Constructions

Exercise 4.1

I. Very Short Answer Type Questions [1 Mark]

1. Multiple Choice Questions (MCQs)

Choose the correct answer from the given options:

(1) To divide a line segment AB in the ratio 5 : 7, first a ray AX is drawn such that ∠BAX is an acute angle and then at equal distances points are marked on the ray such that the minimum number of these points is

(*a*) 8 (*b*) 10 (*c*) 11 (*d*) 12

(2) To divide line segment AB in the ratio $m : n$, draw a ray AX so that ∠BAX is an acute angle and then mark points on ray AX at equal distance such that the minimum number of these points is

(*a*) $m + n$ (*b*) $m - n$ (*c*) $m \times n$ (*d*) $m \div n$

(3) To divide a line segment AB in the ratio 5 : 6, we draw a ray such that ∠BAX is an acute angle, locate points A_1, A_2, A_3, ... at equal distances on the ray AX and join point B to

(*a*) A_{12} (*b*) A_{11} (*c*) A_{10} (*d*) A_9

2. Assertion-Reason Type Questions

In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(*a*) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(*b*) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(*c*) Assertion (A) is true but reason (R) is false.

(*d*) Assertion (A) is false but reason (R) is true.

(1) **Assertion (A):** By geometrical construction, it is possible to divide a line segment in the ratio $\sqrt{3} : \frac{1}{\sqrt{3}}$.

Reason (R): To divide a line segment in the ratio $p : q$, p and q must be positive integers.

(2) **Assertion (A):** When a line segment is divided in the ratio 2 : 3, the number of parts in which the line is divided is 5.
Reason (R): To divide a line segment in the ratio $p : q$, we divide it into $(p + q)$ parts.

3. Answer the following:

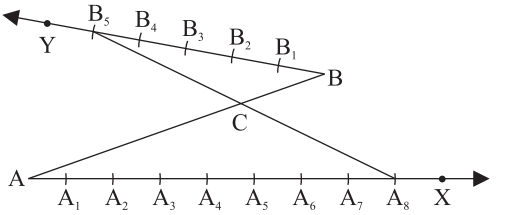
(1) Draw a line segment of length 6 cm. Using compasses and ruler, find a point P on it which divides it in the ratio 3 : 4. [Delhi 2011]

(2) Draw a line segment AB of length 6.5 cm. Find a point P on it such that $\frac{AP}{AB} = \frac{3}{5}$. [Foreign 2011]

(3) Geometrically divide a line segment of length 8.4 cm in the ratio 5 : 2. [CBSE 2015]

(4) Draw a line segment of length 7.6 cm and divide it in the ratio 3 : 2. [Foreign 2011]

(5) In the figure given on the next page, if B_1, B_2, B_3,..... and A_1, A_2, A_3,..... have been marked at equal distances. In what ratio C divides AB? [CBSE Standard SP 2020-21]



(6) To divide a line segment BC internally in the ratio 3 : 5, we draw a ray BX such that ∠CBX is an acute angle. What will be the minimum number of points to be located at equal distances, on ray BX?

II. Short Answer Type Questions - I [2 Marks]

4. Draw a line segment AB of length 7 cm. Using ruler and compasses, find a point P on AB such that AP : PB = 3 : 5. [NCERT Exemplar] [CBSE 2011]

5. Draw a line segment of length 8 cm and divide it internally in the ratio 4 : 5. [Delhi 2017]

6. Draw a line segment of length 7.6 cm and divide it in the ratio 5 : 8. Measure the two parts. [NCERT]

III. Short Answer Type Questions - II [3 Marks]

7. Draw a line segment of length 8 cm and divide it in the ratio 2 : 3.

8. Draw a line segment of length 6 cm and divide it in the ratio 3 : 2.

9. Draw a line segment of length 7 cm. Find a point P on it which divides it in the ratio 3 : 5.

Answers and Hints

1. (1) (*d*) 12 (1) (2) (*a*) $m + n$ (1)

(3) A_{11} (1)

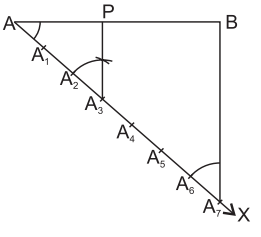
2. (1) (*a*) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A). (1)

(2) (*a*) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A). (1)

3. (1) Steps of construction:

(*i*) Draw a line segment AB = 6 cm.

