14.1 INTRODUCTION

Pictures of some objects are given below.

Carefully study the shape of these objects. Classify them according to their shape in this table:

<table>
<thead>
<tr>
<th>Shape</th>
<th>Object</th>
</tr>
</thead>
<tbody>
<tr>
<td>Like a match box</td>
<td></td>
</tr>
<tr>
<td>Like a ball</td>
<td></td>
</tr>
<tr>
<td>Like a wooden log</td>
<td></td>
</tr>
<tr>
<td>Like a dice</td>
<td></td>
</tr>
<tr>
<td>Like a cone</td>
<td></td>
</tr>
</tbody>
</table>

14.2 3D-SHAPES

We have learnt about triangles, squares, rectangles etc. in the previous classes. All these shapes spread in two directions only and thus called two-dimensional or 2D shapes.

All solid objects like above, have a length, breadth and height or depth. They are thus called three dimensional or 3D-shapes. Now, we will learn about various 3 dimensional or 3D shapes.
14.2.1 Cuboid

The shapes like a closed match box are examples of a cuboid. Touch your hand on the top of the match box. This plane surface is the face of match box. How many faces does a match box have?

The sides of the faces are the edges. How many edges does a match box have?

The corners of the edges are the vertices of the match box. How many vertices does a match box have?

Now take an eraser, whose shape is similar to that of a match box. Touch your hand along its faces, edges and vertices.

Does the eraser have the same number of faces, edges and vertices as that of match box? You will find this to be true.

Objects like match boxes, erasers etc. are in the shape of a cuboid and have 6 faces, 12 edges and 8 vertices.

14.2.2 Cube

A dice is an example of a cube. Take a dice. Locate its faces, edges and vertices. Count them. How many faces, edges and vertices does a dice have?

You will find that a die has 6 faces, 12 edges and 8 vertices, same as that of a cuboid. Then what is the difference between a cube and a cuboid? You will find that the length, breadth and height of a cube are all same, but in a cuboid they are different. Verify this by measuring the length, breadth and height of an eraser and a die.

**Try These**

1. (i) What is the shape of the face of a cube?
   (ii) What is the shape of the face of a cuboid?

2. Ramesh has collected some boxes in his room. Pictures of these are given here. How many are cubes and how many are cuboids.

3. Ajith has made a cuboid by arranging cubes of 2 centimeter each. What is the length, breadth and height of the cuboid so formed?

14.2.3 Cylinder

Objects like a wooden log, a piece of pipe, a candle, tube light are in the shape of a cylinder. Take a candle. Slice it on the top as shown in the fig.1. Lay it down horizontally (fig.2). Can you roll it?

Now erect candle up vertically (fig.3). Does it roll?
The surface on which the candle rolls is called its curved surface. The surface on which the candle does not roll, but stands vertically is the base, which is circular in shape.

Now what is the height and width of the candle? Look at the height and width of the cylinder shown in the figure.

14.2.4 Cone

Raju wants to buy a special cap for his birthday. He asked Leela to come along with him. Leela said that there is no need to go to the market as they can make the cap on their own.

Would you like to make a cap? Let us try.

Draw a circle on a thick paper using a compass. Draw two lines from the centre to the circumference as shown in the figure (ii).

Cut this part with scissors it will look like. (fig. iii)

Now join OA and OB with adhesive tape. Your cap is ready now. Decorate it as you wish.

Raju inverted the cap and said "oh! it looks like an ice-cream cone."

Here is a figure of a cone. \( \overline{OA} \) is the radius of the circular part and \( \overline{OC} \) is the height of the cone.

**Think, Discuss and Write**

What is the difference between a cylinder and a cone with respect to the number of faces, vertices and edges? Discuss with your friends.

14.2.5 Sphere

Balls, laddoos, marbles etc. are all in the shape of a sphere. They roll freely on all sides.

Can you call a coin a sphere? Does it roll on all its sides? Is the case with a bangle?

You may have seen lemon in your daily life.

When we cut it horizontally it looks like the shape shown in the figure. The shape of such an object is called semisphere.
**Do This**

Fill the table accordingly:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Object</th>
<th>Shape</th>
<th>Slides only</th>
<th>Roll only</th>
<th>Slides and rolls</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Cell</td>
<td>Cylindrical</td>
<td>✗</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>2.</td>
<td>Ball</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Oil can</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Biscuit packet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Coin</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Marble</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Orange</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The cylinder, the cone and the sphere have no straight edges. What is the base of a cone? Is it a circle? The cylinder has two bases. What shape is the base? Of course, a sphere has no face! Think about it.

**14.2.6 Prism**

Here is a diagram of a **prism**.

Have you seen it in the laboratory? Two of its faces is in the shape of triangle. Other faces are either in the shape of rectangle or parallelogram. It is a triangular prism. If the prism has a rectangular base, it is a rectangular prism. Can you recall another name for a rectangular prism?

**14.2.7 Pyramid**

A **pyramid** is a solid shape with a base and a point vertex, the other faces are triangles. All the triangular faces meet at vertex of the prism.

Here is a square pyramid. Its base is a square. Can you imagine a triangular pyramid? Attempt a rough sketch of it.

**Activity**

Take a sheet of chart. Draw a triangle with equal sides on the chart, cut it. Then using this triangle cut out three more triangles of exactly same size from the chart. Join the edges of the four triangles, thus formed in order to make a closed object. This object is in the shape of a tetrahedron or triangular pyramid.
**Exercise-14.1**

1. A triangular pyramid has a triangle at its base. It is also known as a tetrahedron. Find the number of
   - Faces : ____________
   - Edges : ____________
   - Vertices : ____________

2. A square pyramid has a square at its base. Find the number of
   - Faces : ____________
   - Edges : ____________
   - Vertices : ____________

3. Fill the table

<table>
<thead>
<tr>
<th>Shape</th>
<th>No. of curved surfaces</th>
<th>No. of plane surfaces</th>
<th>No. of Vertices</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Triangle" /></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><img src="image2.png" alt="Cylinder" /></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><img src="image3.png" alt="Sphere" /></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. A triangular prism is often in the shape of a kaleidoscope. It has triangular faces.
   - No. of triangular Faces : ____________
   - No. of rectangular Faces : ____________
   - No. of Edges : ____________
   - No. of Vertices : ____________

**14.3 Polygons**

We have learnt about open and closed figures in the chapter 'Basic Geometrical Ideas'. See the figures given below. Which of the following figures are open and which are closed?

(i) ![Open Figure](image4.png)
(ii) ![Closed Figure](image5.png)
(iii) ![Open Figure](image6.png)
(iv) ![Closed Figure](image7.png)
(v) ![Closed Figure](image8.png)
A figure is a polygon if it is a closed figure, formed with a definite number of straight lines. Some examples are shown here.

**Do This**

1. Draw ten polygons with different shapes in your notebook.
2. Use match-sticks or broom-sticks and form closed figures using:
   (i) Six sticks
   (ii) Five sticks
   (iii) Four sticks
   (iv) Three sticks
   (v) Two sticks

In which case was it not possible to form a polygon? Why?

You will find that you could not form a polygon using two sticks. A polygon must have at least three sides. A polygon with three sides is called a triangle. Study the table given below and learn the names of the various types of polygons.

