total grain sold by the shopkeeper = 320.400 kg
+ 200.320 kg
+ 020.700 kg
= 541.420 kg

Thus, the shopkeeper sold 541.420 kg of grain in all.

8.5 Subtraction of Decimals

- **Step 1 :** Write one number on top of the other, such that the decimal points line up vertically.
- **Step 2 :** Check if the decimal numbers have the same number of digits to the right of the decimal point. If not, add zeros to the right of the number till the number of digits are same.
- **Step 3 :** Subtract as we subtract whole numbers.
- **Step 4 :** Put the decimal in the answer directly below the other decimal points.

E.g. 35.55 – 5.15 = ?

	Tens	Ones	Tenths	Hundredths
	3	5 ●	5	5
–		5 ●	1	5
	3	**0** ●	**4**	**0** ← Start subtraction from here

∴ 35.55 – 5.15 = **30.40**

1. Subtract the following :

Example 7.6 – 2.5

$$\begin{array}{r} 7.6 \\ -\ 2.5 \\ \hline 5.1 \end{array}$$

Thus, **7.6 – 2.5 = 5.1**

(1) 8.3 – 3.8

$$\begin{array}{r} \overset{7}{\not{8}}.\overset{13}{3} \\ -\ 3.8 \\ \hline 4.5 \end{array}$$

Thus, 8.3 – 3.8 = 4.5

(2) 11.5 – 9.3

$$\begin{array}{r} \overset{0}{1}\overset{11}{1}.5 \\ -\ 09.3 \\ \hline 02.2 \end{array}$$

Thus, 11.5 – 9.3 = 2.2

Example 25.5 – 8.545

$$\begin{array}{r} \overset{1}{\not{2}}\ \overset{14}{\not{5}}.\overset{14}{\not{5}}\ \overset{9}{\not{0}}\ \overset{10}{0} \\ -\ \ \ 8.5\ 4\ 5 \\ \hline 1\ 6.9\ 5\ 5 \end{array}$$

Thus, **25.5 – 8.545 = 16.955**

(3) 81.09 – 80.005

$$\begin{array}{r} 81.0\overset{8}{\not{9}}\ \overset{10}{\not{0}} \\ -80.0\ 0\ 5 \\ \hline 01.0\ 8\ 5 \end{array}$$

Thus, 81.09 – 80.005 = 1.085

(4) 898.25 – 235.00

$$\begin{array}{r} 898.25 \\ -235.00 \\ \hline 663.25 \end{array}$$

Thus, 898.25 – 235.00 = 663.25

Example **Vijayaben had 25 m 55 cm long cloth. She cuts 5 m 25 cm length of cloth from this for making a pillow cover. How much cloth is left with her ?**

Length of cloth Vijayaben had = 25 m 55 cm = 25.55 m

Length of cloth used for pillow cover = 5 m 25 cm = 5.25 m

Remaining cloth = 25.55 m – 5.25 m

= 20.30 m

$$\begin{array}{r} 25.55 \text{ m} \\ -\ 05.25 \text{ m} \\ \hline 20.30 \text{ m} \end{array}$$

Thus, **20 m 30 cm of cloth is left with her.**

2. Raju travels 25 km 750 m. Out of this he travels 14 km 200 m by car and the rest by bus. How much distance does he travel by bus ?

Total distance traveled	=	25 km 750 m
distance traveled by car	=	–14 km 200 m
distance traveled by bus	=	11 km 550 m

So, Raju traveles 11 km 550 m distance by bus

3. Montu had ₹ 50.50. He bought a chocolate for ₹ 20.10 from it. Find the balance amount left with Montu.

Total amount	=	₹ 50.50
Amount spent on chocolate	=	– ₹ 20.10
Amount lift with Montu	=	₹ 30.40

4. Rameshbhai had ₹ 9.50. He bought chocolates for ₹ 6.75. Find the balance amount left with Rameshbhai.

Total amount	=	₹ 9.50
Amount spent on chocolates	=	– ₹ 6.75
Amount lift with Rameshbhai	=	₹ 2.75

5. Jalpa made a gold ring weighing 15.75 grams out of 25 grams of gold she had with her. How much gold is left with her now ?

Weight of gold Jalpa has with her	=	$\overset{1}{\cancel{2}}\,\overset{14}{\cancel{5}}\,.\,\overset{9}{\cancel{0}}\,\overset{10}{\cancel{0}}$ g
Weight of gold used to make a ring	=	– 1 5. 7 5 g
Weight of gold remaining	=	0 9. 2 5 g

Thus, Jalpa has 9.25 grams of gold left with her.

6. Meenaben bought vegetables weighing 12 kg. Out of this, 4 kg 400 gm is onions, 3 kg 50 gm is tomatoes and the rest is potatoes. What is the weight of the potatoes ?

Total Weight of Vegetable = 12.000 kg,

Weight of onions = 4.400 kg,

Weight of tomatoes = 3.050 kg,

Weight of potatoes = Total weight of Vegetable – (Weight of onions + Weight of tomatoes)

= 12.000 – (7.450)

= 4.450 kg

= 4 kg 450 gm

$$\begin{array}{r} 4.400 \text{ kg} \\ +\ 3.050 \text{ kg} \\ \hline 7.450 \text{ kg} \end{array}$$

$$\begin{array}{r} 12.000 \\ -\ 7.450 \\ \hline 4.550 \end{array}$$

Objective Questions

1. Choose the correct option.

(1) 8.06 ________ 8.006 **B**

(A) < (B) > (C) = (D) None of these

(2) 4.532 ________ 4.533 **B**

(A) = (B) < (C) > (D) None of these

(3) 2.09 ________ 2.093 **A**

(A) < (B) = (C) > (D) None of these

(4) 25 paise = ₹ ________ **C**

(A) 0.75 (B) 0.30 (C) 0.25 (D) 0.15

(5) 65 cm = ________ m **B**

(A) 6.5 (B) 0.65 (C) 650 (D) $\frac{5}{13}$

(6) 45 m 25 cm = ________ m **B**

(A) 4.525 (B) 45.25 (C) 0.4525 (D) 452.5

(7) 0.65 + 0.60 + 0.40 = ? **B**

(A) 1.50 (B) 1.65 (C) 1.80 (D) 1.70

2. Fill in the blanks.

(1) 1 paisa = ₹ **0.01**

(2) ₹ 0.65 = **65** paise.

(3) 1 rupee 7 paise = ₹ **1.07**

(4) 1 m = **100** cm

(5) 1 cm = **0.01** m.

(6) 1 m = **0.001** km.

(7) 1 g = **0.001** kg.

(8) 5 m = **0.005** km.

(9) 2 km = **2000** m.

(10) 400 kg 100 g = **400.100** g.

(11) 5760 g = **5.760** kg.

(12) 0.5 + 0.55 + 5.5 + 55.5 = **62.05**

(13) 26.054 + 0.56 + 0.004 = **26.618**

(14) 0.27 + 12.325 + 0.2 = **12.795**

(15) 5.66 – 0.66 = **5.00**

(16) 2.39 – 0.85 = **1.54**

(17) 7.35 – 2.86 = **4.49**

(18) 12.6 – 9.786 = **2.814**

3. Mark as '✓' or '✗'.

(1) 0.3 is greater than 0.03. ✓

(2) 300 km 5000 m means 3005 km. ✗

(3) 4 kg 5 g means 4.5 kg. ✗

(4) 0.8 + 1.5 = 0.23 ✗

(5) 50 paise = ₹ 0.5 ✓

(6) 6 – 0.6 = 0 ✗

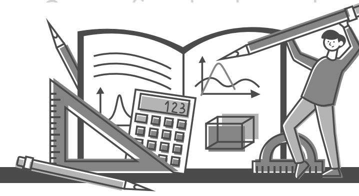
(7) 9 – 9.0 = 0 ✓

4. Match the following :

(1)

A	B	Answer
(1) 75 paise	(A) 360 paise	(1) → **B**
(2) 2 ₹ 5 paise	(B) ₹ 0.75	(2) → **C**
(3) 2 ₹ 50 paise	(C) ₹ 2.05	(3) → **D**
(4) ₹ 3.60	(D) ₹ 2.50	(4) → **A**

9 Data Handling



9.2 Recording Data and 9.3 Organisation of Data

✦ **Data :**

✤ A **data** is a collection of numbers gathered to give some information.

✦ **Recording and Organisation of Data :**

✤ After collecting and recording data, it can be organised in different ways to understand and interpret it.

✤ To get particular information from the given data quickly, the data can be arranged in a tabular form using tally marks.

✤ The following table tells the numbers represented by different tally marks.

Tally Marks	Number
|	1
||	2
|||	3
||||	4
𝍸	5
𝍸 |	6
𝍸 ||	7
𝍸 |||	8
𝍸 ||||	9
𝍸 𝍸	10

Remember :

✦ 𝍸 represents 5.

1. What is data ?

A. Data is a collection of numbers gathered to give some information.

Example **In a Mathematics test, the following marks were obtained by 32 students of standard 6. Arrange these marks in a table using tally marks :**

80	**55**	**92**	**63**	**85**	**50**	**37**	**42**	**92**	**63**	**55**	**50**	**63**
85	**42**	**50**	**55**	**37**	**42**	**37**	**50**	**63**	**80**	**55**	**63**	**85**
50	**55**	**80**	**37**	**63**	**50**							

Frequency distribution of marks

Marks	Tally Marks	No. of Students
37	IIII	4
42	III	3
50	卌 I	6
55	卌	5
63	卌 I	6
80	III	3
85	III	3
92	II	2
	Total	**32**

Answer the following questions from this frequency distribution table.

(1) How many students have got 55 marks in Mathematics ?

Ans. 5

(2) How many students have got 80 marks in Mathematics ?

Ans. 3

(3) State the number of students who got the highest marks in Mathematics.

Ans. 2

(4) State the number of students who got the lowest marks in Mathematics.

Ans. 4

(5) State the difference between the number of students who got the lowest and the highest marks in Mathematics.

Ans. Difference = 4 – 2 = 2

2. 30 girls from a school participated in an essay writing competition. They were given grades A, B, C, D and E. The grades obtained by the girls are as follows. Prepare a frequency distribution table based on this data :

B	D	C	A	B	E	A	B	C	D	A	C	D	B
E	A	C	A	B	C	E	D	A	E	A	B	C	D
A	E												

Grade	Tally Marks	No. of girls.
A	𝍸 |||	8
B	𝍸 |	6
C	𝍸 |	6
D	𝍸	5
E	𝍸	5
Total	--	**30**

Answer the following questions from this frequency distribution table.

(1) What grade did the most girls get ? **A**

(2) What grade did the least girls get ? **D and E**

(3) How many girls got A grade ? **8**

(4) Is the number of girls who got D and the number of girls who got E the same ?

Yes

(5) How many girls got B grade and C grade respectively ? **6, 6**

3. Following is the weight (in kg) of 25 students of class VI. Make a table and enter the data using tally marks.

35 38 36 40 37 39 42 41 38 40 37 41 39

38 36 35 36 43 34 38 41 42 38 35 38

Weight in kg	Tally Marks	No. of Students
34	|	1
35	|||	3
36	|||	3
37	||	2
38	~~||||~~ |	6
39	||	2
40	||	2
41	|||	3
42	||	2
43	|	1
Total	**–**	**25**

Answer the following questions from the table.

(1) How many students have maximum weight ? **1 student**

(2) How many students have minimum weight ? **1 student**

(3) How many student weigh more than 40 kg ? **6 student**

(4) How many students weigh less than 38 kg ? **1+ 3 + 3 + 2 = 9 student**

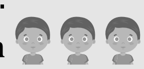
9.4 Pictograph and 9.5 Interpretation of Pictograph

✦ **Pictograph :**

- Representation of data through pictures is called a **pictograph**.
- A pictograph represents data through pictures of objects. It helps answer the questions on the data at a glance.
- Pictographs are often used by dailies and magazines to attract readers' attention.

