CONSTRUCTIONS

✅ (A) OBJECTIVE TYPE QUESTIONS

🌐 Stand Alone MCQs (1 Mark Each)

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   C + U

Ans. Option (D) is correct.

> *Explanation:* Minimum number of the points marked = sum of ratios = 5 + 7 = 12.

2. To divide a line segment AB in 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}

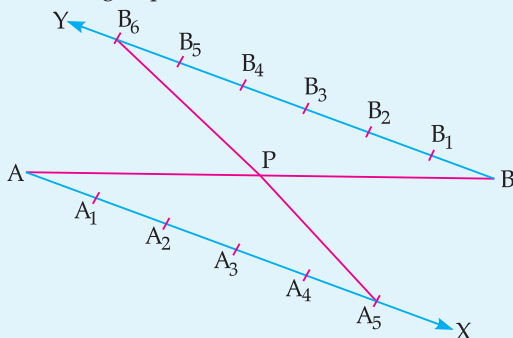(C) A_{10} (D) A_9 C + U

Ans. Option (B) is correct.

> *Explanation:* We have to divide the line segment into 7 + 4 = 11 equal parts and 11th part will be joined to B, here A_{12} will never appear.

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 C 59 + U

Ans. Option (A) is correct.

> *Explanation:* In the figure, segment *AB* of given length is divided into 2 parts of ratio 5 : 6 in following steps:
>
>
>
> (i) Draw a line-segment AB of given length.
> (ii) Draw an acute angle BAX as shown in figure.

(iii) Draw angle $\angle ABY = \angle BAX$ on other side of AB.

(iv) Divide AX into 5 equal parts by using compass.

(v) Divide BX into at in 6 equal parts at as AX was divided.

(vi) Now, join A_5 and B_6 which meet AB at P. P divides AB in ratio $AP : PB = 5 : 6$.

AI 4. 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°

Ans. Option (D) is correct.
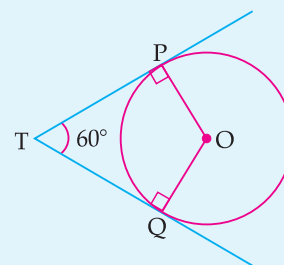
> *Explanation:*
>
>
>
> We know that tangent and radius at contact point are perpendicular to each other. So, $\angle P$ and $\angle Q$ in quadrilateral TPOQ formed by tangents and radii will be of 90° each.
>
> So, the sum of
> $$\angle T + \angle O = 180°$$
> as $\qquad \angle T = 60° \qquad$ [Given]
> $\therefore \qquad \angle O = 180° - 60°$
> $$= 120°$$

👁 Case-based MCQs (1 Mark Each)

Attempt any four sub-parts from each question. Each sub-part carries 1 mark.

AI I. Read the following text and answer the questions given below it:

> A school conducted Annual Sports Day on a triangular playground. On the ground, parallel lines have been drawn with chalk powder at a distance of 1 m. 7 flower pots have been placed at a distance of 1 m from each other along DM as shown in the figure.
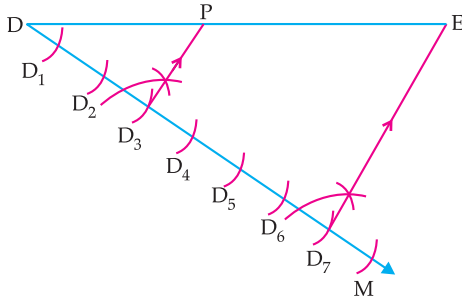
1. PD_3 is parallel to:

(A) PD   (B) PE

(C) ED_7 (D) None of these.

Ans. Option (C) is correct.

> *Explanation:* In ΔED_7D,
> $$PD_3 \parallel ED_7.$$

2. If $\angle PD_3D = 82°$, then the measure of $\angle ED_7D$ is:

(A) 98°   (B) 82°

(C) 90°   (D) 45°

Ans. Option (B) is correct.

> *Explanation:* We have,
> $$PD_3 \parallel ED_7$$

Then, $\angle ED_7D = \angle PD_3D$
[Corresponding angles]

∴ $\angle ED_7D = 82°$.