<table>
<thead>
<tr>
<th>Figure</th>
<th>No. of sides</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="triangle.png" alt="Triangle" /></td>
<td>3</td>
<td>Triangle</td>
</tr>
<tr>
<td><img src="quadrilateral.png" alt="Quadrilateral" /></td>
<td>4</td>
<td>Quadrilateral</td>
</tr>
<tr>
<td><img src="pentagon.png" alt="Pentagon" /></td>
<td>-</td>
<td>Pentagon</td>
</tr>
<tr>
<td><img src="hexagon.png" alt="Hexagon" /></td>
<td>-</td>
<td>Hexagon</td>
</tr>
<tr>
<td><img src="septagon.png" alt="Septagon" /></td>
<td>7</td>
<td>Septagon</td>
</tr>
<tr>
<td><img src="octagon.png" alt="Octagon" /></td>
<td>-</td>
<td>Octagon</td>
</tr>
</tbody>
</table>
**TRY THIS**

Find out the differences:

![Diagram of two shapes](image)

Measure the lengths of the sides and angles of (i) and (ii). What did you find?

---

### 14.3.1 Regular Polygon

A polygon with all equal sides, and all equal angles is called a regular polygon. Equilateral triangles and squares are examples of regular polygons.

- **Equilateral triangle**: A triangle with all sides and all angles equal
- **Square**: A quadrilateral with all sides and all angles equal.

Similarly, if all the sides and all the angles of a pentagon, hexagon, septagon and octagon are equal they are called regular pentagon, regular hexagon, regular septagon and regular octagon respectively.

---

**Exercise - 14.2**

1. Examine whether the following are polygons if not why?

![Shapes](image)
2. Count the number of sides of the polygons given below and name them:

(i)  
(ii)  
(iii)  
(iv)  

3. Identify the regular polygons among the figures given below:

What have we discussed?

1. Various boxes are normally in the shapes of cubes and cuboids:

<table>
<thead>
<tr>
<th>Shapes</th>
<th>Faces</th>
<th>Edges</th>
<th>Vertices</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Cube" /></td>
<td>6</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td><img src="image2" alt="Cuboid" /></td>
<td>6</td>
<td>12</td>
<td>8</td>
</tr>
</tbody>
</table>

2. Ice-cream cones, joker’s caps etc. are in the shape of cone.
3. Tins, oil drums, wooden logs are in the shape of a cylinder.
4. Balls, laddoos etc. are in the shape of a sphere.
5. A polygon is a closed figure made up of line segments.
6. If all the sides and angles of a polygon are equal, it is called a regular polygon.
Answers

**EXERCISE - 1.1**

1. | Greatest number | Smallest number |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>i 15892</td>
<td>15370</td>
</tr>
<tr>
<td>ii 25800</td>
<td>25073</td>
</tr>
<tr>
<td>iii 44687</td>
<td>44602</td>
</tr>
<tr>
<td>iv 75671</td>
<td>75610</td>
</tr>
<tr>
<td>v 34899</td>
<td>34891</td>
</tr>
<tr>
<td>i 375, 1475, 4713, 15951</td>
<td>i 9347, 12300, 19035, 22570</td>
</tr>
<tr>
<td>ii 89715, 89254, 45321, 1876</td>
<td>i 18500, 8700, 3900, 3000</td>
</tr>
<tr>
<td>iii</td>
<td></td>
</tr>
<tr>
<td>iv &lt;</td>
<td>iii &gt;</td>
</tr>
<tr>
<td>v 375, 1475, 4713, 15951</td>
<td>v 9347, 12300, 19035, 22570</td>
</tr>
<tr>
<td>i Seventy two thousand six hundred forty two</td>
<td></td>
</tr>
<tr>
<td>ii Fifty five thousand three hundred forty five</td>
<td></td>
</tr>
<tr>
<td>iii Sixty six thousand six hundred</td>
<td></td>
</tr>
<tr>
<td>iv Thirty thousand three hundred one</td>
<td></td>
</tr>
<tr>
<td>i 40270</td>
<td>i 14064</td>
</tr>
<tr>
<td>ii 40270</td>
<td>iii 9700</td>
</tr>
<tr>
<td>iii 40270</td>
<td>iv 60000</td>
</tr>
<tr>
<td>vi 1000</td>
<td>i 9999</td>
</tr>
<tr>
<td>ii 9999</td>
<td>iii 10000</td>
</tr>
<tr>
<td>iii 10000</td>
<td>iv 99999</td>
</tr>
</tbody>
</table>

**EXERCISE - 1.2**

1. | i 90             | i 420           |
   | ii 700           | ii 36200        |
   | iii 3000         | iii 70000       |
   | iv 3407          | iv 12351        |
   | i 4000 + 300 + 40 + 8 | i 30000 + 200 + 10 + 4 |
   | ii 20000 + 2000 + 200 + 20 + 2 | iv 70000 + 5000 + 20 + 5 |
   | i 4000 + 300 + 40 + 8 | i 30000 + 200 + 10 + 4 |
   | ii 20000 + 2000 + 200 + 20 + 2 | iv 70000 + 5000 + 20 + 5 |

**EXERCISE - 1.3**

1. | i 1,12,45,670 | i 2,24,02,151 |
   | ii 3,06,08,712 | iv 19,03,08,020 |
   | i Thirty four thousand twenty five |
### Exercise - 1.4

1. \(7,645,315\) \(\quad\) \(20,048,421\)
   \(476,356\) \(\quad\) \(9,490,026,834\)

3. **Indian system**
   - Twelve crore thirty one lakh fifteen thousand twenty seven
   - Eight crore ninety six lakh forty three thousand ninety two

   **International system**
   - One hundred twenty three million one hundred fifteen thousand twenty seven
   - Eight nine million six hundred forty three thousand ninety two

4. \(2\) \(\quad\) \(4\)
   \(0\) \(\quad\) Three hundred two

### Exercise - 1.5

1. 54,284
2. 2, 34, 732

3. Greatest number = 75430
   Smallest number = 30457
   Difference = 44,973

4. 96875 bicycles
5. 31,200

6. 1680 grams
7. 22 km 500 m

8. 22 shirts; 40 cm cloth will be left
9. ₹ 45000
**Exercise - 2.1**

1. i. T  
   ii. F [All natural numbers are whole numbers]  
   iii. F [The whole number on the left of another number on the number line is smaller]  
   iv. T  
   v. F [We can show the smallest whole number on the number line]  
   vi. F [We can’t check the greatest whole number on the number line]

2. 18

3. i. 

   ![Number Line 1](image)

   ii. 

   ![Number Line 2](image)

   iii. 