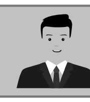
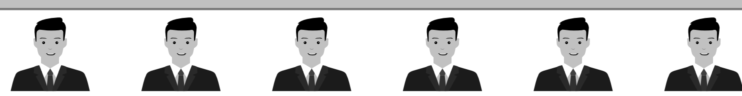
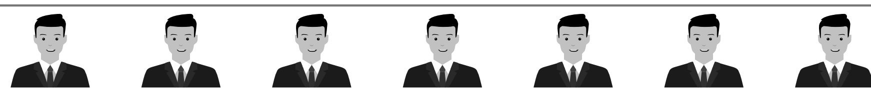
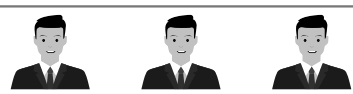
Note :

✦ Every pictograph has a key that explains what each symbol means and what number it represents. It is the scale of a pictograph.

✦ To interpret a pictograph the scale is used. We multiply the number represented by one picture with the number of pictures given for particular information.
E.g. If  = 5 boys, then  = 5 × 3 = 15 boys.

✦ A half picture in a pictograph shows half of the value given in the scale.
E.g If  = 10 boys, then  = 5 boys

1. Following is a pictograph of favourite colour of people living in Haridarshan Society :

Colour	Numbers of people  = 5 People
Red	
White	
Blue	
Black	

(1) Find the number of people who chose white colour. **7 × 5 = 35 People**

(2) How many people like black colour ? **4 × 5 = 20 People**

(3) Find the number of people who chose red colour. **6 × 5 = 30 People**

(4) Which is the least preferred colour ? By how many people it is preferred ?

Blue ; 5 × 3 = 15 people

(5) How many people in all have been surveyed ?

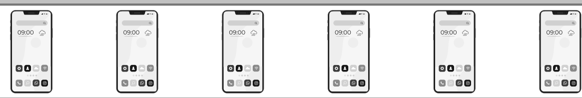
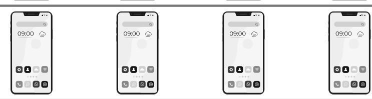
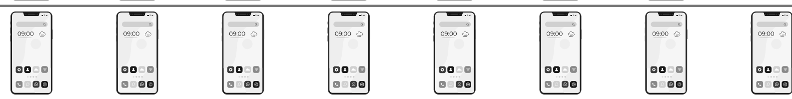
A. Total number of the people those have been surveyed

= (Total number of symbol) × Scale of one symbol

= (20) × 5

= 100 people

2. **The sale of mobiles on different days of a week is shown below :**

Days	Number of mobiles  = 2 mobiles
Monday	
Tuesday	
Wednesday	
Thursday	
Friday	
Saturday	
Sunday	

Observe the pictograph and answer the following questions :

(1) How many mobiles were sold on Thursday ?

A. (3 × 2) = 6 mobiles

(2) On which day were the maximum number of mobiles sold ? How many ?

A. Sunday ; (8 × 2) = 16 mobiles

(3) On which days were 10 mobiles sold ?

A. For 10 mobiles we must have 5 symbols ; Wednesday, Friday

(4) On which days were the same number of mobiles sold ?

A. Wednesday, Friday

(5) On which of the days, were minimum number of mobiles sold ?

A. Thursday

(6) How many mobiles were sold in the whole week ?

A. 76 mobiles

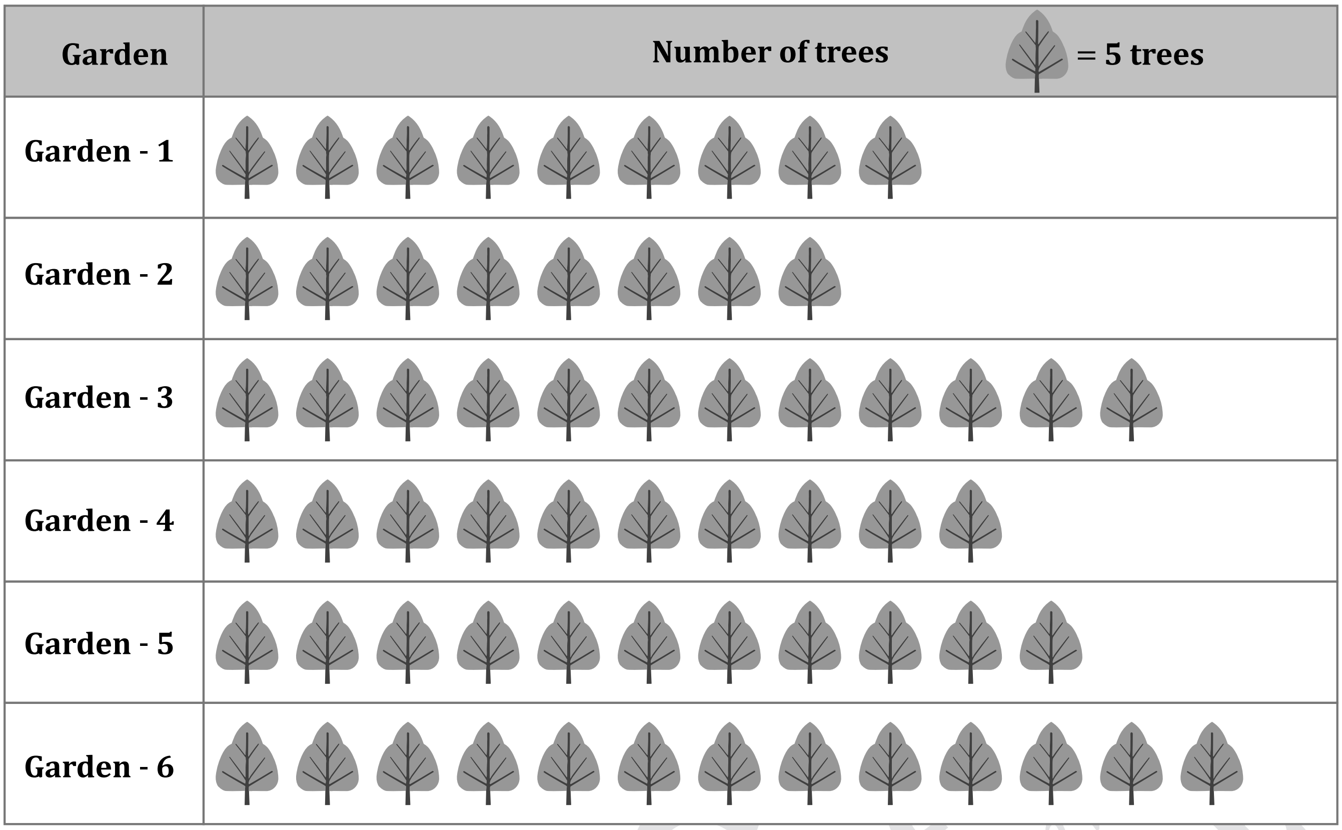
Total number of the mobiles sold in whole week

= (Total number of the symbol) × scale of one symbol

= (38 × 2)

= 76

3. Following pictograph shows the number of trees in 6 different gardens.



Answer the following questions from the pictograph.

(1) How many trees are there in garden - 4 ?

A. $(10 \times 5) = 50$ trees

(2) How many trees are there in garden - 5 ?

A. $(11 \times 5) = 55$ trees

(3) Find out the total number of trees in 6 gardens.

A. $(63 \times 5) = 315$

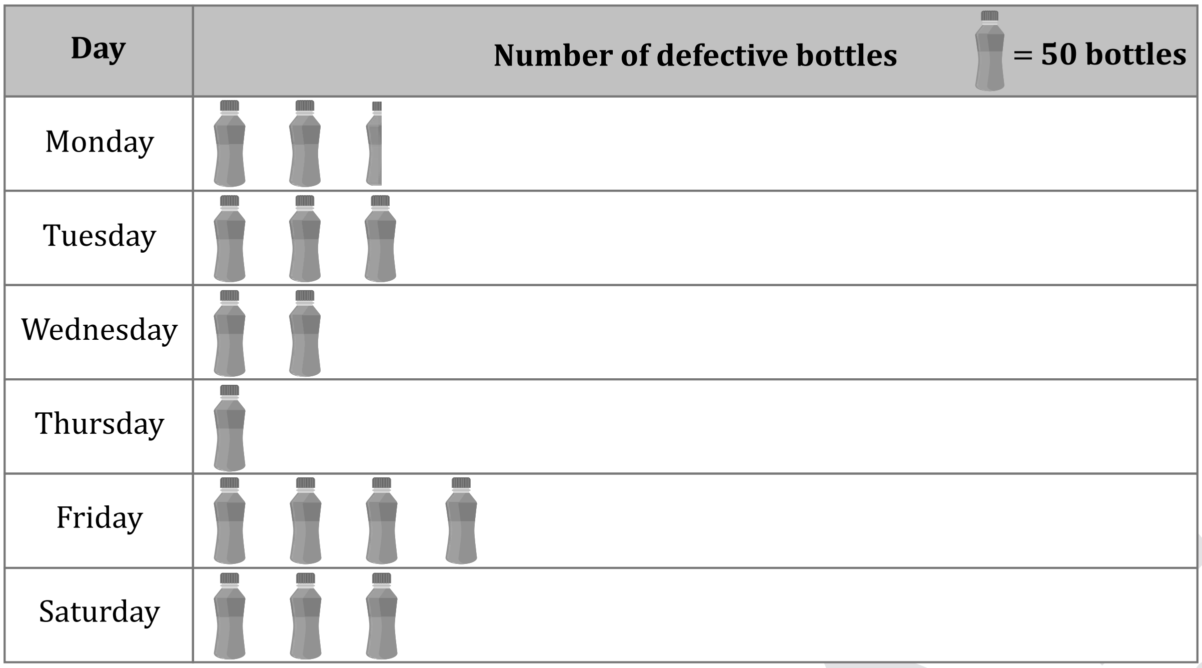
(4) Which garden has maximum number of trees ? How many ?

A. Garden 6 ; 65 trees

(5) Which garden has minimum number of trees ? How many ?

A. Garden –2 ; 40 trees

4. Following pictograph shows the number of defective bottles manufactured by a company.



Answer the following questions from the pictograph.

(1) How many defective bottles where manufactured on Monday ?

A. (2.5) × 50 = 125 bottles

(2) On which day were the maximum number of defective bottles manufactured ?

A. Friday

(3) On which day were the minimum number of defective bottles manufactured ?

A. Thursday

(4) How many defective bottles in all were manufactured during the whole week ?

A. 775 bottles

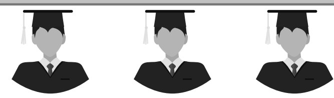
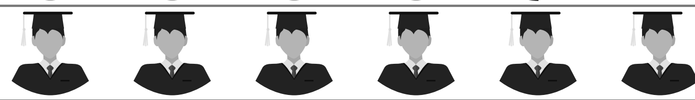
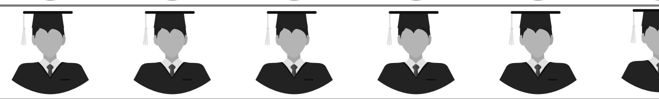
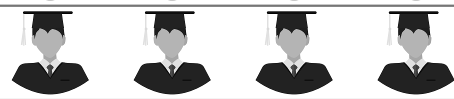
Total number of the bottle manufactured during week

= (Total number of the symbol) × scale of one symbol

= (15.5) × 5

= 775

5. A survey was carried out in a certain school to find out the popular school subject among students of class VI and VII. The data in this regard is displayed as pictograph given below.

Subject	Number of Students  = 50 Students
Hindi	
English	
Maths	
Science	
Social Science	

Answer the following questions from the pictograph.

(1) How many students in all like English or Math ?

A. (10.5) × 50 = 525 Students

(2) How many students like Science ?