3. The ratio in which P divides DE, is:

(A) 3 : 4   (B) 7 : 3

(C) 3 : 7   (D) 2 : 5

Ans. Option (A) is correct.

> *Explanation:* P divides DE in the ratio 3 : 4.

4. The ratio of DE to DP will be:

(A) 2 : 5   (B) 3 : 4

(C) 3 : 7   (D) 7 : 3

Ans. Option (D) is correct.

> *Explanation:* Since
> $$DP : PE = 3 : 4$$
> ∴ $DE : DP = 7 : 3$

5. The total distance used for putting 7 flower pots is:

(A) 6 m   (B) 7 m

(C) 5 m   (D) 8 m.
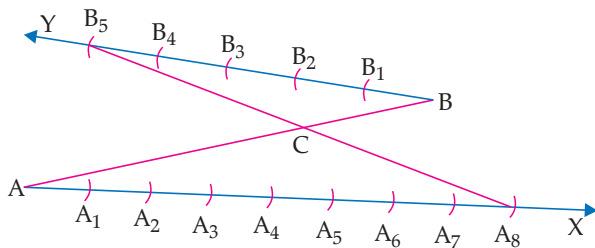
Ans. Option (B) is correct.

> *Explanation:* Since, 7 flower pots have been placed at a distance of 1 m from each other, then total distance = 7 m.

✔ (B) SUBJECTIVE QUESTIONS

Very Short Answer Type Questions
(1 Mark Each)

AI 1. In the figure, if B_1, B_2, B_3,…... and A_1, A_2, A_3,…... points have been marked at equal distances. On lines X and Y in what ratio does C divides AB?

U [CBSE SQP, 2020-21]

Sol. C divides AB internally in the ratio 8 : 5.

2. To find a point P on the line segment $AB = 6$ cm, such that $\dfrac{AP}{AB} = \dfrac{2}{5}$, in which ratio the line segment AB is divided.

A

Sol. The line segment AB is divided in the ratio

$$AP : PB = 2 : (5 - 2) = 2 : 3$$

3. A line segment AB is divided at point P such that $\dfrac{PB}{AB} = \dfrac{3}{7}$, then find the radio $AP : PB$.

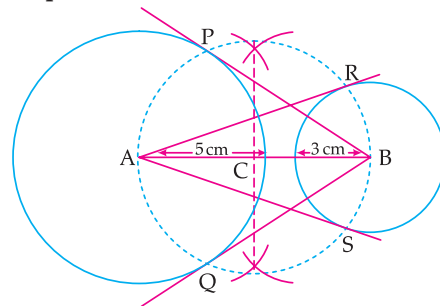A

Sol. Here, $AB = 7$, $PB = 3$

∴ $AP = AB - PB = 7 - 3 = 4$

∴ $AP : PB = 4 : 3$

Short Answer Type Questions-I
(2 Marks Each)

AI 1. 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.

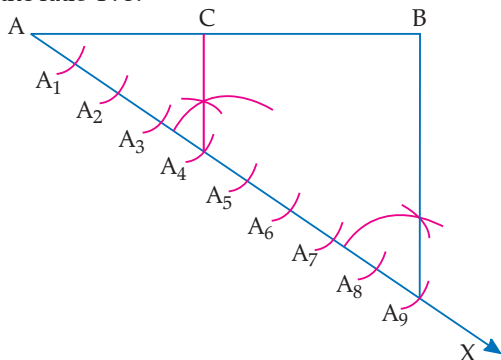**Sol. Steps of Construction:**

1. Draw a line segment AB of 9 cm.

2. Taking A and B as centres draw two circles of radii 5 cm and 3 cm respectively.

3. Bisect the line AB. Let mid-point of AB be C.

4. Taking C as centre draw a circle of radius AC which intersects the two circles at point P, Q, R and S.

5. Join BP, BQ, AS and AR.

BP, BQ and AR, AS are the required tangents.