   ![Number Line 3](image)

4. i. 895 is on the right of 239  
   ii. 10001 is on the right of 1001  
   iii. 10015678 is on the right of 284013

6. i > ii > iii < iv >

**Exercise 2.2**

1. i. 532  
   ii. 47  
   iii. C  
   iv. 100  
   v. 85  
   vi. d

2. i. 1095  
   ii. 600

3. i. 196300  
   ii. 1530000

4. i. 11040  
   ii. 388710

5. i. 407745  
   ii. 2000955

6. ₹3000  
   7. ₹330

8. i. c  
   ii. e  
   iii. b  
   iv. a  
   v. d

**Exercise 2.3**

1. 123456 × 8 + 6 = 987654  
   1234567 × 8 + 7 = 9876543  
   12345678 × 8 + 8 = 98765432  
   123456789 × 8 + 9 = 987654321
2. \(91 \times 11 \times 4 = 4004\)
\(91 \times 11 \times 5 = 5005\)
\(91 \times 11 \times 6 = 6006\)
\(91 \times 11 \times 7 = 7007\)
\(91 \times 11 \times 8 = 8008\)
\(91 \times 11 \times 9 = 9009\)
\(91 \times 11 \times 10 = 10010\)

**Exercise 3.1**

1. Divisible by 2 -- ii, iii, iv, v vi, viii
Divisible by 3 -- i, ii, iii, iv, v vii
Divisible by 6 -- ii, iii, iv, v
2. Divisible by 5 -- 25, 125, 250, 1250, 10205, 70985, 45880
Divisible by 10 -- 250, 1250, 45880
5. 12345 is divisible by 3, 5
54321 is also divisible by 3, 5
7. i 2, 8 ii 0, 9 iii 1, 7
8. 2 9. 6

**Exercise 3.2**

1. i 1, 2, 3, 4, 6, 9, 12, 18, 36
   ii 1, 23
   iii 1, 2, 3, 4, 6, 8, 12, 16, 24, 32, 48, 96
   iv 1, 5, 23, 115
2. i, ii 3. 19
4. Prime number- 11, 13, 17, 19, 23, 29
   Composite number- 12, 14, 15, 16, 18, 20, 21, 22, 24, 25, 26, 27, 28
5. 13-31, 79-97
6. (3, 5), (5, 7), (11, 13), (17, 19)
7. 5 and 7
8. 13, 23
9. 90 to 96
10. (31, 11, 11); (13, 17, 23); (3, 19, 31) etc
11. (3, 13); (7, 17); (23, 13)...
12. (2, 3); (3, 7); (7, 13) etc

**Exercise 3.3**

1. i
2. \(2 \times 2 \times 3 \times 7\)
3. Greatest 4 digit number - 9999
   Prime factors are - \(101 \times 11 \times 3 \times 3\)
4. It is 210 because \(210 = 2 \times 3 \times 5 \times 7\)

**Exercise 3.4**

1. i 9 ii 53 iii 5 iv 32
2. 4 3. 3 4. No; 1

**Exercise 3.5**

1. i 60 ii 75 iii 42 iv 54 v 1008 vi 182
2. i 2352 ii 2142 iii 1980
3. 247
4. i 900 ii 904
5. 576 6. 8 7. 13th day

**Exercise 3.6**

1. i LCM = 120 HCF = 3
   ii LCM = 48 HCF = 12
2. 25 3. 546 4. 18

**Exercise 3.7**

1. i, ii, iii, iv
2. ii, iv, v
3. i No ii Yes iii Yes
4. Divisible by 4 - i, ii, iii
   Divisible by 8 - i, ii, iii
5. 1 6. 1
7. 1001, 1012, 1023, 1034, 1045, 1056, 1067, 1078, 1089
8. 1243 9. 104
Exercise - 4.1

1. i. AB, BC, AC ii. PQ, QR, RS, ST, PT
2. Do yourself
3. i. uncalculated/many ii. one
4. iii. line segment
5. i. two ii. one iii. none
6. i. T ii. T iii. F iv. F v. T
7. Do yourself

Exercise - 4.2

1. i., ii, iv
2. Open (i., v) closed (ii., iii., iv)
3. Interior (A, B, E, G, I), boundary (K, F, C), exterior (J, D)
4. Do yourself

Exercise - 4.3

1. ii. ∠BOC, O, OB, OC iii. ∠COD, O, OC, OD
   iv. ∠AOD, O, OA, OD
2. ∠BAD, ∠ABC, ∠BCD, ∠ADC
3. Do yourself
4. i., iii.

Exercise - 4.4

1. Do yourself
2. i. PS ii. R iii. PS and QR iv. P and R
3. i. S, R ii. A, B, C, D, E iii. T, P, Q

Exercise - 4.5

1. Do yourself
2. Do yourself
3. i. T ii. T iii. T iv. F v. F
4. Do yourself
EXERCISE 5.1
3. Largest line segment in AE.
4. Reshma located correct.

EXERCISE 5.2
1. i True
   ii False A right angle measure 90°
   iii False A straight angle measure 180°
   iv True
   v True
2. Acute angle $\angle 1, \angle 3$
   Obtuse angle $\angle 2, \angle 4$
3. $\angle ABC = 60^\circ$
   $\angle DEF = 120^\circ$
   $\angle PQR = 90^\circ$
   $\angle DEF$ is the largest angle
4. i right angle
   ii zero angle
   iii straight angle
   iv obtuse angle
   v reflex angle
5. Acute angle, 45°
   Right angle, 90°
   Obtuse angle, 150°
   Reflex angle, 270°
   Straight angle, 180°

EXERCISE 5.3
1. i Parallel lines
   ii Parallel lines
   iii neither of them
   iv parallel lines
   v perpendicular
3. parallel lines $AB \parallel CD, AD \parallel BC$
   perpendicular $AD \parallel AB, AB \parallel BC$, $BC \perp CD$, $CD \perp DA$
   pair of intersecting line $AC, BD$
**Exercise - 6.1**

1. i. + 3000 meters ii. -10 meters iii. + 35°C iv. 0°C v. -36°C vi. -500 meters vii. -19°C viii. +18°C

2. (-1, -2, -3, -4, -5 ....... etc.)

3. (1, 2, 3, 4, 5 ....... etc.)

4. [Image showing a number line with numbers from -5 to 5]

5. i. [False, left side] ii. [False] iii. [True] iv. [True]

**Exercise - 6.2**

1. i. < ii. > iii. < iv. > v. < vi. <

2. i. (-7, -3, 5) ii. (-1, 0, 3) iii. (-6, 1, 3) iv. (-5, -3, -1) v. (3, 1, -6) vi. (-1, -3, -5)

3. i. (True) ii. (False, -12 is negative integer and +12 is positive integer) iii. (True) iv. (True) v. (False, -100 < +100) vi. (False, -1 > -8)

4. i. 0 ii. -4, -3, -2, -1 iii. 7 iv. -1, -2

5. Kufri, -6°C < 4°C

**Exercise - 6.3**

1. i. 1 ii. -10 iii. -9 iv. 0 v. -16 vi. 3

2. i. 7 ii. 6 iii. 0 iv. -115 v. -132 vi. 6

3. i. -154 ii. -40 iii. 199 iv. 140

4. i. 6 ii. -78 iii. -64 iv. 25
**Exercise - 6.4**

1. i. 18 ii. -14 iii. -33 iv. -33 v. 44 vi. 19

2. i. < ii. > iii. > iv. =

3. i. 13 ii. 0 iii. -9 iv. -6

4. i. -13 ii. 21 iii. -33 iv. 88

**Exercise - 7.1**

1. ii, iii

2. iv, v

   \[
   \left[ \begin{array}{c}
   \frac{13}{2} \\
   \frac{7}{3}
   \end{array} \right]
   \] between 6 and 7
   \[
   \left[ \begin{array}{c}
   \frac{3}{2}
   \end{array} \right]
   \] between 2 and 3

3. ii, iv

4. i. \(\frac{2}{3}\) ii. \(\frac{26}{8} = \frac{13}{4}\) iii. \(\frac{92}{9}\) iv. \(\frac{79}{9}\) v. \(\frac{9}{7}\)

5. i. \(\frac{5}{2}\) ii. \(\frac{1}{4}\) iii. \(\frac{3}{4}\) iv. \(\frac{6}{4}\)

**Exercise 7.2**

1. i. \(\frac{2}{3}\) ii. \(\frac{5}{3}\) iii. \(\frac{1}{3}\) iv. \(\frac{4}{3}\) v. \(\frac{2}{3}\)

3. i. \(\frac{3}{5} and \frac{2}{5}\) ii. \(\frac{7}{8} and \frac{2}{8}\)

**Exercise 7.3**

1. Ascending Descending

   i. \(\frac{1}{8} < \frac{3}{8} < \frac{4}{8} < \frac{6}{8}\) or \(\frac{6}{8} > \frac{4}{8} > \frac{3}{8} > \frac{1}{8}\)

   ii. \(\frac{3}{9} < \frac{4}{9} < \frac{6}{9} < \frac{8}{9}\)

   Write in descending order yourself.