A. (5.5) × 50 = 275 Students

(3) How many students like Social Science ?

A. (4) × 50 = 200 Students

(4) How many students like Hindi ?

A. (3) × 50 = 150 Students

Objective Questions

1. **Choose the correct option.**

(1) ____________ is a collection of numbers gathered to give some information. **B**

(A) Table (B) Data (C) Tally marks (D) Pictograph

(2) An observation occurring five times in a data is recorded as ____________ using tally marks. **A**

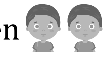
(A) 卌 (B) 卌 || (C) 卌 | (D) 卌 |||

(3) Using tally marks, which one of the following represents the number eight ? **D**

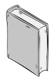
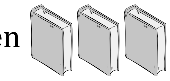
(A) ||||| ||| (B) 卌 卌 (C) 卌 || (D) 卌 |||

(4) 卌 || means that an observation is occurring ____________ times in a data. **C**

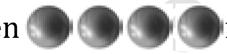
(A) 6 (B) 4 (C) 7 (D) 8

(5) In a pictograph, if a symbol  represents 10 children, then  represent ____________ children. **C**

(A) 15 (B) 10 (C) 20 (D) 30

(6) In a pictograph, if a symbol  represents 3 books, then  represent ____________ books. **C**

(A) 6 (B) 3 (C) 9 (D) 12

(7) In a pictograph, if a symbol  represents 25 marbles, then  represent ____________ marbles. **A**

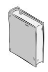
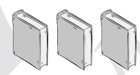
(A) 100 (B) 75 (C) 50 (D) 25

2. Fill in the blanks.

(1) **A pictograph** represents data through pictures of objects. It helps to answer the questions on the data at a glance.

(2) An observation occuring ten times in a data is represented as 卌 卌 .

(3) In a pictograph, if a symbol  represents 500 people, then  represent **1000** people.

(4) In a pictograph, if a symbol  represents 70 books, then  represent **210** books.

(5) In a pictograph, if a symbol  represents 10 chocolate, then  represent **40** chocolates.

3. Mark as '✓' or '✗'.

(1) Pictographs are often used in newspapers and magazines. ✓

(2) Data is a collection of numbers. ✓

(3) An observation occurring nine times in a data is recorded as 卌 |||| ✓

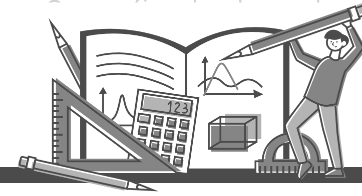
(4) An observation occurring six times in a data is recorded as 卌 卌 ✗

4. Match the following :

(1)

A (Tally Marks)	B (Value)	Answer
(1) 卌 |||	(A) 10	(1) → **D**
(2) 卌		(B) 4	(2) → **C**
(3) ||||	(C) 6	(3) → **B**
(4) 卌 卌	(D) 8	(4) → **A**

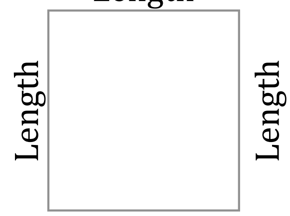
10 Mensuration



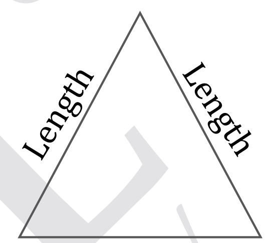
10.2 Perimeter

- **Perimeter :**
  - Perimeter is the distance covered along the boundary forming a closed figure when you go round the figure once.

Perimeter of a rectangle
= 2 × (length + breadth)



Perimeter of a square
= 4 × length of a side

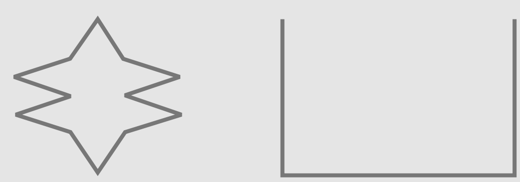


Perimeter of an equilateral triangle
= 3 × length of a side

- **Regular closed figures :**
  - Figures having all the sides of equal length and all the angles of equal measure are called **regular closed figures**.
- **Perimeter of regular shapes: :**
  - Perimeter of a regular shape = number of sides × length of a side
- **Use of perimeter in our daily life:**

  There are many uses of perimeter in our daily life. Following are some of them.
  - Perimeter of a field helps the farmer to know the cost of fencing around the field.
  - Perimeter of a garden helps a person to know the distance walked around the garden.
  - Perimeter of a piece of cloth helps to know the length of the lace required and its costing.

Note
- We can find out the perimeter of a closed figure only.
- Open shapes do not have a perimeter as they do not have a well-defined boundary.



Worth Knowing

- We can find out the perimeter of a closed figure even if it is not made of straight lines.

We can find perimeter of both these figures.

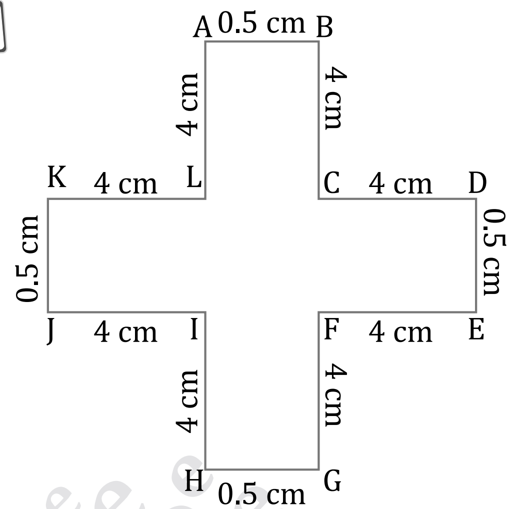
1. **Define :** perimeter **The distance covered along the boundary forming a closed figure when you go round the figure once is called perimeter.**

2. Write two situations where perimeter is required.

(1) To find the length of wire to fence a field. (2) To find the length of wooden strip required to frame a photograph.

3. **Find the perimeter of the following figures :**

Example



Here, AB = DE = GH = JK = 0.5 cm;

LA = BC = CD = EF = FG = HI = IJ = KL = 4 cm

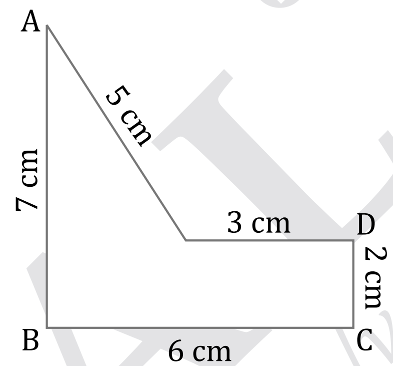
Perimeter $= 4 \times 0.5\text{ cm} + 8 \times 4\text{ cm}$

$= 4 \times \frac{5}{10}\text{ cm} + 32\text{ cm}$

$= 2\text{ cm} + 32\text{ cm}$

$\therefore$ **Perimeter = 34 cm**

(1)



Perimeter = 7 cm + 6 cm + 2 cm + 3 cm + 5 cm

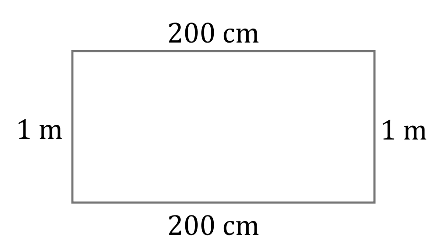
= 23 cm

$\therefore$ Perimeter = 23 cm

Example **Find the perimeter of a rectangular table-top whose length and breadth are 200 cm and 1 metre respectively.**

Length of the table = 200 cm

Breadth of the table = 1 metre = 100 cm



$\therefore$ Perimetre of the rectangular table-top = 2 × (length + breadth)

= 2 × (200 + 100) cm

= 2 × (300) = 600 cm

= 6 metre

Thus, **the perimeter of the given rectangular table top is 6m.**

4. Find the perimeter of the following rectangles :

Example **Length = 12.5 cm, Breadth = 6.5 cm**

Perimeter of a rectangle

= 2 × (length + breadth)

= 2 × (12.5 + 6.5) cm

= 2 × (19) cm

= 38 cm

Thus, **perimeter of the given rectangle = 38 cm**

(1) Length = 20 cm, Breadth = 15 cm

Perimeter of a rectangle

= 2 × (length + breadth)

= 2 × (20 + 15)

= 2 × (35)

= 70 cm

Thus, **perimeter of the given rectangle = 70 cm**

Example **Find the cost of fencing a rectangular park of length 2500 m and breadth 2000 m at the rate of ₹ 50 per metre.**

Length of the rectangular park = 2500 m

Breadth of the rectangular park = 2000 m

To find the cost of fencing, we require perimeter.

Perimeter of a rectangle = 2 × (length + breadth)

= 2 × (2500 + 2000) m

= 2 × (4500) m = 9000 m

Cost of fencing 1 m of park = ₹ 50

∴ The cost of fencing the park = ₹ 50 × 9000

= ₹ 4,50,000

Thus, **the cost of fencing the rectangular park = ₹ 4,50,000**

5. The length of a table cover is 2 m 50 cm and the width is 1 m 10 cm. The cost of putting a lace border around it is ₹ 2 per 10 cm. Find out the total cost of putting lace around the table-cover.

Length of the table cover

= 2 m 50 cm

= 2 m + 50 cm

= 200 cm + 50 cm [∵ 1m = 100 cm]

= 250 cm

Breadth of the table cover

= 1 m 10 cm

= 1 m + 10 cm

= 100 cm + 10 cm

= 110 cm

Perimeter of the table cover = 2 × (length + breadth)

= 2 × (250 cm + 110 cm)

= 2 × (360 cm) = 720 cm

The cost of putting lace for 10 cm = ₹ 2

∴ The cost of putting lace for 720 cm = $\frac{2 \times 72\not{0}}{1\not{0}}$ = ₹ 144

Thus, the total cost of putting lace around the table cover will be ₹ 144

6. **Define :** regular closed figure A figure having all the sides of equal length and all the angles of equal measure, is called a regular closed figure.

7. Find the length of one side of a square having perimeter of 40 metre.

Perimeter of a square = 4 × length of one side

40 m = 4 × length of one side

Length of one side = $\frac{40 \text{ m}}{4}$ = 10 m

8. **Find the perimeter of each of the following shapes with the given measurements :**

Example **An isosceles triangle, having equal sides each of length 5 cm and the third side is of length 4 cm.**

Perimeter of an isosceles triangle

= [2 × length of equal sides] + length of the third side

= [2 × 5 cm] + 4 cm

= 10 cm + 4 cm

= 14 cm

Thus, **the perimeter of the given isosceles triangle is 14 cm.**

(1) A triangle with the sides 5 cm, 6 cm and 8 cm

Perimeter of a triangle

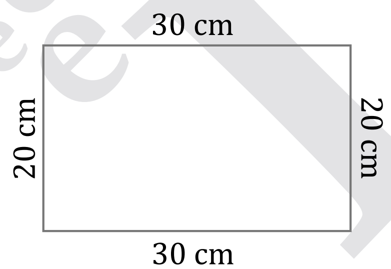
= The sum of measure of all three sides.

= 5 cm + 6 cm + 8 cm **= 19 cm**

Thus, the perimeter of the given triangle is 19 cm.

9. **What is the perimeter of each figure ?**

(1)



Perimeter of a rectangle

= 2 × (length + breadth)

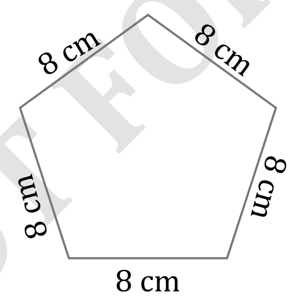
= 2 × (30 cm + 20 cm)

= 2 × (50 cm)

= 100 cm

Thus, perimeter of the given rectangle is 100 cm.