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

Sol. Steps of Construction:

1. Draw a line segment $AB = 8$ cm and draw a ray AX making an acute angle with AB at A.

2. Locate $(4 + 5) = 9$ points $A_1, A_2, A_3, ... A_9$ on AX such that $AA_1 = A_1A_2 = A_2A_3 .... = A_8A_9$.

3. Join BA_9

4. Through the point A_4 draw a line parallel to BA_9 intersecting AB at C.

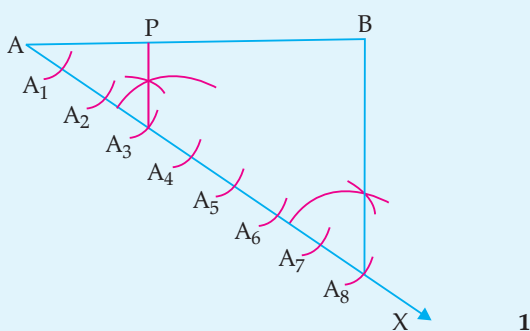**5.** Therefore, C is the point which divides the AB in the ratio 4 : 5.

3. Draw a line segment of length 7 cm. Find a point P on it which divides it in the ratio 3 : 5. Ⓤ **[CBSE Term-II, 2015]**

Sol. Steps of construction:

1. Draw a line segment $AB = 7$ cm.

2. Draw any ray AX making an acute angle down ward with AB.

3. Mark the points $A_1, A_2, A_3, ..., A_8$ on AX such that $AA_1 = A_1A_2 = A_2A_3 = ..., A_7A_8$.

4. Join BA_8.

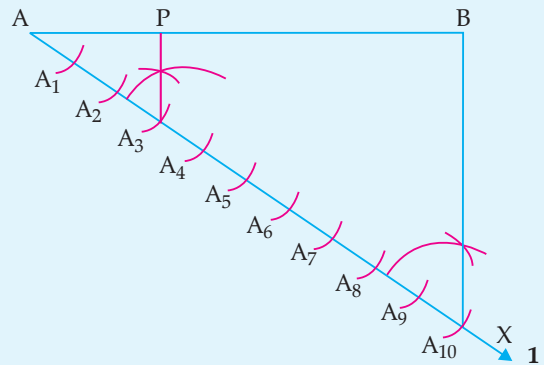**5.** Through the point A_3, draw a line parallel to BA_8. To meet AB on P.

Hence $AP : PB = 3 : 5$ **1**

[CBSE Marking Scheme, 2015]

4. Draw a line segment of length 5 cm and divide it in the ratio 3 : 7. Ⓤ **[CBSE Term-II, 2015]**

Sol. Steps of Construction:

1. Draw a line segment $AB = 5$ cm.

2. Draw any ray AX making an acute angle downward with AB.

3. Mark the points $A_1, A_2, A_3, ... A_{10}$ on AX such that $AA_1 = A_1A_2 = ... = A_9A_{10}$.

4. Join BA_{10}.

5. Through the point A_3 draw a line parallel to BA_{10}. To meet AB at P.

Hence $AP : PB = 3 : 7$. **1**

[CBSE Marking Scheme, 2015]

5. Draw a line segment AB of length 7 cm. Taking A as centre, draw a circle of radius 3 cm and taking B as centre, draw another circle of radius 2 cm. Construct tangents to each circle from the centre of the other circle. Ⓐ **[CBSE Delhi Term-II, 2015]**

Sol. Steps of Construction:

1. Draw a line segment AB of 7 cm.

2. Taking A and B as centres draw two circles of radii 3 cm and 2 cm respectively.
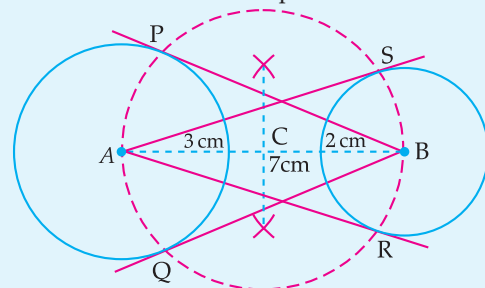
3. Bisect the line AB. Let mid-point of AB be C.