2. \(\frac{2}{6} < \frac{4}{6} < \frac{5}{6} < \frac{6}{6}\)
3. i \(\frac{1}{6} \geq \frac{1}{3}\)  
   ii \(\frac{3}{4} \geq \frac{2}{6}\)  
   iii \(\frac{2}{3} \geq \frac{2}{4}\)

   iv \(\frac{6}{6} \geq \frac{3}{5}\)  
   v \(\frac{5}{6} \geq \frac{5}{6}\)

4. i \(\frac{1}{2} \geq \frac{1}{5}\)  
   ii \(\frac{2}{4} \geq \frac{3}{6}\)  
   iii \(\frac{3}{5} \geq \frac{2}{3}\)

   iv \(\frac{3}{4} \geq \frac{2}{8}\)  
   v \(\frac{3}{5} \geq \frac{6}{5}\)  
   vi \(\frac{7}{9} \geq \frac{3}{7}\)

5. i No; because \(\frac{4}{5}\) is greater then \(\frac{5}{9}\)

   ii No; \(\frac{9}{16}\) is greater then \(\frac{5}{9}\)

   iii Yes \(\frac{4}{5} = \frac{16}{20}; \frac{4}{5} = \frac{4}{5}\)

   iv No, because \(\frac{4}{30}\) is greater then \(\frac{1}{15}\); \(\frac{4}{30} = \frac{2}{15} > \frac{1}{15}\)

6. Varshitha, because Lalita reach \(\frac{2}{5}\) of 100 that is 40 pages.

7. i +  
   ii –  
   iii +

8. i \(\frac{2}{18} = \frac{1}{9}\)  
   ii \(\frac{11}{15}\)  
   iii \(\frac{2}{7}\)  
   iv \(\frac{22}{22} = 1\)

   v \(\frac{5}{15}\)  
   vi \(\frac{8}{8} = 1\)  
   vii \(\frac{1}{3}\)  
   viii \(\frac{1}{4}\)  
   ix \(\frac{3}{5}\)

9. i \(\frac{4}{10}\)  
   ii \(\frac{8}{21}\)  
   iii \(\frac{9}{6}\)  
   iv \(\frac{7}{27}\)

10. Complete wall

11. \(\frac{2}{7}\)

12. \(\frac{5}{8}\)

13. Reshma takes less time she takes \(\frac{9}{20}\) minutes less to half across the school ground.
### Exercise 7.4

1. \( \frac{8}{10}, 15, 9, 10 \text{ tenth or } \frac{8}{10}, \text{ decimal point} \)
   - i. 125.4
   - ii. 20.2
   - iii. 8.6
2. .16, .278, .06, 3.69
   - v. .016
   - vi. 34.5
3. \( \frac{8}{100}, \frac{9}{10}, \frac{5}{10} \)
   - v. \( \frac{3}{100} \)
   - vi. \( \frac{7}{10} \)
4. 0.4, 70.7, 6.6, 7.4, 0.8
5. 0.4, 70.7, 6.6, 7.4, 0.8
6. 0.04 < 0.14 < 1.04 < 1.14, 0.99 < 1.1 < 7 < 9.09
7. 8.8 > 8.6 > 8.59 > 8.09, 8.68 > 8.66 > 8.06 > 6.8

### Exercise 7.5

1. i. 1.25 rupees
   - ii. .75
   - iii. 3.75 Rupees
2. i. 28.91
   - ii. 17.09
   - iii. 10.46
   - iv. 21.24
   - v. 6.32
3. 8 km, 323 meter
4. 12 m

### Exercise 9.1

1. \( 3m, 4m, 3m \)
2. 3 n
3. i. 2 s
   - ii. 3 s
4. 7 n
5. 90 m
6. \( \text{₹} 23 \)
7. \( x - 2 \)
8. 2 y + 3
9. 6 z
10. i. 19
   - ii. 3 + 2(n - 1)

### Exercise 9.2

1. \( 5q, \frac{y}{4}, \frac{pq}{4}, 3z+5 \)
   - v. 9n + 10
   - vi. 2y - 16
   - vii. 10y + x
**Exercise 9.3**

1. i, iv, v, vii, x, xi, xii
2. i \(LHS = x - 5\) \(\text{RHS} = 6\)  
   ii \(LHS = 4y\) \(\text{RHS} = 12\)  
   iii \(LHS = 2z + 3\) \(\text{RHS} = 7\)  
   iv \(LHS = 3p\) \(\text{RHS} = 24\)  
   v \(LHS = 4\) \(\text{RHS} = x - 2\)  
   vi \(LHS = 20 - 3\) \(\text{RHS} = -5\)
3. i \(x = 2\)  
   ii \(y = 9\)  
   iii \(a = 8\)  
   iv \(p = 3\)  
   v \(n = 5\)  
   vi \(z = 9\)

**Exercise 10.1**

1. 230 cm., 48 cm., 24 cm., 40 cm.
2. Perimeters are 120, 120 cm., 120 cm., 144 cm. and cost of wire are ₹1800, ₹1800, ₹2160 respectively.
3. So many like (1,6) (2,5) (3,4) (2.5, 4.5) etc.  
4. ₹840
5. i 20 cm  
   ii 15 cm  
   iii 10 cm  
   iv 12 cm
6. Bunty; 13000 m  
7. length - 16 cm Breadth-8 cm  
8. 10 cm
9. i 12 cm  
   ii 27 cm  
   iii 22 cm

**Exercise 10.2**

1. i 1000 cm\(^2\)  
   ii 2925 m\(^2\)  
   iii 400 cm\(^2\)  
   iv 133 km\(^2\)
2. i 676 m\(^2\)  
   ii 289 km\(^2\)  
   iii 2704 cm\(^2\)  
   iv 64 cm\(^2\)
3. 45 cm  
4. 1800 m\(^2\)
5. length of side = 10 cm; Area = 100 cm\(^2\)
6. 200 m  
7. 24 m\(^2\); ₹5760
8. Square plot; 64 m\(^2\)  
9. 18.7 cm, rectangle
10. The cost of fencing Rahul’s field = ₹1,20,00,000  
The cost of fencing Ramu’s field = ₹1,35,00,000  
Ramu can plant more trees; 1000 trees more
11. 80 m  
12. ₹26,400
13. ₹5,04,000
14. i Area increases by 4 times  
   ii Area increases by 6 times
15. i Area increases by 4 times  
   ii Area become \(\frac{1}{4}\) of the original area.
Exercise 11.1

1. i \(7 : 11\)  
   ii \(2 : 3\)  
   iii \(5 : 8\)  
   iv \(3 : 5\)

2. i \(2\)  
   ii \(\frac{1}{2}\)  
   iii \(2 : 1\)

3. i \(1 : 4\)  
   ii chilli : pulses  
   iii \(1 : 1\)  
   \(1 : 80\)  
   \(80 : 1\)