(2)



Perimeter of a regular pentagon

= 5 × (length of one side)

= 5 × 8 cm

= 40 cm

Thus, perimeter of the given pentagon is 40 cm.

Example **The perimeter of a regular hexagon is 120 cm. How long is its each side ?**

Perimeter of a regular hexagon = 6 × (length of a side)

∴ 120 cm = 6 × (length of a side)

∴ $\frac{120}{6}$ cm = length of a side

∴ length of a side = 20 cm

∴ **Length of each side of the given regular hexagon is 20 cm.**

---

10. Two sides of a triangle are 15 cm and 10 cm respectively. The perimeter of the triangle is 40 cm. What is its third side ?

Perimeter of a triangle = Sum of all three sides

∴ 40 cm = first side + second side + third side

40 cm = 15 cm + 10 cm + third side

∴ third side = 40 cm – 15 cm – 10 cm

∴ third side = 40 cm – 25 cm

∴ third side = 15 cm

∴ The measure of third side of the given triangle is 15 cm.

Example **Rahimchacha has received an order to fence a square field of side 80 m. Uncle Josh has received an order to fence an 80 m long and 60 m wide field. If both charge ₹ 20 per metre as the cost of fencing, who will receive a greater amount and by how much ?**

Rahimchacha has received an order to fence around a square field.

Length of the square field = 80 m

The perimeter of the square field = 4 × length of side

= 4 × 80 m

= 320 m

The cost to fence 1 m = ₹ 20

The cost to fence 320 m = ₹ 20 × 320

= ₹ 6400

Uncle Josh has received an order to fence around a rectangular field having length 80 m and width 60 m

The perimeter of the rectangular field $= 2 \times (\text{length} + \text{breadth})$

$= 2 \times (80 + 60)$

$= 2 \times (140)$

$= 280$ m

The cost to fence 1 m = ₹ 20

The cost to fence 280 m = ₹ 20 × 280

= ₹ 5600

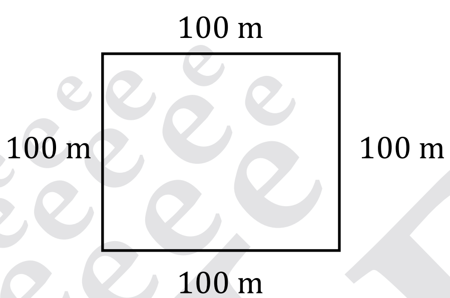
Difference in amount = ₹ 6400 – ₹ 5600

= ₹ 800

Thus, **Rahimchacha will receive ₹ 800 more than uncle Josh.**

---

11. Himanshi runs around a square field of side 100 m. Bhakti runs around a rectangle field with length 130 m and breadth 70 m. If both take 3 rounds then who covers more distance ?



- **For Himanshi :**

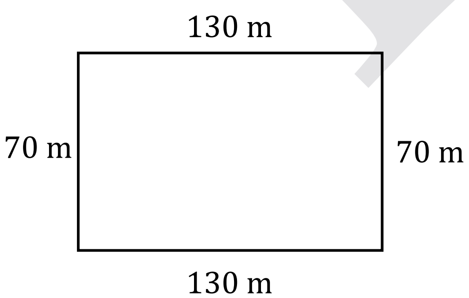
  Himanshi runs 3 round around a square field.

  So, Total distance Covered by himanshi $= 3 \times (\text{Perimeter of square})$

  $= 3 \times (4 \times 100)$

  $= 3 \times 400$

  $= 1200$ m.



- **For Bhakti :**

  Bhakti runs 3 round around a rectangle field

  So, Total distance Covered by bhakti $= 3 \times (\text{Perimeter of rectangle})$

  $= 3 \times (2 \times (70 + 130))$

  $= 3 \times 2 \times 200$

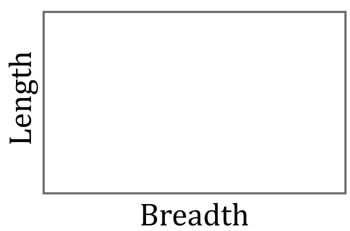
  $= 1200$ m.

Thus, himanshi and bhakti cover the same distance, so no one covers more distance.

10.3 Area

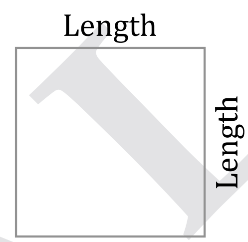
- The amount of surface enclosed by a closed figure is called its **area**.
- To calculate the area of a figure using a squared paper or graph paper where every square measures 1 cm × 1 cm, the following conventions are adopted :
  (a) The area of one full square is taken as 1 sq unit. If it is a centimetre square sheet, then area of one full square will be 1 sq cm.
  (b) Ignore portions of the area that are less than half a square.
  (c) If more than half a square is in a region, count it as one square.
  (d) If exactly half the square is counted, take its area as $\frac{1}{2}$ sq units.

Area of a Rectangle



Area of a rectangle = (length × breadth)

Area of a Square



Area of a square = length × length
= side × side

Worth Knowing

- For any given area, it is possible to predict the rectangle (considering only natural number lengths) with the greatest and the least perimeter.
  - The rectangle with greatest difference of length and breadth would have the greatest perimeter.
  - The rectangle with least difference of length and breadth would have the least perimeter.

  E.g. If the area of the rectangle is 24 sq cm, then following are the possible rectangles (consider only natural number lengths).

Dimensions of rectangle	Difference between length and breadth	Perimeter = 2 × (length + breadth)
length = 8 cm, breadth = 3 cm	8 – 3 = 5	22 cm
length = 12 cm, breadth = 2 cm	12 – 2 = 10	28 cm
length = 6 cm, breadth = 4 cm	6 – 4 = 2	20 cm

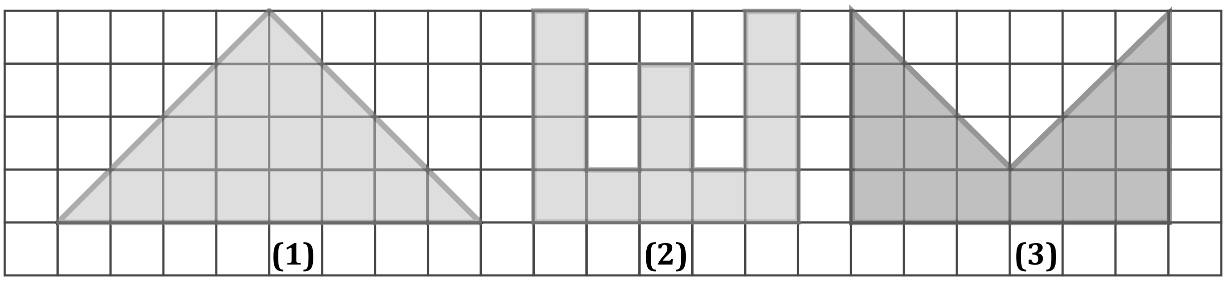
∴ Thus, the rectangle whose length and breadth are 12 cm and 2 cm respectively (greatest difference between length and breadth) has the greatest perimeter, while the rectangle whose length and breadth are 6 cm and 4 cm respectively (least difference between length and breadth) has the least perimeter.

1. **Define :** area

Ans : The amount of surface enclosed by a closed figure is called its area.

2. **Find the areas of the following figures by counting squares : (Area of 1 square = 1 sq. unit)**

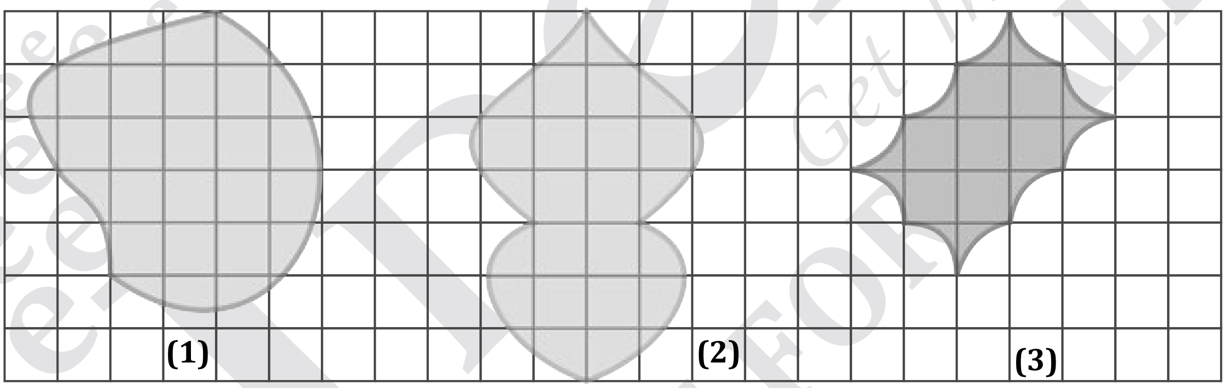
Example



Covered area (detail)	Figure (1)		Figure (2)		Figure (3)	
	Number	Area (in sq units)	Number	Area (in sq units)	Number	Area (in sq units)
(1) Fully-filled squares	12	12 sq units	13	13 sq units	12	12 sq units
(2) Half-filled squares	8	4 sq units	–	–	6	3 sq units
(3) More than half-filled squares	–	–	–	–	–	–
(4) Less than half-filled squares	–	–	–	–	–	–
Total area	–	16 sq units	–	13 sq units	–	15 sq units

---

(1)



Covered area (detail)	Figure (1)		Figure (2)		Figure (3)	
	Number	Area (in sq units)	Number	Area (in sq units)	Number	Area (in sq units)
(1) Fully-filled squares	**14**	**14**	**12**	**12**	**7**	**7**
(2) Half-filled squares	–	–	**4**	**2**	–	–
(3) More than half-filled squares	**7**	**7**	**6**	**6**	–	–
(4) Less than half-filled squares	**8**	–	**6**	–	**10**	–
Total area		**21 sq units**		**20 sq units**		**7 sq units**

3. **Find the area of the rectangles whose sides are given below :**

Example **10 cm, 12 cm**

Area of a rectangle = length × breadth

= 12 cm × 10 cm

= 120 sq cm

Thus, **area of the given rectangle is 120 sq cm.**

(1) 15 m, 13 m

Area of a rectangle = length × breadth

= 15 m × 13 m

= 195 sq m

Thus, the area of the given rectangle is 195 sq m.

4. The area of a rectangular piece of field 100 m long is 3000 sq m. Find the width of the field.

Area of the rectangular field = length × breadth

3000 sq m = 100 m × breadth

$$\text{Breadth} = \frac{3000 \text{ sq m}}{100 \text{ m}} = 30 \text{ m}$$

Breadth of the field = 30 m

5. Find the area of a rectangular piece of cloth whose length and breadth are 4 m and 2 m 25 cm respectively.

Length of cloth = 4 m

Breadth of cloth = 2 m 25 cm = 2 m + 0.25 m = 2.25 m (∵ 25 cm = 0.25 m)

Area of the rectangular cloth = length × breadth

= 4 m × 2.25 m = 9 sq m.

∴ Area of the cloth = 9 sq m.

Example **Find the cost of tiling the floor of a room 500 m wide and 300 m long at the rate of ₹ 10 per 100 sq m.**

Area of rectangular plot = length × breadth

= 500 m × 300 m = 1,50,000 sq m.

The cost of tiling for 100 sq m = ₹ 10

$$\text{The cost for 1,50,000 sq m} = \frac{1{,}50{,}000 \times 10}{100}$$

= ₹ 15,000

Thus, **total cost of tiling is ₹ 15,000.**

6. How many tiles whose length and breadth are 18 cm and 10 cm respectively will be needed to fit in a rectangular floor whose length and breadth are 150 cm and 120 cm respectively ?

Length and breadth of a rectangular tile are 18 cm and 10 cm respectively.

Area of a tile = length × breadth

= 18 cm × 10 cm

= 180 sq cm

Length and breadth of the rectangular floor are 150 cm and 120 cm respectively.