(*ii*) Draw any ray AX making an acute angle XAB with AB.



(*iii*) Along AX mark 7 (3 + 4) points $A_1, A_2, A_3, A_4, \ldots\ldots, A_7$ at equal distances such that $AA_1 = A_1A_2 = \ldots\ldots = A_6A_7$.

(*iv*) Join A_7B.

(*v*) From A_3, draw A_3P parallel to A_7B (by making an angle equal to $\angle AA_7B$ at A_3), to meet AB at point P.

Then AP : PB = 3 : 4. (1)

(5) 8 : 5 (1)

(6) 8 (1)

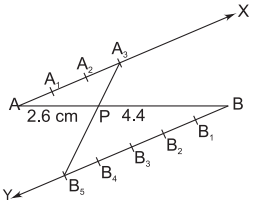
4. Steps of construction:

(*i*) Draw a line segment AB = 7 cm.

(*ii*) Draw AX || BY such that ∠A and ∠B are acute angles.

(*iii*) Divide AX and BY in 3 and 5 parts equally by compass and mark $A_1, A_2, A_3, B_1, B_2, B_3, B_4$ and B_5 respectively.

(*iv*) Join A_3B_5 which intersects AB at P and divides AP : PB = 3 : 5.



Hence, P is the required point on AB which divides it in 3 : 5. (2)

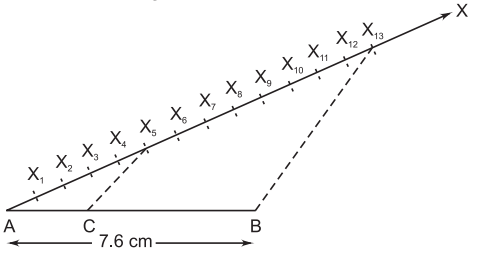
6. Steps of construction:

(*i*) Draw a line segment AB = 7.6 cm.

(*ii*) Draw a ray AX making an acute angle with AB.

(*iii*) Mark 13 (8 + 5) equal points on AX, and mark them as $X_1, X_2, X_3, \ldots\ldots, X_{13}$.

(*iv*) Join 'point X_{13}' and B.



(*v*) From 'point X_5', draw $X_5C \parallel X_{13}B$, which meets AB at C.

Thus, C divides AB in the ratio 5 : 8

On measuring the two parts, we get:

AC = 2.9 cm and BC = 4.7 cm. (2)

Exercise 4.2

I. Very Short Answer Type Questions [1 Mark]

1. Multiple Choice Questions (MCQs)

Choose the correct answer from the given options:

(1) To draw a pair of tangents to a circle which are inclined to each other at an angle of 30°, it is required to draw tangents at end points of those two radii of the circle, the angle between them should be

(*a*) 150° (*b*) 90° (*c*) 60° (*d*) 120°

(2) If you draw a pair of tangents to a circle C(O, *r*) from point P such that OP = 2*r*, then the angle between the two tangents is

(*a*) 90° (*b*) 30° (*c*) 60° (*d*) 45°

2. Assertion-Reason Type Question

In the following question, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(*a*) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(*b*) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(*c*) Assertion (A) is true but reason (R) is false.

(*d*) Assertion (A) is false but reason (R) is true.

(1) **Assertion (A):** If two tangents AB and AC are drawn from a common point A to a circle of radius 4 cm, then AB = AC.

Reason (R): Tangents drawn from an external point to a circle are equal.

3. Answer the following:

(1) Is it possible to construct a pair of tangents from point P to circle of radius 5 cm situated at a distance of 4.9 cm from the centre?