Exercise 11.2

1. Simplest form- i, iii, v, vi  
   i \(16 : 20 \rightarrow 4 : 5\)  
   iv \(20 : 60 \rightarrow 1 : 3\)

2. Rice : wheat  
   rice : total  
   \(1 : 3\)  
   \(1 : 4\)

3. i \(5 : 3\)  
   ii \(5 : 8\)  
   iii \(3 : 8\)

5. \(4 : 1\)

6. \(20 : 60\), simplest form is \(1 : 3\)

7. \(2 : 5\)

Exercise 11.3

1. i \(15\)  
   ii \(10\)

2. \(A X = 6\) cm  
   \(X B = 8\) cm

3. Geeta = \(\text{Rs} 450\),  
   Laxmi = \(\text{Rs} 600\)

4. Satya = \(\text{Rs} 1350\),  
   Siri = \(\text{Rs} 2250\)

6. numbers are 60 and 72

7. income = 6534,  
   saving = 1188

Exercise 11.4

1. \(\text{Rs} 75\)

2. \(\text{Rs} 24\)

3. 525 gram

4. 20 chair

5. 12 hrs

6. i \(\text{Rs} 25000\)  
   ii 1 year 7 month

7. \(\text{Rs} 210\)

8. i 480 sheeps  
   ii \(8 : 11\)  
   iii \(11 : 3\)

9. Not, By changing order 3, 5, 9, 15

10. \(5^o\)

11. \(\frac{15}{18} = \frac{5}{6} = \frac{10}{12} = \frac{25}{30}\)
12. | Breadth | 10 | 20 | 40 |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>25</td>
<td>50</td>
<td>100</td>
</tr>
</tbody>
</table>

13. i. 3 : 1  
ii. 1 : 4  
iii. 3 : 4

14. i. 5 : 4  
ii. 4 : 5

15. i. 3 : 1  
ii. 24  
iii. 8  
iv. 30  
v. 64

16. i. 4 : 5  
ii. 12  
iii. 30  
iv. 25

**Exercise 12.2**

3. i. 4  
ii. 2  
iii. 2  
iv. 0  
v. 4  
vi. 2

5. i. 3  
ii. 1  
iii. 0  
iv. 2  
v. 6  
vi. Un countable lines which passes through the centre of the circle.

**Exercise 14.1**

1. Faces | Edges | Vertices
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>

2. F E V

| 5 | 8 | 5 |

3. Cone | 1 | 1 | 1 |
Cylendre | 1 | 2 |
Sphere | Nil | Nil |

4. Faces 2  
Edges 9  
Vertices 6

**Exercise 14.2**

1. i. Not because polygon is a closed figure made by straight lines  
ii. not, see the above answer and find.

2. i. pentagon  
ii. octagon  
iii. hexagon  
iv. triangle
INSTRUCTIONS TO TEACHERS

Dear Teachers ........

Greetings and a hearty welcome to the newly developed textbook Mathematics for class VI.

- The present textbook is developed as per the syllabus and academic standards conceived by the mathematics position paper prepared based on APSCF – 2011 and RTE – 2009 for Upper Primary stage of education.

- The new textbook constitutes 14 chapters with concepts from the main branches of mathematics like Number system, Arithmetic, Algebra, Geometry, Mensuration and Statistics.

- The concepts in these chapters emphasize the prescribed academic standards of Problem Solving, Reasoning-proof, Communication, Connections and representation. These are aimed at to develop the skills of observation of patterns, making generalization through deductive, inductive and logical thinking finding different methods for problem solving, questioning, interaction etc., and the utilization of the same in daily life.

- The situations, examples and activities given in the textbook are based on the competencies acquired by the child at Primary Stage. So the child participates actively in all the classroom activities and enjoys learning of Mathematics.

- Primary objective of teacher should be to achieve the “Academic standards” by involving students in the discussions and activities suggested in the textbook and making them to understand the concepts.

- Mere completion of a chapter by teacher doesn’t make any sense. The skills specified in the syllabus and academic standards prescribed should be exhibited by the student only ensures the completion of the chapter.

- Students should be encouraged to answer the questions given in the chapters. These questions help to improve logical, inductive and deductive thinking of the child.

- Understanding and generalization of properties are essential. Student first finds the need and then proceeds to understand, followed by solving similar problems on his own and then generalises the facts. The strategy in the presentation of concepts followed.
• Clear illustrations and suitable pictures are given wherever it was found necessary to improve the connection and correct the misconnection necessary.

• Exercises of ‘Do This’ and ‘Try This’ are given extensively after completion of each concept. Exercises given under ‘Do This’ are based on the concept taught. After teaching of two or three concepts some exercises are given based on them. Questions given under ‘Try This’ are intended to test the skills of generalization of facts, ensuring correctness of statements, questioning etc., ‘Do This’ exercise and other exercises given are supposed to be done by students on their own. This process helps the teacher to know how far the students can fare with the concepts they have learnt. Teacher may assist in solving problems given in ‘Try This’ sections.

• Students should be made to digest the concepts given in “what have we discussed” completely. The next chapter is to be taken up by the teacher only after satisfactory performance by the students in accordance with the academic standards designated for them (given at the end).

• Teacher should prepare his own problems related to the concepts besides solving the problems given in the exercises. Moreover students should be encouraged to identify problems from day-to-day life or create their own problems.

• Above all the teacher should first study the textbook completely thoroughly and critically. All the given problems should be solved by the teacher well before the classroom teaching.
<table>
<thead>
<tr>
<th>Area &amp; Chapters</th>
<th>Syllabus Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number System (60 hrs)</strong></td>
<td></td>
</tr>
</tbody>
</table>
| **1. Knowing our Numbers:** | (i) **Knowing our Numbers:**  
- Consolidating the sense of number up to 99,999; Estimation of numbers; Comparison of numbers; Place value (recapitulation and extension); connectives: use of symbols =, <, >; Use of brackets.  
- Word problems on number operations involving large numbers up to a maximum of 6 digits in the answer (This would include conversions of units of length & mass from the larger to the smaller units).  
- Estimation of outcome of number operations.  
- Introduction to large numbers (a) up to lakhs and ten lakhs (b) up to crores.  
- International system of numbers (Millions..) |
| **2. Whole Numbers** | (ii) **Whole numbers:**  
- Natural numbers, whole numbers.  
- Properties of numbers (closure, commutative, associative, distributive, additive identity, multiplicative identity).  
- Number line. Seeing patterns, identifying and formulating rules to be done by children.  
- Utility of properties in fundamental operations. |
| **3. Playing with Numbers** | (iii) **Playing with Numbers:**  
- Consolidating divisibility rules of 2, 3, 5, 6, 9, 10.  
- Discovering divisibility rules of 4, 8, 11 through observing patterns.  
- Multiples and factors, Even/odd numbers, prime/composite numbers, Co-prime numbers.  
- Prime factorization, every number can be written as products of prime factors.  
- HCF and LCM, prime factorization and division method.  
- Property: LCM × HCF = product of two numbers.  
- LCM & HCF of co-primes.  
- Importance of Zero, and its properties. |
| **6. Integers** | (iv) **Negative Numbers and Integers:**  
- How negative numbers arise, models of negative numbers, connection to daily life, ordering of negative numbers, representation of negative numbers on number line.  
- Children to see patterns, identify and formulate rules.  
- Understanding the definition of integers, identification of integers on the number line.  
- Operation of addition and subtraction of integers, showing the operations on the number line (Understanding that the addition of negative integer reduces the value of the number).  
- Comparison of integers, ordering of integers. |
### Fractions and Decimals:
- Revision of what a fraction is, fraction as a part of whole.
- Representation of fractions (pictorially and on number line).
- Fraction as a division, proper, improper, and mixed fractions.
- Equivalent fractions, like, unlike fractions, comparison of fractions.
- Addition and subtraction of fractions.
- Word problems (Avoid large and complicated calculations).
- Estimates the degree of closeness of a fraction (1/2, 1/4, 3/4 etc.).
- Review of the idea of a decimal fraction.
- Place value in the context of decimal fraction.
- Inter conversion of fractions and decimal fractions (avoid recurring decimals at this stage).
- Word problems involving addition and subtraction of decimals (word problems should involve two operations). Contexts: money, mass, length, temperature.