Area of the rectangular floor = length × breadth

= 150 cm × 120 cm

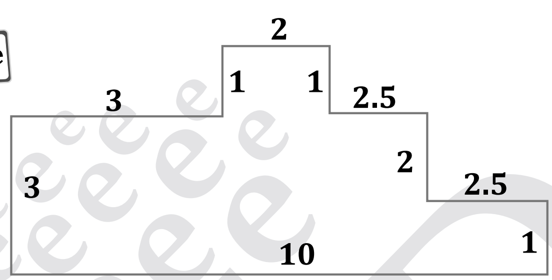
= 18,000 sq cm

Number of tiles required $= \frac{\text{Area of the floor}}{\text{Area of one tile}} = \frac{18{,}000 \text{ sq cm}}{180 \text{ sq cm}} = 100$ tiles

Thus, 100 tiles will be required.

7 By splitting the following figures into rectangles, find their areas. (The measures are given in cm)

Example



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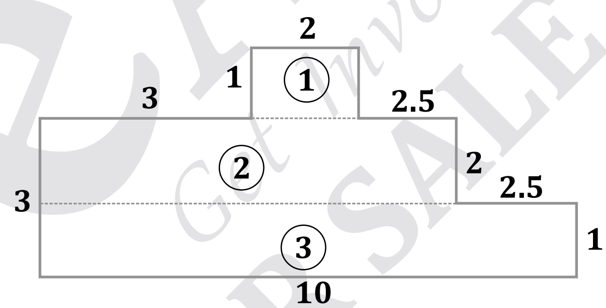


Area of rectangle (1) = length × breadth

= 2 × 1 sq cm

= 2 sq cm

Area of rectangle (2) = length × breadth

= (3 + 2 + 2.5) × 2 sq cm

= 7.5 × 2 sq cm

= 15.0 sq cm

Area of rectangle (3) = length × breadth

= 10.0 × 1 sq cm

= 10 sq cm

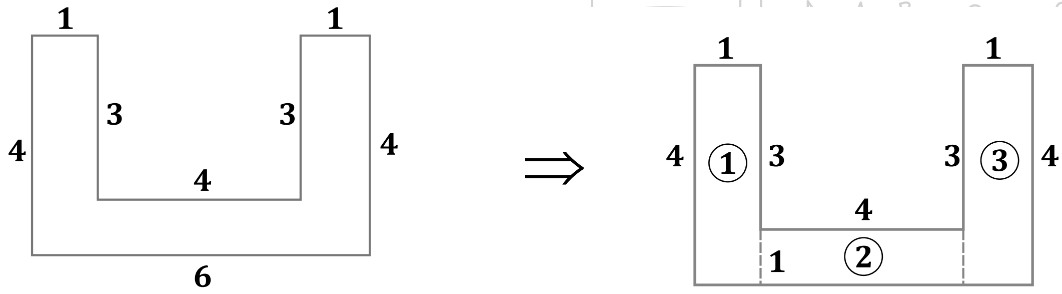
Area of the given figure = area of rectangle (1) + area of rectangle (2) + area of rectangle (3)

= 2 sq cm + 15 sq cm + 10 sq cm

= 27 sq cm

Thus, **total area of the given figure is 27 sq cm.**

(1)



Area of rectangle (1) = length × breadth
= 1 cm × 4 cm
= 4 sq cm

Area of rectangle (3) = length × breadth
= 1 cm × 4 cm
= 4 sq cm

Area of rectangle (2) = length × breadth
= 4 cm × 1 cm
= 4 sq cm

Thus, total area of the figure = Area of rectangle (1) + Area of rectangle (2) + Area of rectangle (3)
= 4 sq cm + 4 sq cm + 4 sq cm
= 12 sq cm

8. Find the areas of each of the following squares whose sides are :

(1) 18 cm

Area of a square = side × side
= 18 cm × 18 cm
= 324 sq cm

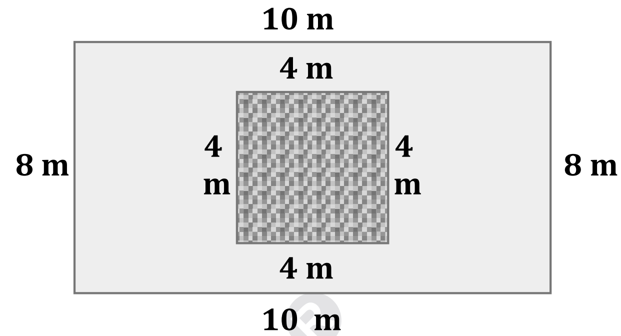
Thus, area of the given square is 324 sq cm

(2) 25 cm

Area of a square = side × side
= 25 cm × 25 cm
= 625 sq cm

Thus, area of the given square is 625 sq cm

Example **A room is 10 m long and 8 m wide. A square carpet of sides 4 m is laid on its floor. Find the area of the floor that is not carpeted.**



Length of the floor = 10 m

Breadth of the floor = 8 m

Area of the floor = length × breadth

= 10 m × 8 m

= 80 sq m

A square carpet is laid on the floor.

Area of the square carpet = side × side

= 4 m × 4 m

= 16 sq m

Area of the floor is 80 sq m but the area covered by the carpet is 16 sq m.

∴ Area of the floor that is not carpeted

= 80 sq m – 16 sq m

= 64 sq m

Thus, **64 sq m area of the floor is not carpeted.**

---

9. How many square tiles of length 20 cm will be needed to fit in a floor of the room whose length and breadth are 8 m and 8 m respectively ?

Area of the floor = length × breadth

= 8 m × 8 m

= 800 cm × 800 cm

[∵ 1 m = 100 cm]

= 6,40,000 sq cm

Area of a square tile = side × side

= 20 cm × 20 cm

= 400 sq cm

$$\therefore \text{ Number of tiles required} = \frac{\text{Area of the floor of the room}}{\text{Area of one tile}} = \frac{6{,}40{,}000 \text{ sq cm}}{400 \text{ sq cm}} = 1600$$

Thus, 1600 square tiles will be required.

Objective Questions

1. Choose the correct option.

(1) The length of a regular pentagon is ____________ cm, if its perimeter is 60 cm. **A**

(A) 12 (B) 10 (C) 15 (D) 18

(2) The length of an equilateral triangle is ____________ cm, if its perimeter is 12 cm. **A**

(A) 4 (B) 3 (C) 6 (D) 2

(3) If the length and breadth of a rectangle is 10 cm and 8 cm respectively, the area of this rectangle is ____________ sq cm. **C**

(A) 40 (B) 20 (C) 80 (D) None of these

(4) The area of a rectangle is 50 sq cm. If its breadth is 5 cm, then its length is ________ cm. **A**

(A) 10 (B) 25 (C) 250 (D) 50

(5) The area of a rectangle is 1800 sq cm. If its length is 60 cm, then its breadth is _____ cm. **D**

(A) 6 (B) 8 (C) 10 (D) 30

2. Fill in the blanks.

(1) Perimeter of a rectangle = **2 (length + breadth)**.

(2) Perimeter of a square = **4 × (side)**.

(3) Perimeter of a square is **20** cm, if its side is 5 cm.

(4) The side of a square is **15** cm, if its perimeter is 60 cm.

(5) Perimeter of an equilateral triangle = **3 × length of a side**.

(6) One side of an equilateral triangle is 15 cm. The perimeter of this triangle is **45** cm.

(7) Perimeter of regular hexagon with each side 6 cm = **36 cm**.

(8) Perimeter of a regular pentagon = **5 × length of one side**.

(9) Perimeter of a regular hexagon = **6 × length of one side**.

(10) Perimeter of a regular octagon = **8 × length of one side**.

(11) Area of a square = **side × side**.

(12) The area of a square of side 9 cm is **81** sq cm.

3. **Mark as '✓' or '✗'.**

(1) All the sides of a square are equal. ✓

(2) All the sides in an isosceles triangle are of equal length. ✗

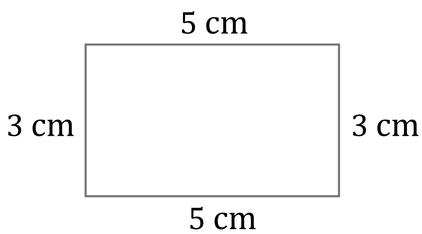
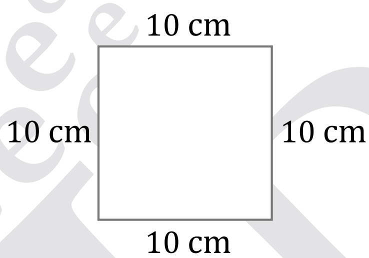
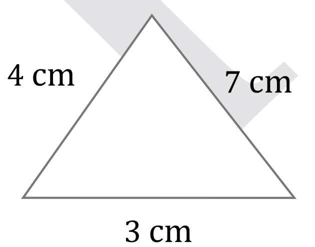
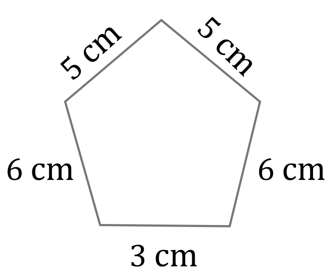
(3) Square and equilateral triangle are examples of regular closed figures. ✓

(4) The perimeter of a square and of an equilateral triangle each having side of length 5 cm, are equal. ✗

(5) The perimeter of a triangle with sides measuring 6 cm, 7 cm and 8 cm respectively is 20 cm. ✗

4. **Match the following :**

(1)

A (Figure)	B (Perimeter)	Answer
(1) 	(A) 14 cm	(1) → **B**
(2) 	(B) 16 cm	(2) → **C**
(3) 	(C) 40 cm	(3) → **A**
(4) 	(D) 25 cm	(4) → **D**

✦ ❄ ✦ ❄ ✦

11 Algebra

11.1 Matchstick Patterns and Variables

- **Arithmetic :**
  - The branch of mathematics in which we study numbers is called **arithmetic**.
- **Geometry :**
  - The branch of mathematics in which we study shapes is called **geometry**.
- **Algebra :**
  - The branch of mathematics which deals with variables and constants to represent problems in the form of mathematical expressions is called **algebra**.
- **Variable :**
  - The word 'variable' means something that can vary, i.e. change. The value of a variable is not fixed. It can take different values.

    E.g. The length of a square can have any value. It is a variable. Similarly, length of a side of a triangle is also a variable.
  - We may use any letter n, l, m, p, x, y, z, etc. to show a variable.

Note:

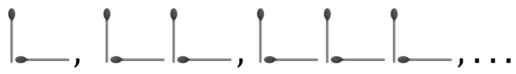
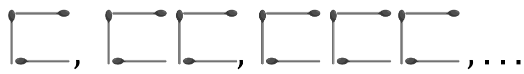
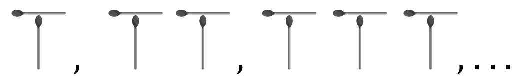
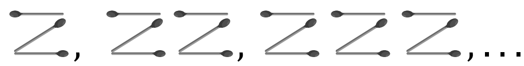
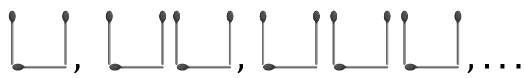
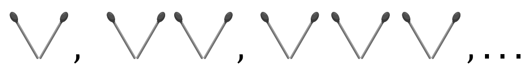
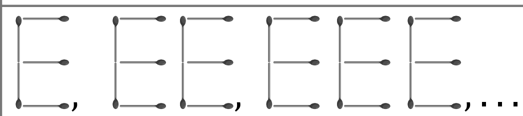
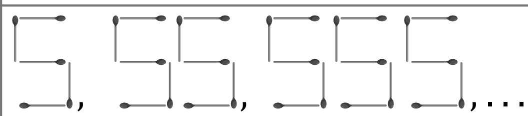
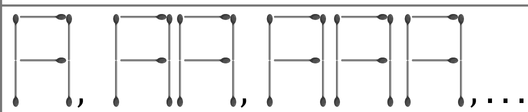
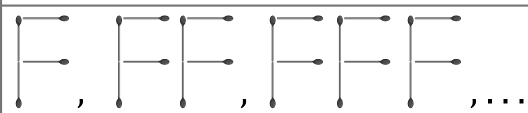
- The number 5 or the number 100 or any other given number is not a variable. They have fixed values. Similarly, the number of angles of a triangle has a fixed value i.e. 3. It is not a variable. The number of corners of a quadrilateral (4) is fixed; it is also not a variable.