(2) Is it possible to construct a pair of tangents from point P lying on circle of radius 4 cm and centre O?

II. Short Answer Type Questions - I [2 Marks]

4. Draw a circle of radius 3 cm. Take a point P at a distance of 4.5 cm from the centre of the circle and from the point P, draw two tangents to the circle.

5. Draw two tangents to a circle of radius 4 cm from a point P at a distance of 6 cm from its centre.

6. Draw a line segment AB of length 9 cm. With A and B as centres, draw circles of radius 5 cm and 3 cm respectively. Construct tangents to each circle from the centre of the other circle. [CBSE Standard SP 2020-21]

III. Short Answer Type Questions - II [3 Marks]

7. Draw a circle of radius 3 cm. From a point 6 cm away from its centre, construct the pair of tangents to the circle and measure their lengths. [CBSE 2014]

8. Draw a pair of tangents to a circle of radius 5 cm which are inclined to each other at an angle of 60°. [Foreign 2014]

9. Draw a pair of tangents to a circle of radius 4 cm, which are inclined to each other at an angle of 60° [CBSE 2016, AI 2013]

10. Draw a circle of radius 4 cm. From the point 7 cm away from its centre, construct the pair of tangents to the circle.

11. Draw a circle of radius 3.5 cm. Take a point P outside the circle at a distance of 7 cm from the centre of the circle and construct a pair of tangents to the circle from that point. [CBSE Standard 2020]

IV. Long Answer Type Questions [5 Marks]

12. Draw a right triangle ABC in which AB = 6 cm, BC = 8 cm and $\angle B = 90°$. Draw BD perpendicular from B on AC and draw a circle passing through the points B, C and D. Construct tangents from A to this circle. [Delhi 2014]

13. Draw a line segment AB of length 8 cm. Taking A as centre, draw a circle of radius 4 cm and taking B as centre, draw another circle of radius 3 cm. Construct tangents to each circle from the centre of the other circle. [AI 2014]

14. ΔABC is a right-angled triangle, in which AB = 3 cm, BC = 4 cm and $\angle B = 90°$. BD is perpendicular from B on AC. The circle through B, C and D is drawn. Construct the tangents from A to the given circle. [CBSE 2015]

15. Draw two concentric circles C_1 and C_2 of radii 3 cm and 5 cm. Taking a point on outer circle C_2, construct the pair of tangents to the other. Measure the length of a tangent and verify it by actual calculation. [NCERT Exemplar]

16. Draw two concentric circles of radii 3 cm and 5 cm. Construct a tangent to smaller circle from a point on the larger circle. Also measure its length. [Delhi 2016]

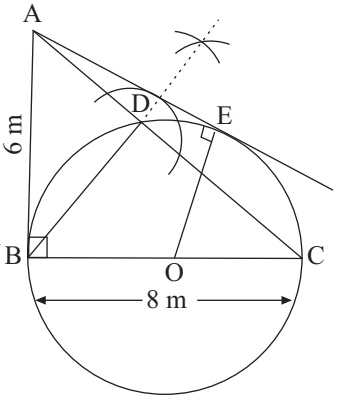
17. Draw a circle of radius 3 cm. Take two points P and Q on one of its extended diameters each at a distance of 7 cm from its centre. Draw tangents to the circle from these two points P and Q. [NCERT]]

18. Construct a pair of tangents to a circle of radius 3 cm which are inclined to each other at an angle of 60°. [CBSE Standard SP 2019-20]

19. Draw a circle of radius 2 cm with centre O and take a point P outside the circle such that OP = 6.5 cm. From P, draw two tangents to the circle. [CBSE Standard 2020] **[Imp.]**

Case Study Based Questions

I. The management of a school decided to arouse interest of their students in Mathematics. So they want to construct some geometrical shapes in one corner of the school premises. They showed a rough sketch of a right triangular structure on a plane sheet of paper with sides AB = 6 m, BC = 8 m and $\angle B = 90°$. The diagram shows a perpendicular from the vertex B to the front side AC. They want to build a circular wall through B, C and D but they had certain problems in doing so. So they called on some students of class X to solve this problem. They made some suggestions.