### Algebra
(15 hrs)

9. Introduction Algebra:
- Introduction to variable through patterns and through appropriate word problems and generalizations (example 5 × 1 = 5 etc.).
- Generate such patterns with more examples.
- Introduction to unknowns through examples with simple contexts (single operations).
- Number forms of even and odd (2n, 2n+1).

### Arithmetic
(15 hrs)

11. Ratio and Proportion:
- Concept of Ratio.
- Proportion as equality of two ratios.
- Unitary method (with only direct variation implied).
- Word problems.
- Understanding ratio and proportion in Arithmetic.

### Geometry
(65 hrs)

4. Basic geometrical ideas:
- Introduction to geometry. Its linkage with and reflection in everyday experience.
- Line, line segment, ray.
- Open and closed figures.
- Interior and exterior of closed figures.
- Curvilinear and linear boundaries.
- Angle — Vertex, arm, interior and exterior.
- Triangle — Sides, vertices, sides, angles, interior and exterior, altitude and median.
- Quadrilateral — Sides, vertices, angles, diagonals, adjacent sides and opposite sides (only convex quadrilateral are to be discussed), interior and exterior of quadrilateral.
- Circle — Centre, radius, diameter, interior and exterior, arc, chord, sector, segment, semicircle, circumference.
<table>
<thead>
<tr>
<th>Measures of Lines and Angles</th>
<th>Measures of Lines and Angles:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Measure of Line segment.</td>
<td>• Measure of Line segment.</td>
</tr>
<tr>
<td>• Measure of angles.</td>
<td>• Measure of angles.</td>
</tr>
<tr>
<td>• Types of angles- acute,</td>
<td>• Types of angles- acute,</td>
</tr>
<tr>
<td>obtuse, right, straight,</td>
<td>obtuse, right, straight,</td>
</tr>
<tr>
<td>reflex, complete and</td>
<td>reflex, complete and</td>
</tr>
<tr>
<td>zero angle.</td>
<td>zero angle.</td>
</tr>
<tr>
<td>• Pair of lines Intersecting and perpendicular lines</td>
<td>• Pair of lines Intersecting and perpendicular lines</td>
</tr>
<tr>
<td>Parallel lines.</td>
<td>Parallel lines.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symmetry</th>
<th>Symmetry:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Observation and identification of 2-D symmetrical objects for reflection symmetry.</td>
<td>• Observation and identification of 2-D symmetrical objects for reflection symmetry.</td>
</tr>
<tr>
<td>• Operation of reflection (taking mirror images) of simple 2-D objects.</td>
<td>• Operation of reflection (taking mirror images) of simple 2-D objects.</td>
</tr>
<tr>
<td>• Recognising reflection symmetry (identifying axes).</td>
<td>• Recognising reflection symmetry (identifying axes).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Practical Geometry (Constructions)</th>
<th>Practical Geometry (Constructions):</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Drawing of a line segment (using Straight edge Scale, protractor, compasses).</td>
<td>• Drawing of a line segment (using Straight edge Scale, protractor, compasses).</td>
</tr>
<tr>
<td>• Construction of circle.</td>
<td>• Construction of circle.</td>
</tr>
<tr>
<td>• Perpendicular bisector.</td>
<td>• Perpendicular bisector.</td>
</tr>
<tr>
<td>• Construction of angles (using protractor)</td>
<td>• Construction of angles (using protractor)</td>
</tr>
<tr>
<td>• Angle 60°, 120° (Using Compasses)</td>
<td>• Angle 60°, 120° (Using Compasses)</td>
</tr>
<tr>
<td>• Angle bisector - making angles of 30°, 45°, 90° etc. (using compasses)</td>
<td>• Angle bisector - making angles of 30°, 45°, 90° etc. (using compasses)</td>
</tr>
<tr>
<td>• Angle equal to a given angle (using compass)</td>
<td>• Angle equal to a given angle (using compass)</td>
</tr>
<tr>
<td>• Drawing a line perpendicular to a given line from a point</td>
<td>• Drawing a line perpendicular to a given line from a point</td>
</tr>
<tr>
<td>a) on the line b) outside the line.</td>
<td>a) on the line b) outside the line.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Understanding 3D, 2D Shapes</th>
<th>Understanding 3D, 2D Shapes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Identification of 3-D shapes: Cubes, Cuboids, cylinder, sphere, cone, prism (triangular), pyramid (triangular and square) Identification and locating in the surroundings</td>
<td>• Identification of 3-D shapes: Cubes, Cuboids, cylinder, sphere, cone, prism (triangular), pyramid (triangular and square) Identification and locating in the surroundings</td>
</tr>
<tr>
<td>• Elements of 3-D figures. (Faces, Edges and vertices)</td>
<td>• Elements of 3-D figures. (Faces, Edges and vertices)</td>
</tr>
<tr>
<td>• Nets for cube, cuboids, cylinders, cones and tetrahedrons.</td>
<td>• Nets for cube, cuboids, cylinders, cones and tetrahedrons.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Perimeter and Area</th>
<th>Perimeter and Area:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Introduction and general understanding of perimeter using many shapes.</td>
<td>• Introduction and general understanding of perimeter using many shapes.</td>
</tr>
<tr>
<td>• Shapes of different kinds with the same perimeter.</td>
<td>• Shapes of different kinds with the same perimeter.</td>
</tr>
<tr>
<td>• Concept of area, Area of a rectangle and a square Counter examples to different misconceptions related to perimeter and area.</td>
<td>• Concept of area, Area of a rectangle and a square Counter examples to different misconceptions related to perimeter and area.</td>
</tr>
<tr>
<td>• Perimeter of a rectangle – and its special case – a square.</td>
<td>• Perimeter of a rectangle – and its special case – a square.</td>
</tr>
<tr>
<td>• Deducing the formula of the perimeter for a rectangle and then a square through pattern and generalisation.</td>
<td>• Deducing the formula of the perimeter for a rectangle and then a square through pattern and generalisation.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data Handling</th>
<th>Data Handling:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• What is data.</td>
<td>• What is data.</td>
</tr>
<tr>
<td>• Collection and organisation of data - examples of organising it in tally marks and a table.</td>
<td>• Collection and organisation of data - examples of organising it in tally marks and a table.</td>
</tr>
<tr>
<td>• Pictograph- Need for scaling in pictographs interpretation &amp; construction.</td>
<td>• Pictograph- Need for scaling in pictographs interpretation &amp; construction.</td>
</tr>
<tr>
<td>• Making bar graphs for given data interpreting bar graphs.</td>
<td>• Making bar graphs for given data interpreting bar graphs.</td>
</tr>
</tbody>
</table>
## Academic Standards

