CHAPTER 10

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°, it is required to draw tangents at the end points of those two radii of the circle, the angle between which is

(A) 105° (B) 70° (C) 140° (D) 145°

Solution : Answer (D)

EXERCISE 10.1

Choose the correct answer from the given four options:

1. To divide a line segment AB in the ratio 5:7, first a ray AX is drawn so that ∠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

2. To divide a line segment AB in the ratio 4:7, a ray AX is drawn first such that ∠BAX is an acute angle and then points A_1, A_2, A_3, ... 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

3. To divide a line segment AB in the ratio 5 : 6, draw a ray AX such that ∠BAX is an acute angle, then draw a ray BY parallel to AX and the points A_1, A_2, A_3, ... and B_1, B_2, B_3, ... 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

4. To construct a triangle similar to a given ΔABC with its sides $\frac{3}{7}$ of the corresponding sides of ΔABC, first draw a ray BX such that ∠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, ... 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

5. To construct a triangle similar to a given ΔABC with its sides $\frac{8}{5}$ of the corresponding sides of ΔABC draw a ray BX such that ∠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

6. To draw a pair of tangents to a circle which are inclined to each other at an angle of 60°, it is required to draw tangents at end points of those two radii of the circle, the angle between them should be

(A) 135° (B) 90° (C) 60° (D) 120°

(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 $7-4\sqrt{3}:1$ and $7-4\sqrt{3}$ 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 ΔABC with its sides $\frac{7}{3}$ of the corresponding sides of ΔABC, 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, ..., 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°.

(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 ∠B = 90°. 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 ∠ABC = 60°, divide it into two triangles say, ABC and ADC. Construct the triangle AB′C′ similar to ΔABC 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 ∠ABC = 60° as given in Fig. 10.1 and join AC. Construct the triangle AB'C' similar to ΔABC 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.

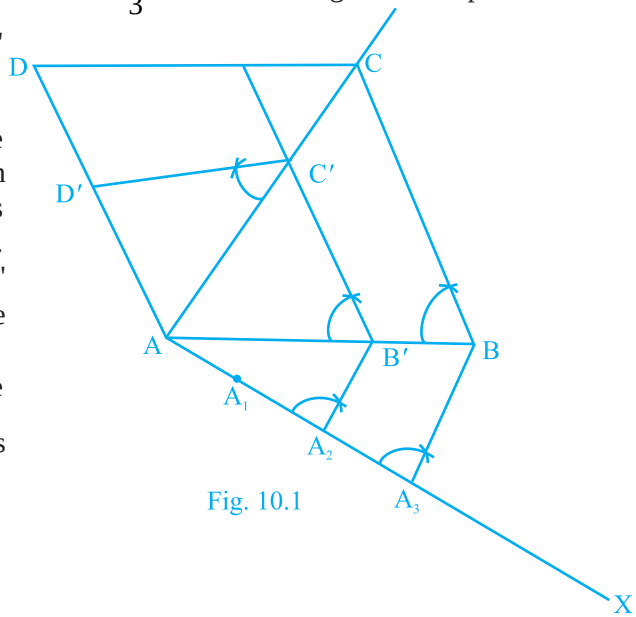

Fig. 10.1

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

1. Two line segments AB and AC include an angle of 60° 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.

2. Draw a parallelogram ABCD in which BC = 5 cm, AB = 3 cm and ∠ABC = 60°, divide it into triangles BCD and ABD by the diagonal BD. Construct the triangle $BD'C'$ similar to ΔBDC 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?

3. 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.

4. Draw an isosceles triangle ABC in which AB = AC = 6 cm and BC = 5 cm. Construct a triangle PQR similar to ABC in which PQ = 8 cm. Also justify the construction.

5. Draw a triangle ABC in which AB = 5 cm, BC = 6 cm and $\angle ABC = 60°$. Construct a triangle similar to 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^{o}. 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 ΔABC 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.