1. To find centre of the circle, the students made some suggestions which are as follows:

(*a*) Draw perpendicular BD on AC

(*b*) Draw perpendicular bisectors of BC and CD.

(*c*) The intersecting point of perpendiculars of BC and CD are the centre of the circle.

(*d*) All of the above

2. Referring to the above, what will be the length of AD?

(*a*) 3.6 m (*b*) 3.8 m (*c*) 4.8 m (*d*) 5.6 m

3. Referring to the above, what is the length of perpendicular drawn on side AC from vertex B?

(*a*) 2.6 m (*b*) 3.0 m (*c*) 4.8 m (*d*) 4.0 m

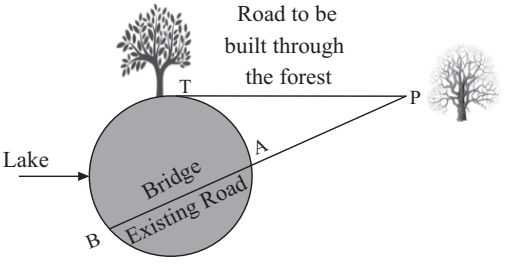
4. Referring to the above, the length of tangent AE is

(*a*) 10 m (*b*) 8 m (*c*) 12 m (*d*) 6 m

5. Referring to the above, sum of angles $\angle BAE$ and $\angle BOE$ is

(*a*) 120° (*b*) 180° (*c*) 90° (*d*) 60°

II. The construction of a road is in progress. A road already exists through a forest that goes over a circular lake. The engineer wants to build another road through the forest that connects this road, but does not go through the lake.



As it turns out, the road the engineer will be building and the road it will connect to both represent characteristics of a circle that have their own name. The road/bridge that already exists is called a secant of the circular lake, and the road the engineer is going to build is called the tangent of the circular lake.

1. Refer to the above, if PT = 12 km and PA = 9 km, then the length of existing bridge is

(*a*) 7 km (*b*) 9 km (*c*) 12 km (*d*) 16 km

2. Refer to the above if the length of existing bridge is 5 km and the length of the existing road outside the lake is 4 km, then the length of the road under construction is

(*a*) 4 km (*b*) 6 km (*c*) 10 km (*d*) 14 km

3. Refer to the question (2) if the road under construction, PT is 6 km and it is inclined at an angle of 30° to the line joining the centre, the radius of the lake is

(*a*) $3\sqrt{3}$ km (*b*) $4\sqrt{3}$ km (*c*) $2\sqrt{3}$ km (*d*) $5\sqrt{3}$ km

4. Refer to the question (3) above, the circumference of the lake is

(*a*) $2\sqrt{3}\,\pi$ km (*b*) $3\sqrt{3}\,\pi$ km (*c*) $4\sqrt{3}\,\pi$ km (*d*) $5\sqrt{3}\,\pi$ km

5. Refer to the question (3) above, the area of the lake is

(*a*) 12π km^2 (*b*) 16π km^2 (*c*) 18π km^2 (*d*) 9π km^2

Answers and Hints

1. (1) (*a*) 150° (1) (2) (*c*) 60° (1)

2. (1) (*a*) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A). (1)

3. (1) No (1) (2) No (1)

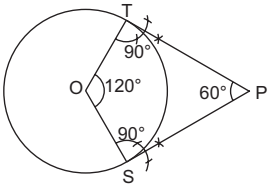
7. 5.20 m (approx) (3)

8. Steps of construction:

(*i*) A circle, with centre O and radius 5 cm is drawn.

(*ii*) As tangents are inclined at 60°.

$\therefore \quad \angle TOS = 120°$.



(*iii*) Two radius OT and OS, inclined at an angle of 120° are drawn.

(*iv*) Tangents are drawn to the circle at T and S meeting at P.