<table>
<thead>
<tr>
<th>CONTENT</th>
<th>ACADEMIC STANDARDS</th>
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</thead>
<tbody>
<tr>
<td><strong>Number system</strong></td>
<td></td>
</tr>
<tr>
<td><strong>1. Knowing our numbers</strong></td>
<td><strong>Problem Solving</strong></td>
</tr>
<tr>
<td></td>
<td>• Word problems on number operations involving large numbers up to a maximum of 5 digits in the answers.</td>
</tr>
<tr>
<td></td>
<td>• Conversions of units of length and mass.</td>
</tr>
<tr>
<td></td>
<td><strong>Reasoning, Proof</strong></td>
</tr>
<tr>
<td></td>
<td>• Estimation of outcome of number operations.</td>
</tr>
<tr>
<td></td>
<td>• Comparison of numbers up to large numbers with concept of place value.</td>
</tr>
<tr>
<td></td>
<td>• Formation of different numbers by using given numbers and select biggest, smallest among them.</td>
</tr>
<tr>
<td></td>
<td><strong>Communication:</strong></td>
</tr>
<tr>
<td></td>
<td>• Writes any five digit numbers in words and vice versa.</td>
</tr>
<tr>
<td></td>
<td>• Comparison of five digit numbers using the symbols &lt;, &gt;, =.</td>
</tr>
<tr>
<td></td>
<td><strong>Connections:</strong></td>
</tr>
<tr>
<td></td>
<td>• Understands the Usage of large numbers in daily life (village population, income from land, etc.)</td>
</tr>
<tr>
<td></td>
<td><strong>Representation:</strong></td>
</tr>
<tr>
<td></td>
<td>• Expresses the numbers into expanded and compact form.</td>
</tr>
<tr>
<td></td>
<td>• By using unit, ten, hundred, thousand blocks represents numbers through them.</td>
</tr>
</tbody>
</table>

| **2. Whole numbers** | **Problem Solving** |
| | |
| | **Reasoning, Proof** |
| | • Verification of properties of whole numbers such as closure, associative, inverse, identity, distributive, commutative (+, -, x) |
| | **Communication:** |
| | • Understands the need of whole number instead of natural numbers. |
| | **Connections:** |
| | • Finds the usage of whole numbers from their daily life. |
| | • Understands the relation between N, and W. |
| | **Representation:** |
| | • Represents the whole numbers on the number line. |

| **3. Playing with Numbers** | **Problem Solving** |
| | • Simplification of numerical statements involving two or more brackets |
| | • Tests the divisibility rules |
| | • Understands the use of LCM and HCF in different situations and find them in division, prime factorization method. |
| 6. Integers | Reasoning, Proof | • Finds the logic behind the divisibility rules.  
• Understands the relationship between LCM and HCF of two numbers by verification, why this relation hold only in two numbers, take more than two numbers and see the pattern, conclude |
| Communication: | • Uses brackets involving fundamental operations. |
| Connections: | • Establishes the relation among factors.  
• Understands the use of LCM and HCF from their real life situations.  
• Finds the patterns in division, multiplication tables. |
| Representation: | • |

| 7. Fractions and Decimals | Problem Solving | • Solves the problems on addition, subtraction involving integers  
• Compares integers, and ordering of integers.  
• Difference of $+, -$ between N, and Z |
| Reasoning, Proof | • Adds, subtracts, multiplies like and unlike fractions (avoid complicated, large tasks)  
• Inter conversion of fractions and decimal fractions.  
• Word problems involving $+, -$ of decimals (two operations together on money, mass, length, temperature) |
<p>| Communication: | • |</p>
<table>
<thead>
<tr>
<th>Connections:</th>
<th>• Connections between fraction, decimal fractions, decimal numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Representation:</td>
<td></td>
</tr>
<tr>
<td>Algebra 9. Introduction Algebra</td>
<td></td>
</tr>
<tr>
<td>Problem Solving</td>
<td>• Finds the value of the expression when substituting a value in place of variable (Simple expressions can be taken and single operation)</td>
</tr>
<tr>
<td>Reasoning, Proof</td>
<td>• Generalizes the given patterns and express as algebra expression.</td>
</tr>
<tr>
<td>Communication:</td>
<td>• Converts the real life simple contexts into Algebraic expression (vice versa)</td>
</tr>
<tr>
<td>Connections:</td>
<td>• Finds the usage of algebraic expression when occurring the unknown values.</td>
</tr>
<tr>
<td></td>
<td>• Inter links the number system with algebraic system by usage of simple contexts.</td>
</tr>
<tr>
<td>Representation:</td>
<td>• Represents the even, odd number in general form as 2n, 2n+1.</td>
</tr>
<tr>
<td>Arithmetic 11. Ratio and Proportion</td>
<td></td>
</tr>
<tr>
<td>Problem Solving</td>
<td>• Calculates compound, inverse ratio of two ratios.</td>
</tr>
<tr>
<td></td>
<td>• Solves word problem involving unitary method</td>
</tr>
<tr>
<td>Reasoning, Proof</td>
<td>• Compares the given ratios.</td>
</tr>
<tr>
<td></td>
<td>• Verifies the rule of proportion involving the ratios.</td>
</tr>
<tr>
<td></td>
<td>• Gives the reasons why the same units can be taken in expressing of ratios.</td>
</tr>
<tr>
<td>Communication:</td>
<td>• Write ratios in symbiotic and equivalent fractional form.</td>
</tr>
<tr>
<td>Connections:</td>
<td>• Observes the relation between line and work, time and distance writing reading to proportions.</td>
</tr>
<tr>
<td></td>
<td>• Understands the usage of ratios and proportion in daily life problems.</td>
</tr>
<tr>
<td>Representation:</td>
<td></td>
</tr>
<tr>
<td>Geometry</td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td></td>
</tr>
<tr>
<td>4. Basic Geometrical Ideas</td>
<td></td>
</tr>
<tr>
<td><strong>Problem Solving</strong></td>
<td>• ________________</td>
</tr>
</tbody>
</table>
| **Reasoning, Proof** | • Differentiates the basic geometric shapes (triangle, circle, Quadrilaterals)  
• Differentiates and compares the Quadrilaterals and triangle.  
• Differentiates and compares the Quadrilaterals and triangle. |
| **Communication**: | • Gives the example of basic geometry shapes (from surface of the surrounding objects). |
| **Connections**: | • Visualizes the basic geometric shapes from surroundings.  
• Understands the inter relation between various components of a circle (Circle, Semi Circle, Sector, Diameter, Radius, chord etc). |
| **Representation**: | • Gives pictorial representation of basic geometric shapes. |

