

## CONSTRUCTIONS

### (A) Main Concepts and Results

- Division of a line segment internally in a given ratio.
- Construction of a triangle similar to a given triangle as per given scale factor which may be less than 1 or greater than 1.
- Construction of the pair of tangents from an external point to a circle.

### (B) Multiple Choice Questions

Choose the correct answer from the given four options:

**Sample Question 1 :** To divide a line segment AB in the ratio  $p : q$  ( $p, q$  are positive integers), draw a ray AX so that  $\angle BAX$  is an acute angle and then mark points on ray AX at equal distances such that the minimum number of these points is

- (A) greater of  $p$  and  $q$  (B)  $p + q$   
(C)  $p + q - 1$  (D)  $pq$

**Solution :** Answer (B)

**Sample Question 2 :** To draw a pair of tangents to a circle which are inclined to each other at an angle of  $35^\circ$ , it is required to draw tangents at the end points of those two radii of the circle, the angle between which is

- (A)  $105^\circ$  (B)  $70^\circ$  (C)  $140^\circ$  (D)  $145^\circ$

**Solution :** Answer (D)

### EXERCISE 10.1

Choose the correct answer from the given four options:

- To divide a line segment AB in the ratio 5:7, first a ray AX is drawn so that  $\angle BAX$  is an acute angle and then at equal distances points are marked on the ray AX such that the minimum number of these points is  
(A) 8 (B) 10 (C) 11 (D) 12
- To divide a line segment AB in the ratio 4:7, a ray AX is drawn first such that  $\angle BAX$  is an acute angle and then points  $A_1, A_2, A_3, \dots$  are located at equal distances on the ray AX and the point B is joined to  
(A)  $A_{12}$  (B)  $A_{11}$  (C)  $A_{10}$  (D)  $A_9$
- To divide a line segment AB in the ratio 5 : 6, draw a ray AX such that  $\angle BAX$  is an acute angle, then draw a ray BY parallel to AX and the points  $A_1, A_2, A_3, \dots$  and  $B_1, B_2, B_3, \dots$  are located at equal distances on ray AX and BY, respectively. Then the points joined are  
(A)  $A_5$  and  $B_6$  (B)  $A_6$  and  $B_5$  (C)  $A_4$  and  $B_5$  (D)  $A_5$  and  $B_4$
- To construct a triangle similar to a given  $\triangle ABC$  with its sides  $\frac{3}{7}$  of the corresponding sides of  $\triangle ABC$ , first draw a ray BX such that  $\angle CBX$  is an acute angle and X lies on the opposite side of A with respect to BC. Then locate points  $B_1, B_2, B_3, \dots$  on BX at equal distances and next step is to join  
(A)  $B_{10}$  to C (B)  $B_3$  to C (C)  $B_7$  to C (D)  $B_4$  to C
- To construct a triangle similar to a given  $\triangle ABC$  with its sides  $\frac{8}{5}$  of the corresponding sides of  $\triangle ABC$  draw a ray BX such that  $\angle CBX$  is an acute angle and X is on the opposite side of A with respect to BC. The minimum number of points to be located at equal distances on ray BX is  
(A) 5 (B) 8 (C) 13 (D) 3
- To draw a pair of tangents to a circle which are inclined to each other at an angle of  $60^\circ$ , it is required to draw tangents at end points of those two radii of the circle, the angle between them should be  
(A)  $135^\circ$  (B)  $90^\circ$  (C)  $60^\circ$  (D)  $120^\circ$

**(C) Short Answer Questions with Reasoning**

Write True or False and give reasons for your answer.

**Sample Questions 1 :** By geometrical construction, it is possible to divide a line segment in the ratio  $2\sqrt{3} : 2\sqrt{3}$ .

**Solution :** False. As  $2\sqrt{3} : 2\sqrt{3}$  can be simplified as  $4\sqrt{3} : 1$  and  $4\sqrt{3}$  is not a positive integer, while 1 is.

**EXERCISE 10.2**

Write True or False and give reasons for your answer in each of the following:

1. By geometrical construction, it is possible to divide a line segment in the ratio  $\sqrt{3} : \frac{1}{\sqrt{3}}$ .
2. To construct a triangle similar to a given  $\triangle ABC$  with its sides  $\frac{7}{3}$  of the corresponding sides of  $\triangle ABC$ , draw a ray  $BX$  making acute angle with  $BC$  and  $X$  lies on the opposite side of  $A$  with respect to  $BC$ . The points  $B_1, B_2, \dots, B_7$  are located at equal distances on  $BX$ ,  $B_3$  is joined to  $C$  and then a line segment  $B_6C'$  is drawn parallel to  $B_3C$  where  $C'$  lies on  $BC$  produced. Finally, line segment  $A'C'$  is drawn parallel to  $AC$ .
3. A pair of tangents can be constructed from a point  $P$  to a circle of radius 3.5 cm situated at a distance of 3 cm from the centre.
4. A pair of tangents can be constructed to a circle inclined at an angle of  $170^\circ$ .

**(D) Short Answer Questions**

**Sample Question 1 :** Draw an equilateral triangle  $ABC$  of each side 4 cm. Construct a triangle similar to it and of scale factor  $\frac{3}{5}$ . Is the new triangle also an equilateral?

**Solution :** Follow the similar steps as given in Mathematics Textbook for Class X. Yes, the new triangle is also equilateral.