Remember :

- Variables are numbers, although their value is not fixed. We can do the operations of addition, subtraction, multiplication and division on them just as in the case of fixed numbers. Using different operations we can form expressions with variables.

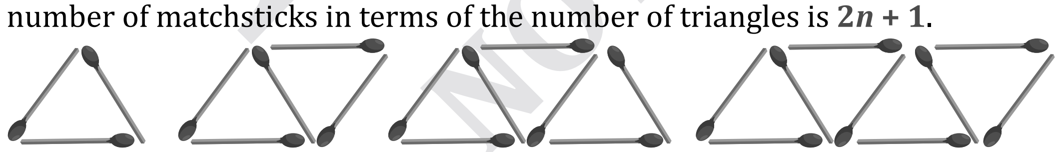
  E.g. : $x - 3$, $x + 3$, $2n$, $5m$, $\frac{m}{4}$, $2y + 3$, $3l - 5$ etc.

- **Matchstick Patterns :**
  - We can understand patterns of making letters and other shapes using matchsticks.
  - We can write the general relation between the number of matchsticks required for repeating a given shape.
  - The number of times a given shape is repeated varies; it takes on values 1,2,3,.... . It is a variable, denoted by some letter like n.

n is the number of letter in the pattern		
Letter	**Pattern of letters**	**Rule for number of matchsticks**
L		$2n$
C		$3n$
T		$2n$
Z		$3n$
U		$3n$
V		$2n$
E		$5n$
S		$5n$
A		$6n$
F		$4n$

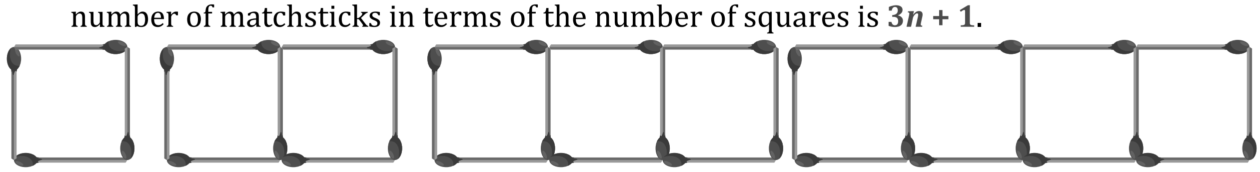
Remember :

- Look at the following matchstick pattern of triangles. The triangles are not separate. Two neighbouring triangles have a common matchstick. Thus, the rule that gives the number of matchsticks in terms of the number of triangles is $\mathbf{2n + 1}$.



(a) (b) (c) (d)

- Similarly, in the following matchstick pattern of squares, the squares are not separate. Two neighbouring squares have a common matchstick. Thus, the rule that gives the number of matchsticks in terms of the number of squares is $\mathbf{3n + 1}$.



(a) (b) (c) (d)

1. **Find the rule which gives the number of matchsticks required to make the following matchstick patterns. Use a variable to write the rule :**

Example **A pattern of the letter Z :**

To form one (*n* = 1), number of matchsticks required = 3 = 3 × 1

To form two (*n* = 2) number of matchsticks required = 6 = 3 × 2

To form three (*n* = 3) number of matchsticks required = 9 = 3 × 3

To form four (*n* = 4) number of matchsticks required = 12 = 3 × 4

Thus, to form '*n*' , number of matchsticks required = 3 × *n* = 3*n*

---

(1) A pattern of the letter U :

To form one (n = 1), number of matchsticks required = 3 = 3 × 1

To form two (n = 2), number of matchsticks required = 6 = 3 × 2

To form three (n = 3), number of matchsticks required = 9 = 3 × 3

To form four (n = 4), number of matchsticks required = 12 = 3 × 4

Thus, to form 'n' , number of matchsticks required = 3 × n = 3n

---

(2) A pattern of the letter S :

To form one (n = 1), number of matchsticks required = 5 = 5 × 1

To form two (n = 2), number of matchsticks required = 10 = 5 × 2

To form three (n = 3), number of matchsticks required = 15 = 5 × 3

Thus, to form 'n' number of matchsticks required is 5n

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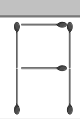
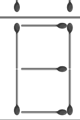
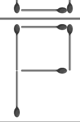
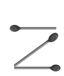
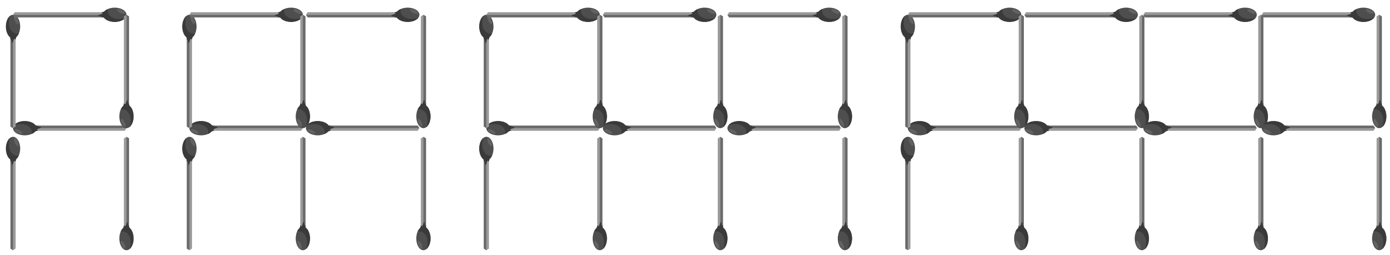
2. **Complete the table :**

Letter	**Number of letter**	**Number of matchsticks required**	**Rule for pattern**
	1	6	6*n*
	3	7 × 3 = 21	7*n*
	4	20	5*n*
	5	15	3*n*

3. **Look at the following pattern. Observe the patterns and find the rule that gives the number of matchsticks. :**



(1) (2) (3) (4)

(1) Number of As = 1 Number of matchsticks = 6 = 4 × 1 + 2	(2) Number of As = 2 Number of matchsticks = 10 = 4 × 2 + 2
(3) Number of As = 3 Number of matchsticks = 14 = 4 × 3 + 2	(4) Number of As = 4 Number of matchsticks = 18 = 4 × 4 + 2

Thus, to form a number of As, number of matchsticks

= 4 × n + 2

= 4n + 2

Example **There are 50 oranges in a box. How will you write total numbers of oranges in terms of the number of boxes ? (Hint: Use *n* for number of boxes)**

Number of oranges in 1 box = 50 Number of boxes = n

Number of oranges in 1 box = 50 = 50 × n

Number of oranges in 2 boxes = 100 = 50 × n

Number of oranges in 3 boxes = 150 = 50 × n

Thus, number of oranges in n boxes = 50 × n

= **50*n***

4. A bird flies 2 kilometres in a minute. If it flies for t minutes, then how much distance will it cover ?

Distance covered in one minute = 2 km = 2 km × 1

Distance covered in 2 minutes = 4 km = 2 km × 2

Distance covered in 3 minutes = 6 km = 2 km × 3

Thus, distance covered in t minutes = 2 km × t = $2t$ km

5. Joy is Kuldeep's elder brother. Joy is 5 years older than Kuldeep. Write Joy's age based on the age of Kuldeep. (Hint : Kuldeep's age is *n* years)

Let Kuldeep's age be n years.

Now, Joy is 5 years older than Kuldeep.

∴ Joy's age = (Kuldeep's age) + 5 years

∴ Joy's age = n years + 5 years = (n + 5) years

Thus, Joy's age will be (n + 5) years.

---

6. The teacher distributes 3 pencils per student. Can you tell how many pencils are needed, given the number of students ?(Hint : Use *s* for the number of students.)

Required number of the pencils for one student = $3 \times 1 = 3$

Required number of the pencils for 2 students = $3 \times 2 = 6$

Required number of the pencils for 3 students = $3 \times 3 = 9$

Thus,

For 's' number of the student required number of the pencils are $3 \times s = 3s$.

---

7. Cadets are marching in a parade. There are 3 cadets in a row. What is the rule which gives the number of cadets, given the number of row ? (Hint : Use *n* for the number of rows.)

For one row number of the cadets = 3×1

For two row number of the cadets = 3×2

For three row number of the cadets = 3×3

Thus,

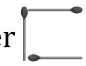
For n number of the row, number of the cadets = $3 \times n = 3n$

Objective Questions

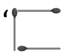
1. Choose the correct option.

(1) 'Number of matchsticks required = $2n$'. Find the variable, in the given rule. **C**

(A) 2 (B) $2n$ (C) n (D) All of these

(2) How many matchsticks are needed to form the letter  ? **B**

(A) 2 (B) 3 (C) 4 (D) 5

(3) If 'n' is the number of ''s, then the rule for number of matchsticks required is ________. **C**

(A) n (B) $2n$ (C) $3n$ (D) $4n$

(4) If there are five triangles in a pattern such that two neighbouring triangles have a common matchstick, then the number of matchsticks used is ________. **C**

(A) 9 (B) 7 (C) 11 (D) 13

(5) How many matchsticks are required to make a pattern of 10 Fs ? **D**

(A) 4 (B) 10 (C) 14 (D) 40

(6) If $n = 3$ then $4n$ = ____________. **D**

(A) 2 (B) 8 (C) 24 (D) 12

(7) If there are 15 apples in a box, then the rule for the number of apples in n number of boxes is ____________. **C**

(A) $15 + n$ (B) $15 - n$ (C) $15n$ (D) 15

(8) If there are five squares in a pattern such that two neighbouring squares have a common matchsticks then the number of matchsticks used is ____________. **C**

(A) 12 (B) 10 (C) 16 (D) 9

2. Fill in the blanks.

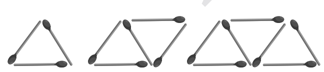
(1) Number of matchsticks required to form the letter 'L' = **2**.

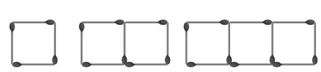
(2) If number of matchsticks used is 6 then number of 'L' formed is **3**.

(3) Number of matchsticks required to form 100 'L' s is **200**.

(4) If 'n' is the number of 'T's, then the rule for number of matchsticks required is **$2n$**.

(5) If 'n' is the number of 'V's, then the rule for number of matchsticks required is **$2n$**.

(6) In the matchstick pattern , if n is the number of  in the pattern then the number of matchsticks required is **$2n + 1$**.

(7) If n is the number of  s in the matchstick pattern  then the number of matchsticks required is given by the rule **$3n + 1$**.

(8) In the three squares made of adjacent matchsticks, there are **10** matchsticks.

(9) If there are 20 mangoes in a box, then the rule for the number of mangoes in n number of boxes is **$20n$**.

(10) If there are 50 oranges in a basket, then the rule for the number of oranges in n number of baskets is **$50n$**.

(11) If $n = 2$ then, $5n =$ **10**.

(12) If $n = 1$ then, $3n =$ **3**.