<table>
<thead>
<tr>
<th>5. Measures of Lines and Angles</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Problem Solving</strong></td>
</tr>
</tbody>
</table>
| **Reasoning, Proof** | • Compares the lengths of line segments by estimation and verification.  
• Classifies the given angles.  
• Differentiates the pair of lines as intersecting, perpendicular lines.  
• Estimates the type of given angle.  
• Compares the given angle.  
• Rounds off an angle to nearest measure by estimation. |
| **Communication**: | • ________________ |
| **Connections**: | • Finds the usage of elementary shapes and their measurements in surroundings. |
| **Representation**: | • Draws a line segment with given measurement.  
• Draws the given angle using apparatus. |
<table>
<thead>
<tr>
<th>Section</th>
<th>Problem Solving</th>
<th>Reasoning, Proof</th>
<th>Communication</th>
<th>Connections</th>
<th>Representation</th>
</tr>
</thead>
<tbody>
<tr>
<td>12. Symmetry</td>
<td>• Finds the symmetric axis of given 2D shapes.</td>
<td>• Distinguishes symmetrical and non symmetrical shapes.</td>
<td>• Explains the reflection symmetry in the given 2D figure.</td>
<td>• Observes and identify the reflective symmetry from surroundings.</td>
<td>• Draws the symmetric axis in the given 2D figures.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Appreciates the reflection symmetric nature in surroundings.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Practical Geometry</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>•</td>
<td>• Estimates the given pair of lines whether they are perpendicular or not.</td>
<td>• Estimates the given line whether it is angle bisector or not.</td>
<td></td>
<td>• Draws the line segment, circle, perpendicular bisector, angle, angle bisector.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Understanding 3D, 2D Shapes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Differentiates the 3D shapes as per faces edges, vertices</td>
<td>• Differentiates the 3D shapes as per faces edges, vertices, faces, vertices</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Connections: | Identifies the 3D shape by their names from surroundings.
|     | Understands the relation between cube, cuboid, cylinder and their nets. |
| Representation: | Represents 3D shape as 2D on paper. |

### Mensuration 10. Perimeter and Area

| Problem Solving | Solves the problems involving perimeter and area of rectangle and square.
|     | Solves word problems |
| Reasoning, Proof | Differentiates perimeter and area of a figure.
|     | Finds the perimeter of a given figure, involving more than 2 shapes.
|     | Gives the measurements of rectangle/square which have same area but different perimeters.
|     | Identifies the same perimeter different shapes from given shapes.
|     | Finds errors in solving of perimeter, area and rectifying them. |
| Communication: | Perimeter/area of rectangle/square is expressed in formulae and in words also |
| Connections: | Establishes relation between units to area and perimeter. |
| Representation: | Shows the area of the polygon by shading the region. |

### 8. Data Handling

| Problem Solving | Organization of raw data into classified data. |
| Reasoning, Proof | Interpretation of tabular data into verbal form. |
| Communication: | Merits, demerits of bar graphs and pictographs, comparing with raw data. |
| Connections: | Understands the usage of bar graphs, pictographs in daily life situations (Year-wise population, Annual Budget, Production of crops etc). |
| Representation: | Represents data in tally marks.
|     | Represents data in tabular forms.
<p>|     | Represents data into bar graphs and pictographs. |</p>
<table>
<thead>
<tr>
<th>State / UT Code</th>
<th>India / State / Union Territory</th>
<th>Total Population</th>
<th>Sex ratio (females per 1000 males)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Persons</td>
<td>Males</td>
</tr>
<tr>
<td>1</td>
<td>INDIA</td>
<td>1,210,193,422</td>
<td>623,724,248</td>
</tr>
<tr>
<td>1</td>
<td>Jammu &amp; Kashmir</td>
<td>12,548,926</td>
<td>6,665,561</td>
</tr>
<tr>
<td>2</td>
<td>Himachal Pradesh</td>
<td>6,856,509</td>
<td>3,473,892</td>
</tr>
<tr>
<td>3</td>
<td>Punjab</td>
<td>27,704,236</td>
<td>14,634,819</td>
</tr>
<tr>
<td>4</td>
<td>Chandigarh</td>
<td>1,054,686</td>
<td>580,282</td>
</tr>
<tr>
<td>5</td>
<td>Uttarakhand</td>
<td>10,116,752</td>
<td>5,154,178</td>
</tr>
<tr>
<td>6</td>
<td>Haryana</td>
<td>25,353,081</td>
<td>13,505,130</td>
</tr>
<tr>
<td>7</td>
<td>NCT of Delhi</td>
<td>16,753,235</td>
<td>8,976,410</td>
</tr>
<tr>
<td>8</td>
<td>Rajasthan</td>
<td>68,621,012</td>
<td>35,620,086</td>
</tr>
<tr>
<td>9</td>
<td>Uttar Pradesh</td>
<td>199,581,477</td>
<td>104,596,415</td>
</tr>
<tr>
<td>10</td>
<td>Bihar</td>
<td>103,804,637</td>
<td>54,185,347</td>
</tr>
<tr>
<td>11</td>
<td>Sikkim</td>
<td>607,688</td>
<td>321,661</td>
</tr>
<tr>
<td>12</td>
<td>Arunachal Pradesh</td>
<td>1,382,611</td>
<td>720,232</td>
</tr>
<tr>
<td>13</td>
<td>Nagaland</td>
<td>1,980,602</td>
<td>1,025,707</td>
</tr>
<tr>
<td>14</td>
<td>Manipur</td>
<td>2,721,756</td>
<td>1,369,764</td>
</tr>
<tr>
<td>15</td>
<td>Mizoram</td>
<td>1,091,014</td>
<td>552,339</td>
</tr>
<tr>
<td>16</td>
<td>Tripura</td>
<td>3,671,032</td>
<td>1,871,867</td>
</tr>
<tr>
<td>17</td>
<td>Meghalaya</td>
<td>2,964,007</td>
<td>1,492,688</td>
</tr>
<tr>
<td>18</td>
<td>Assam</td>
<td>31,169,272</td>
<td>15,954,927</td>
</tr>
<tr>
<td>19</td>
<td>West Bengal</td>
<td>91,347,736</td>
<td>46,927,389</td>
</tr>
<tr>
<td>20</td>
<td>Jharkhand</td>
<td>32,966,238</td>
<td>16,931,688</td>
</tr>
<tr>
<td>21</td>
<td>Orissa</td>
<td>41,947,358</td>
<td>21,201,678</td>
</tr>
<tr>
<td>22</td>
<td>Chhattisgarh</td>
<td>25,540,196</td>
<td>12,827,915</td>
</tr>
<tr>
<td>23</td>
<td>Madhya Pradesh</td>
<td>72,597,565</td>
<td>37,612,920</td>
</tr>
<tr>
<td>24</td>
<td>Gujarat</td>
<td>60,383,628</td>
<td>31,482,282</td>
</tr>
<tr>
<td>25</td>
<td>Daman &amp; Diu</td>
<td>242,911</td>
<td>150,100</td>
</tr>
<tr>
<td>26</td>
<td>Dadra &amp; Nagar Haveli</td>
<td>342,853</td>
<td>193,178</td>
</tr>
<tr>
<td>27</td>
<td>Maharashtra</td>
<td>112,372,972</td>
<td>58,361,397</td>
</tr>
<tr>
<td>28</td>
<td>Andhra Pradesh</td>
<td>84,665,533</td>
<td>42,509,881</td>
</tr>
<tr>
<td>29</td>
<td>Karnataka</td>
<td>61,130,704</td>
<td>31,057,742</td>
</tr>
<tr>
<td>30</td>
<td>Goa</td>
<td>1,457,723</td>
<td>740,711</td>
</tr>
<tr>
<td>31</td>
<td>lakshadweep</td>
<td>64,429</td>
<td>33,106</td>
</tr>
<tr>
<td>32</td>
<td>Kerala</td>
<td>33,387,677</td>
<td>16,021,290</td>
</tr>
<tr>
<td>33</td>
<td>Tamil Nadu</td>
<td>72,138,958</td>
<td>36,158,871</td>
</tr>
<tr>
<td>34</td>
<td>Puducherry</td>
<td>1,244,464</td>
<td>610,485</td>
</tr>
<tr>
<td>35</td>
<td>Andaman &amp; Nicobar Islands</td>
<td>3,79,944</td>
<td>202,330</td>
</tr>
</tbody>
</table>

**Distribution of Population and Sex Ratio: Census 2011**