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 $\angle BAX$ 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

2. 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 $A_1, A_2, A_3, ...$ 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 $\angle BAX$ 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 $\angle CBX$ is an acute angle and X lies on the opposite side of A with respect to BC. Then locate points $B_1, B_2, B_3, ...$ 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 $\angle CBX$ 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

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.

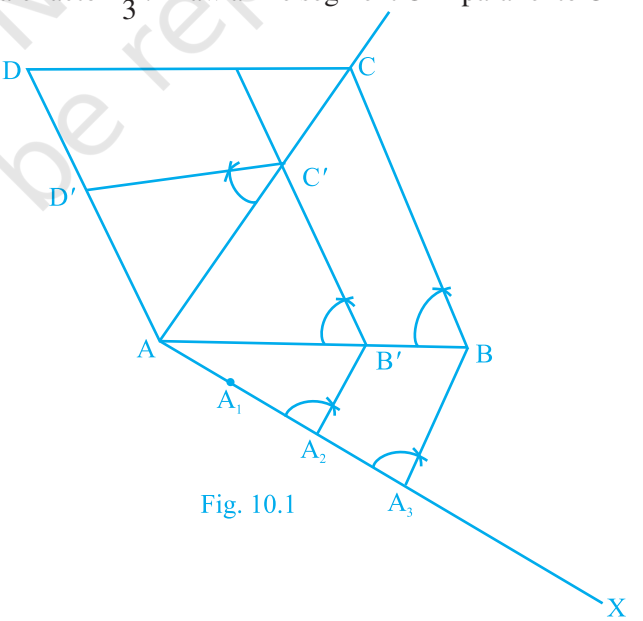

Fig. 10.1

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 ΔABC in which PQ = 8 cm. Also justify the construction.

5. Draw a triangle ABC in which AB = 5 cm, BC = 6 cm and ∠ABC = 60°. Construct a triangle similar to ΔABC 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 60º. 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.