3. Mark as '✓' or '✗'.

(1) Number of matchsticks required to form 150 'L' would be 75. ✗

(2) The value of a variable is not fixed. ✓

(3) Letters like x, y, z, etc. can also be used to denote a variable. ✓

(4) A variable can take different values. ✓

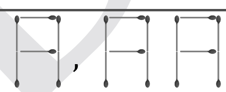
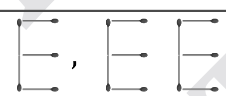
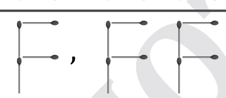
(5) If $n = 10$, then $5n = 60$. ✗

(6) If $n = 5$, then $9n = 45$. ✓

(7) Number of matchsticks required to form 10 triangles such that two neighbouring triangles have a common matchstick is 21. ✓

4. Match the following :

(1)

A	B	Answer
(1) A pattern of letter V as 	(A) $5n$	(1) → **C**
(2) A pattern of letter A as 	(B) $4n$	(2) → **D**
(3) A pattern of letter E as 	(C) $2n$	(3) → **A**
(4) A pattern of letter F as 	(D) $6n$	(4) → **B**

12 Ratio and Proportion

12.2 Ratio

- **Ratio :**
  - When the comparison between any two quantities is done in terms of 'how many times', then this comparison is known as the **ratio**.
  - We denote ratio using symbol ':' and it is read as '**is to**'.

    E.g. 3 : 1 is read as 3 is to 1.

    E.g. Cost of one pen is ₹ 5 and the cost of one pencil is ₹ 1. How many times is the cost of a pen that of a pencil? It is **five times**.

    Thus, the ratio of the cost of a pen to the cost of a pencil $= \frac{₹5}{₹1}$

    $= \frac{5}{1}$

    $= 5 : 1$

Remember :

- For comparison by ratio, the two quantities must be in the same unit. If they are not, they should be expressed in the same unit before the ratio is taken.

  - The same ratio may occur in different situations.

    E.g. Ratio of the breadth of a table to the length of the table is **2 : 3**.

    Rina has 2 marbles and her friend Maya has 3 marbles. Then, the ratio of marbles that Maya and Rina have is also **2 : 3**.

Note :

- The ratio 3 : 2 is different from 2 : 3. Thus, the order in which quantities are taken to express their ratio is important.

  - A ratio may be treated as a fraction, thus the ratio 10 : 3 may be treated as $\frac{10}{3}$.

- **Equivalent Ratios :**
  - Two ratios are equivalent, if the fractions corresponding to them are equivalent. Thus, 3 : 2 is equivalent to 6 : 4 or 12 : 8 because 3 : 2 $= \frac{3}{2} = \frac{3 \times 2}{2 \times 2} = \frac{6}{4}$. Also, $\frac{3 \times 4}{2 \times 4} = \frac{12}{8}$

- **Lowest Form of a Ratio :**
  - A ratio can be expressed in its lowest form in the same way as a fraction.

    E.g. ratio 50 : 15 is treated as $\frac{50}{15}$; in its lowest form $\frac{50}{15} = \frac{10}{3}$.

    Hence, the lowest form of the ratio 50 : 15 is 10 : 3.

Note :

✦ 30 : 20 and 24 : 16 are equivalent ratios because the lowest form of both the ratios is 3 : 2.

1. Find the ratio of the following :

Example **63 to 105**

$\frac{63}{105} = \frac{63 \div 7}{105 \div 7}$

$= \frac{9}{15}$

$= \frac{9 \div 3}{15 \div 3}$

$= \frac{3}{5}$

∴ The ratio of 63 to 105 = **3 : 5**

(1) 95 to 55

$\frac{95}{55} = \frac{95 \div 5}{55 \div 5}$

$= \frac{19}{11}$

= 19 : 11

The ratio of 95 to 55 = 19 : 11

(2) 120 to 90

$\frac{120}{90} = \frac{120 \div 10}{90 \div 10}$

$= \frac{12}{9}$

$= \frac{12 \div 3}{9 \div 3}$

$= \frac{4}{3}$

= 4 : 3

The ratio of 120 to 90 = 4 : 3

2. Find the ratio of the following :

Example **35 km to 140 km**

35 km to 140 km $= \frac{35 \div 35}{140 \div 35}$

$= \frac{1}{4}$

= **1 : 4**

(1) 60 seconds to 15 seconds

$= \frac{60 \div 15}{15 \div 15}$

$= \frac{4}{1}$

= 4 : 1

(2) 30 paise to ₹ 1

₹ 1 = 100 paise

30 paise to ₹ 1 $= \frac{30 \text{ paise}}{100 \text{ paise}}$

$= \frac{3}{10}$

Thus, ratio = 3 : 10

(3) 1500 mL to 4 litres

1 litre = 1000 mL

∴ 4 litres = 4 × 1000 mL

= 4000 mL

Example **There are 30 boys and 20 girls in class-6. What will be the ratio of the total number of boys to the total number of girls ?**

The total number of boys = 30 ; The total number of girls = 20

$\therefore$ The ratio of the number of boys to the number of girls $= \dfrac{\text{total number of boys}}{\text{total number of girls}}$

$= \dfrac{30}{20}$

$= \dfrac{30 \div 10}{20 \div 10}$

$= \dfrac{3}{2} = 3:2$

Hence, **the ratio of number of boys to the number of girls is 3 : 2.**

---

3. A toy costs ₹ 50, while a bag costs ₹ 200. Find the ratio of the cost of the toy to the cost of a bag.

The cost of a toy = ₹ 50 ; The cost of a bag = ₹ 200

$\therefore$ The ratio of the cost of a toy to the cost of a bag $= \dfrac{\text{The cost of a toy}}{\text{The cost of a bag}}$

$= \dfrac{₹\,50}{₹\,200} = \dfrac{50 \div 50}{200 \div 50} = \dfrac{1}{4} = 1:4$

Hence, the ratio of the price of a toy and the price of a bag is 1 : 4.

Example **A school has 73 holidays during a year. Find the ratio of the following :**
(1) Number of working days to the number of holidays. (2) Number of holidays to the number of working days. (3) Number of holidays to the total number of days in a year. (4) Number of working days to the total number of days in a year.

Total number of days in a year = 365; Number of holidays = 73

Number of working days = 365 – 73 = 292

(1) The ratio of number of working days to number of holidays $= \dfrac{292}{73}$

$= \dfrac{292 \div 73}{73 \div 73}$

$= \dfrac{4}{1}$

$\therefore$ **The ratio of number of working days to number of holidays is 4 : 1.**

(2) The ratio of number of holidays to the number of working days $= \frac{73}{292}$

$= \frac{73 \div 73}{292 \div 73}$

$= \frac{1}{4}$

∴ **The ratio of number of holidays to the number of working days is 1 : 4.**

(3) The ratio of number of holidays to the total number of days in a year $= \frac{73}{365}$

$= \frac{73 \div 73}{365 \div 73}$

$= \frac{1}{5}$

∴ **The ratio of number of holidays to the total number of days in a year is 1 : 5.**

(4) The ratio of number of working days to the total number of days in a year $= \frac{292}{365}$

$= \frac{292 \div 73}{365 \div 73}$

$= \frac{4}{5}$

∴ **The ratio of number of working days to the total number of days in a year is 4 : 5.**

4. A dozen bananas costs ₹ 60 and a dozen apples costs ₹ 240. Find the ratio of the cost of a banana to the cost of an apple.

A cost of 1 banana $= \frac{₹60}{12} = ₹5$

Cost of apple $= \frac{₹240}{12} = ₹20$

∴ $\frac{\text{The price of 1 banana}}{\text{The price of 1 apple}} = \frac{₹5}{₹20} = \frac{1}{4}$

∴ The ratio of the cost of a banana to the cost of an apple is 1 : 4.

5. There are 15000 students in a university, of which 8500 are boys and 6500 are girls. Find the ratio of number of boys to the number of girls.

$$\frac{\text{Number of boys}}{\text{Number of girls}} = \frac{8500}{6500}$$

$$= \frac{8500 \div 100}{6500 \div 100}$$

$$= \frac{85}{65}$$

$$= \frac{85 \div 5}{65 \div 5}$$

$$= \frac{17}{13}$$

Thus the ratio of the number of boys to the number of girls = 17 : 13.

6. **Maulik earns ₹ 5,00,000 in two years and saves ₹ 3,50,000. Find the ratio of the following:**

(1) The amount Maulik earns to the amount he saves.

Maulik's total income = ₹ 5,00,000

Maulik's total savings = ₹ 3,50,000

The ratio of the amount he earns to the amount he saves

$$= \frac{\text{total income}}{\text{total savings}}$$

$$= \frac{₹\ 5,00,000}{₹\ 3,50,000}$$

$$= \frac{5,00,000 \div 50,000}{3,50,000 \div 50,000}$$

$$= \frac{10}{7}$$

$= 10 : 7$

(2) The amount Maulik saves to the amount he spends.

The amount Maulik spends =

His earnings – His savings

= ₹ 5,00,000 – ₹ 3,50,000 = ₹ 1,50,000

∴ The ratio of the amount he saves to the amount he spends

$$= \frac{\text{total savings}}{\text{total expenditure}}$$

$$= \frac{₹\ 3,50,000}{₹\ 1,50,000}$$

$$= \frac{3,50,000 \div 50,000}{1,50,000 \div 50,000}$$

$$= \frac{7}{3}$$

$= 7 : 3$

7. The current age of mother is 36 years and the current age of her daughter is 12 years. Find the ratio of the following :

(1) Mother's age to her daughter's age after 6 years from now.

Mother's current age = 36 years

Daughter's current age = 12 years

6 years later :

Mother's age = 36 years + 6 years = 42 years

Daughter's age = 12 years + 6 years = 18 years

The ratio of mother's age to daughter's age

$$= \frac{42 \text{ years}}{18 \text{ years}} = \frac{42 \div 6}{18 \div 6}$$

[∵ H.C.F. of 42 and 18 is 6]

$$= \frac{7}{3} = 7 : 3$$

Thus, ratio of mother's age to daughter's age after 6 years will be 7 : 3.

(2) Mother's age to her daughter's age 8 years ago.

Mother's current age = 36 years

Daughter's current age = 12 years

8 years ago :

Mother's age = 36 years − 8 years = 28 years

Daughter's age = 12 years − 8 years = 4 years

The ratio of mother's age and daughter's age

$$= \frac{28 \text{ years}}{4 \text{ years}} = \frac{28 \div 4}{4 \div 4}$$

[∵ H.C.F. of 28 and 4 is 4]

$$= \frac{7}{1} = 7 : 1$$

Thus, ratio of mother's age to daughter's age 8 years ago was 7 : 1.

8. **Fill in the following blanks :**

Example $\frac{10}{15} = \frac{2}{\square} = \frac{\square}{27} = \frac{30}{\square}$

$\frac{10}{15} = \frac{2}{\square}$

∴ $10 \times \square = 2 \times 15$

∴ $\square = \frac{2 \times 15}{10} = 3$

$\frac{10}{15} = \frac{\square}{27}$

∴ $10 \times 27 = \square \times 15$

∴ $\square = \frac{10 \times 27}{15} = 18$

$\frac{10}{15} = \frac{30}{\square}$

∴ $\square = \frac{30 \times 15}{10} = 45$

∴ $\frac{10}{15} = \frac{2}{\boxed{3}} = \frac{\boxed{18}}{27} = \frac{30}{\boxed{45}}$

(1) $\frac{6}{9} = \frac{\square}{12} = \frac{18}{\square} = \frac{\square}{36}$

Doing cross multiplication in each,

$\frac{6}{9} = \frac{\square}{12}$ ∴ $\square = \frac{6 \times 12}{9} = 8$

$\frac{6}{9} = \frac{18}{\square}$ ∴ $\square = \frac{18 \times 9}{6} = 27$

$\frac{6}{9} = \frac{\square}{36}$ ∴ $\square = \frac{6 \times 36}{9} = 24$

∴ $\frac{6}{9} = \frac{\boxed{8}}{12} = \frac{18}{\boxed{27}} = \frac{\boxed{24}}{36}$

9. Rohitbhai and Rafiqbhai were paid ₹ 3600 for the work they have done by working together. Rohitbhai has worked for 15 hours while Rafiqbhai has worked for 12 hours to complete the work. Divide the amount between the two as per the ratio of their working hours.