Then PT and PS are the required tangents. (3)

9. Proceed same as Q8. (3)

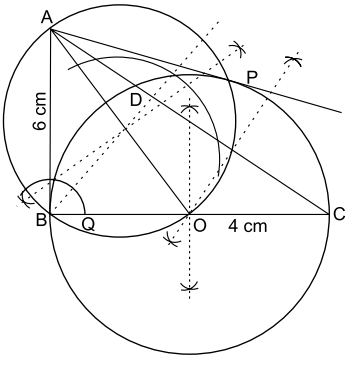
12. Steps of construction:

(*i*) Draw a right angle triangle ABC, right angled at B, AB = 6 cm and BC = 8 cm.

(*ii*) Draw BD ⊥ AC.

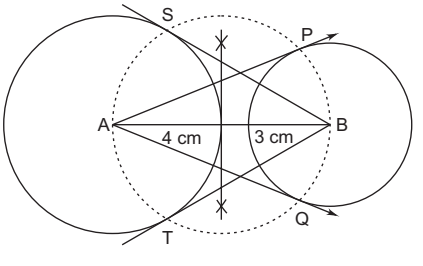
(*iii*) Draw a circumcircle of ΔBDC.

(*iv*) From point A draw a pair of tangents AB and AP.



Then AB and AP are the required tangents. (5)

13. Steps of construction:



(*i*) AB = 8 cm is taken.

(*ii*) With centre A, a circle of radius 4 cm is drawn and with centre B, a circle of radius 3 cm is drawn.

(*iii*) With AB as diameter, a circle is drawn meeting circle with centre A at S and T respectively and circle with centre B at P and Q respectively.

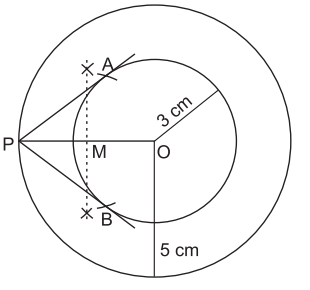
(*iv*) Then AP and AQ are tangents from A to circle with centre B and BS and BT are tangents from B to circle with centre A. (5)

15. 4 cm (5)

16. Steps of construction:

(*i*) Take point O. Draw two concentric circles of radii 3 cm and 5 cm respectively.

(*ii*) Locate point P on the circumference of larger circle.



(*iii*) Join OP and bisect it. Let M be mid-point of OP.

(*iv*) Taking M as centre and MP as radius, draw an arc intersecting smaller circle at A and B.

(*v*) Join PA and PB. Thus, PA and PB are required tangents. (5)

17. Steps of construction:

(*i*) Join P and O.

(*ii*) Bisect PO such that M be its mid-point.

(*iii*) Taking M as centre and MO as radius, draw a circle. Let it intersects the given circle at A and B.

(*iv*) Join PA and PB.

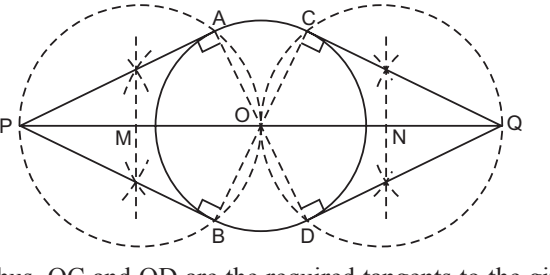
Thus, PA and PB are the two required tangents from P.

(*v*) Now, join O and Q.

(*vi*) Bisect OQ such that N is its mid-point.

(*vii*) Taking N as centre and NO as radius, draw a circle. Let it intersects the given circle at C and D.

(*viii*) Join QC and QD.



Thus, QC and QD are the required tangents to the given circle. (5)

Case Study Based Questions

I. **1.** (*d*) All of the above

2. (*a*) 3.6 m **3.** (*c*) 4.8 m

4. (*d*) 6 m **5.** (*b*) 180°

II. **1.** (*a*) 7 km **2.** (*b*) 6 km

3. (*c*) $2\sqrt{3}$ km **4.** (*c*) $4\sqrt{3}\,\pi$ km

5. (*a*) 12π km^2