### EXERCISE 10.3

1. Draw a line segment of length 7 cm. Find a point P on it which divides it in the ratio 3:5.
2. Draw a right triangle ABC in which  $BC = 12$  cm,  $AB = 5$  cm and  $\angle B = 90^\circ$ .  
Construct a triangle similar to it and of scale factor  $\frac{2}{3}$ . Is the new triangle also a right triangle?
3. Draw a triangle ABC in which  $BC = 6$  cm,  $CA = 5$  cm and  $AB = 4$  cm.  
Construct a triangle similar to it and of scale factor  $\frac{5}{3}$ .
4. Construct a tangent to a circle of radius 4 cm from a point which is at a distance of 6 cm from its centre.

### (E) Long Answer Questions

**Sample Questions 1 :** Given a rhombus ABCD in which  $AB = 4$  cm and  $\angle ABC = 60^\circ$ , divide it into two triangles say, ABC and ADC. Construct the triangle

$AB'C'D'$  similar to  $\triangle ABC$  with scale factor  $\frac{2}{3}$ . Draw a line segment  $C'D'$  parallel to CD

where  $D'$  lies on AD. Is  $AB'C'D'$  a rhombus? Give reasons.

**Solution :** First draw the rhombus ABCD in which  $AB = 4$  cm and  $\angle ABC = 60^\circ$  as given in Fig. 10.1 and join AC. Construct the triangle  $AB'C'$  similar to  $\triangle ABC$  with scale factor  $\frac{2}{3}$  as instructed in the Mathematics Textbook for Class X (See Fig. 10.1).

Finally draw the line segment  $C'D'$  parallel to CD.

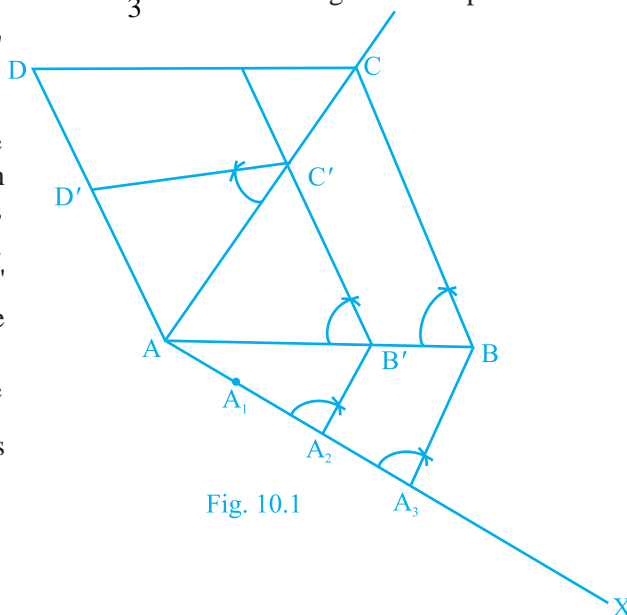


Fig. 10.1

Now 
$$\frac{AB'}{AB} = \frac{2}{3} = \frac{A'C'}{AC}$$

Also 
$$\frac{AC'}{AC} = \frac{C'D'}{CD} = \frac{AD'}{AD} = \frac{2}{3}$$

Therefore,  $AB' = B'C' = C'D' = AD' = \frac{2}{3} AB$ .

i.e.,  $AB'C'D'$  is a rhombus.

#### EXERCISE 10.4

- Two line segments AB and AC include an angle of  $60^\circ$  where  $AB = 5$  cm and  $AC = 7$  cm. Locate points P and Q on AB and AC, respectively such that  $AP = \frac{3}{4} AB$  and  $AQ = \frac{1}{4} AC$ . Join P and Q and measure the length PQ.
- Draw a parallelogram ABCD in which  $BC = 5$  cm,  $AB = 3$  cm and  $\angle ABC = 60^\circ$ , divide it into triangles BCD and ABD by the diagonal BD. Construct the triangle  $BD'C'$  similar to  $\triangle BDC$  with scale factor  $\frac{4}{3}$ . Draw the line segment  $D'A'$  parallel to DA where  $A'$  lies on extended side BA. Is  $A'BC'D'$  a parallelogram?
- Draw two concentric circles of radii 3 cm and 5 cm. Taking a point on outer circle construct the pair of tangents to the other. Measure the length of a tangent and verify it by actual calculation.
- Draw an isosceles triangle ABC in which  $AB = AC = 6$  cm and  $BC = 5$  cm. Construct a triangle PQR similar to  $\triangle ABC$  in which  $PQ = 8$  cm. Also justify the construction.
- Draw a triangle ABC in which  $AB = 5$  cm,  $BC = 6$  cm and  $\angle ABC = 60^\circ$ . Construct a triangle similar to  $\triangle ABC$  with scale factor  $\frac{5}{7}$ . Justify the construction.

6. Draw a circle of radius 4 cm. Construct a pair of tangents to it, the angle between which is  $60^\circ$ . Also justify the construction. Measure the distance between the centre of the circle and the point of intersection of tangents.
7. Draw a triangle ABC in which  $AB = 4$  cm,  $BC = 6$  cm and  $AC = 9$  cm. Construct a triangle similar to  $\triangle ABC$  with scale factor  $\frac{3}{2}$ . Justify the construction. Are the two triangles congruent? Note that all the three angles and two sides of the two triangles are equal.