Working hours of Rohit bhai = 15 hours

Working hours of Rafiq bhai = 12 hours

Ratio of working hours of Rohit bhai to Rafiq bhai = $\frac{15 \text{ hours}}{12 \text{ hours}} = \frac{5}{4} = 5 : 4$

The sum of the two parts of the ratio 5 : 4 = 5 + 4 = 9

Rohit bhai's share = $\frac{5}{9} \times ₹3600 = ₹2000$

Rafiq bhai's share = $\frac{4}{9} \times ₹3600 = ₹1600$

Thus, Rohitbhai will get ₹ 2000 while Rafiqbhai will get ₹ 1600.

12.3 Proportion

- Four quantities are said to be in **proportion**, if the ratio of the first and the second quantities is equal to the ratio of the third and the fourth quantities.
- E.g. 3, 10, 15, 50 are in proportion, since $\frac{3}{10} = \frac{15}{50}$.
- We indicate the proportion by 3 : 10 :: 15 : 50, it is read as 3 is to 10 as 15 is to 50.
- In a statement of proportion, the four quantities involved when taken in order are known as respective **terms**. First and fourth terms are known as **extreme terms**. Second and third terms are known as **middle terms**.

  E.g. In the proportion 3 : 10 :: 15 : 50, 3 and 50 are the extreme terms and 10 and 15 are the middle terms.

Remember :

- The order of terms in the proportion is important. 3, 10, 15 and 50 are in proportion, not 3, 10, 50, 15.

Remember :

✦ if a, b, c and d are in proportion then,

middle term, middle term

$a : b :: c : d$

first term, last term

Here, first term is a , last term is b , middle terms are c and d.

1. Determine if the following are in proportion :

Example 9, 12, 6, 8

Ratio of 9 to 12 $= \frac{9}{12} = \frac{9 \div 3}{12 \div 3} = \frac{3}{4}$

$= 3 : 4$

Ratio of 6 to 8 $= \frac{6}{8} = \frac{6 \div 2}{8 \div 2} = \frac{3}{4}$

$= 3 : 4$

Thus 9 : 12 = 6 : 8

∴ **9, 12, 6, 8 are in proportion.**

(1) 15, 5, 18, 6

Ratio of 15 to 5

$= \frac{15}{5} = \frac{15 \div 5}{5 \div 5}$

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

Ratio of 18 to 6

$= \frac{18}{6} = \frac{18 \div 6}{6 \div 6}$

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

Thus 15 : 5 = 18 : 6

∴ **15, 5, 18, 6 are in proportion.**

(2) 98, 49, 78, 26

Ratio of 98 to 49 =

$\frac{98}{49} = \frac{49 \times 2}{49 \times 1} = \frac{2}{1}$

Ratio of 78 to 26 =

$\frac{78}{26} = \frac{26 \times 3}{26 \times 1} = \frac{3}{1}$

Thus, $98 : 49 \neq 78 : 26$

∴ 98, 49, 78, 26 are not in proportion.

2. Check if the following statements are true or false :

(1) 20 boys : 100 boys = ₹ 10 : ₹ 50

20 boys : 100 boys $= \frac{20 \text{ boys}}{100 \text{ boys}} = \frac{20}{100} = \frac{20 \div 20}{100 \div 20} = \frac{1}{5} = 1 : 5$

₹ 10 : ₹ 50 $= \frac{₹10}{₹50} = \frac{10}{50} = \frac{10 \div 10}{50 \div 10} = \frac{1}{5}$

$= 1 : 5$

Thus, both ratios are equal. 20 boys : 100 boys = ₹ 10 : ₹ 50 is true.

(2) 90 km : 45 km = 7 hours : 14 hours

$$90 \text{ km} : 45 \text{ km} = \frac{90 \text{ km}}{45 \text{ km}} = \frac{90}{45} = \frac{90 \div 45}{45 \div 45} = \frac{2}{1} = 2:1$$

$$7 \text{ hours} : 14 \text{ hours} = \frac{7 \text{ hours}}{14 \text{ hours}} = \frac{7}{14} = \frac{7 \div 7}{14 \div 7} = \frac{1}{2} = 1:2$$

Thus, both ratios are not equal.

∴ 90 km : 45 km = 7 hours : 14 hours is false.

3. Determine if the following ratios form a proportion. Also, write the middle terms and extreme terms where the ratios form a proportion :

Example **100 minutes : 160 minutes and 600 second : 2000 second**

$$100 \text{ minutes} : 160 \text{ minutes} = \frac{100 \text{ minutes}}{160 \text{ minutes}} = \frac{100}{160} = \frac{100 \div 20}{160 \div 20} = \frac{5}{8} = 5:8$$

$$600 \text{ second} : 2000 \text{ second} = \frac{600 \text{ second}}{2000 \text{ second}} = \frac{600}{2000} = \frac{600 \div 200}{2000 \div 200} = \frac{3}{10} = 3:10$$

Here, both ratios are not equal.

Thus, **they do not form a proportion.**

(1) 5 kg : 20 kg and 100 g : 400 g

$$5 \text{ kg} : 20 \text{ kg} = \frac{5 \text{ kg}}{20 \text{ kg}} = \frac{5}{20} = \frac{5 \div 5}{20 \div 5} = \frac{1}{4} = 1:4$$

$$100 \text{ g} : 400 \text{ g} = \frac{100 \text{ g}}{400 \text{ g}} = \frac{100}{400} = \frac{100 \div 100}{400 \div 100} = \frac{1}{4} = 1:4$$

Both Ratios are equal.

∴ 5 kg : 20 kg and 100 g : 400 g are in proportion.

Here, middle terms are 20 kg and 100 g and extreme terms are 5 kg and 400 g

12.4 Unitary Method

- **Unitary Method :**
  - The method in which first we find the value of one unit and then the value of required number of units is known as **Unitary Method**.

    E.g. Suppose the cost of 20 pens is ₹ 40. To find the cost of 50 pens, using the unitary method, we first find the cost of 1 pen. It is ₹ $\frac{40}{20}$ = ₹ 2.

    From this, we find the price of 50 pens as ₹ 2 × 50 = ₹ 100.

---

1. What is unitary method ?

A. The method in which first we find the value of one unit and then the value of required number of units is known as unitary method.

Example **What is the cost of 8 kg rice if the cost of 5 kg rice is ₹ 250 ?**

Cost of 5 kg rice = ₹ 250

∴ Cost of 1 kg rice = $\frac{250}{5}$

= ₹ 50

∴ Cost of 8 kg rice = ₹ 50 × 8

= ₹ 400

∴ **Cost of 8 kg rice is ₹ 400.**

---

2. A car needs 55 litres of petrol to cover a distance of 605 km. How many litres of petrol is required to cover a distance of 715 km ?

Petrol required to cover a distance of 605 km = 55 litres

∴ Petrol required to cover a distance of 1 km $= \left(\frac{55}{605}\right)$ litres $= \left(\frac{55 \div 55}{605 \div 55}\right)$ litres $= \frac{1}{11}$ litres

∴ Petrol required to cover a distance of 715 km $= \left(715 \times \frac{1}{11}\right)$ litres = 65 litres

∴ 65 litres of petrol will be required to cover a distance of 715 km.

3. Jatin earns ₹ 8500 in 15 days. How much money will he earn in a month of 30 days?

Jatin's earnings in 15 days = ₹ 8500

∴ Jatin's earning in 1 day = ₹ $\left(\frac{8500}{15}\right)$

$= ₹\ \frac{8500}{15}$

∴ Jatin's earning in 30 days = ₹ $\left(\frac{8500}{15}\right) \times 30$

$= ₹\ 8500 \times 2$

$= ₹\ 17000$

∴ Jatin will earn ₹ 17000 in one month.

---

4. Cost of 300 safety pins is ₹ 25. How many safety pins can be purchased for ₹ 8 ?

With ₹ 25, the number of pins that can be purchased = 300

with ₹ 1, number of pins that can be purchased = $\frac{300}{25}$

with ₹ 8, number of pins that can be purchased = $\frac{300}{25} \times 8 = 96$

96 pins can be purchased with ₹ 8.

---

5. Mayank gave 56 runs in 7 overs while Krunal gave 56 runs in 8 overs. Find out the number of runs given by each one of them.

For Mayank,

Runs given in 7 overs = 56

∴ Runs given in 1 over $= \frac{56}{7} = 8$

For Krunal,

Runs given in 8 overs = 56

Runs given in 1 over $= \frac{56}{8} = 7$

Thus, Mayank gave 8 runs per over and Krunal gave 7 runs per over.

Objective Questions

1. Choose the correct option.

(1) The comparison by ratio means comparing quantities by using ______________. **D**

(A) addition (B) subtraction (C) multiplication (D) division

(2) The ratio of 50 paise to 30 paise is ______________. **A**

(A) 5 : 3 (B) 3 : 5 (C) 10 : 3 (D) 3 : 10

(3) The ratio of 20 km to 15 km is ______________. **C**

(A) 3 : 4 (B) 10 : 5 (C) 4 : 3 (D) 4 : 1

(4) The ratio of 70 litres to 35 litres is ______________. **B**

(A) 1 : 2 (B) 2 : 1 (C) 7 : 5 (D) 5 : 7

(5) The ratio of 80 paise to ₹ 4 is ______________. **A**

(A) 1 : 5 (B) 5 : 1 (C) 8 : 4 (D) 4 : 8

(6) If the cost of 10 erasers is ₹ 50, then the cost of 5 erasers will be ₹ ______________. **B**

(A) 20 (B) 25 (C) 50 (D) 100

(7) 5 : 6 and ______________ are equal ratios. **D**

(A) 20 : 25 (B) 25 : 36 (C) 30 : 42 (D) 30 : 36

(8) 45 is to ______________ is same as 9 is to 1. **B**

(A) 6 (B) 5 (C) 8 (D) 4

(9) 5 : 7 and 25 : ______________ are equal ratios. **C**

(A) 5 (B) 7 (C) 35 (D) 27

(10) ______________ : 2 : : 8 : 4. **B**

(A) 2 (B) 4 (C) 6 (D) 8

2. Fill in the blanks.

(1) 25 is **5** times of 5.

(2) 8 is the **8^{th}** part of 64.

(3) We denote ratio using the symbol **:** .

(4) The ratio of 6 to 18 is **1 : 3** .

(5) 3 : 4 : : 6 : **8** .

(6) 5 : 6 : : 5 : **6** .

(7) In a statement of proportion, the four quantities involved when taken in order are known as respective **terms** .

(8) In a statement of proportion, the first and fourth terms are known as **extreme terms**, second and third terms are known as **middle terms** .

3. Mark as '✓' or '✗'.

(1) The ratio of ₹ 60 to 120 kg is 1 : 2. ✗

(2) The ratio of father's age to son's age may be 3 : 5. ✗

(3) The ratio of 100 litres and 75 litres is 4 : 3. ✓

(4) The ratio of the width to the length of a hall is 2 : 5. It means that the length of this hall is less than its width. ✗

(5) If two ratios are equal, we say they are proportional. ✓

(6) 7 hours : 6 hours = 14 hours : 12 hours. ✓

(7) 15, 6, 30, 12 are in proportion. ✓

(8) 2 : 3 and 20 : 30 are equal ratios. ✓

(9) 1 : 3 and 3 : 1 are equal ratios. ✗

4. Match the following :

(1)

A	B	Answer
(1) 30 apples : 60 apples	(A) 1 : 4	(1) → **D**
(2) Ratio of ₹ 60 to ₹ 20	(B) 2 : 3	(2) → **C**
(3) 15 grapes : 60 grapes	(C) 3 : 1	(3) → **A**
(4) 40 bananas : 60 bananas	(D) 1 : 2	(4) → **B**

Notes

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