4. Taking C as centre draw a circle of radius AC which intersects the two circles at point P, Q, R and S.

5. Join BP, BQ, AS and AR.

BP, BQ and AR, AS are the required tangents. **2**

[CBSE Marking Scheme, 2015]

ⒶⒾ **6. Draw a circle of radius 1.5 cm. Take a point P outside it. Without using the centre draw two tangents to the circle from the point P.**

Ⓐ 💡 **[O.E.B.]**

Sol. Steps of construction:

1. Draw a circle of radius 1.5 cm. Take a point P outside it.

2. Through P draw a secant PAB to meet the circle at A and B.

3. Produce AP to C such that $PC = PA$. Bisect CB at Q.

4. With CB as diameter and centre as Q, draw a semi-circle.

5. Draw $PD \perp CB$, to meet semi-circle at the point D.

6. Taking P as centre and PD as radius draw an arc to intersect the circle at T and T′.

7. Join P to T and T′

   Hence, PT and PT′ are the required tangents.
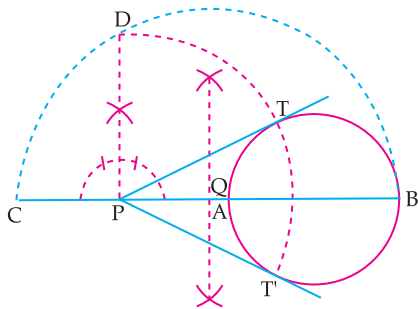
7. **Two line-segments AB and AC include an angle of 60°, where $AB = 5$ cm and $AC = 7$ cm. Locate points P and Q on AB and AC respectively such that $AP = \dfrac{3}{4}\ AB$ and $AQ = \dfrac{1}{4}\ AC$. Join P and Q and measure the length PQ.** [A] 💡 **[O.E.B.]**

Sol. Steps of construction:

1. Draw $\angle BAC = 60°$ such that $AB = 5$ cm and $AC = 7$ cm.

2. Draw acute angle CAX and mark $X_1, X_2, X_3,$ and X_4 equally spaced.

3. Join X_4C.

4. Draw $X_1Q \parallel X_4C$.
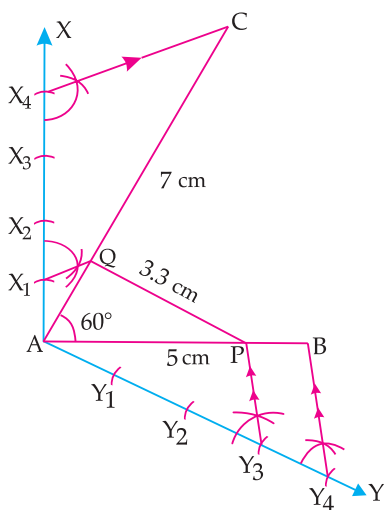
5. Similarly, draw $\angle BAY$ and divide AY in 4 equal parts, *i.e.*, Y_1, Y_2, Y_3 and Y_4.

6. Join Y_4B and draw $Y_3P \parallel Y_4B$.

7. Join PQ and measure it.

8. PQ is equal to 3.3 cm.

❓ Short Answer Type Questions-II

(3 Marks Each)

1. **Draw a circle of radius of 3 cm. Take two points P and Q one of its diameter extended on both sides, each at a distance of 7 cm on opposite sides of its centre. Draw tangents to the circle from these two points.**
   [A] **[CBSE Foreign Set-III, 2017]**

Sol. Steps of Construction:

1. Draw a circle with centre O and radius 3 cm.

2. Draw its diameter MON and extend it to both the sides to P and Q. Such that $OP = OQ = 7$ cm.

3. Taking diameters as OP and OQ draw two circles each of which intersects the first circle at the points A, B and C, D respectively.

4. Join PA, PB, QC and QO to get the required tangents.
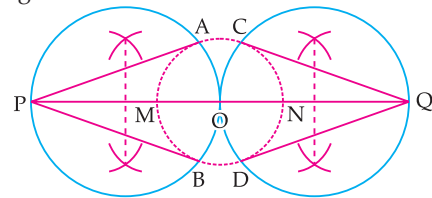
2. **Construct a pair of tangents PQ and PR to a circle of radius 4 cm from a point P outside the circle 8 cm away from the centre. Measure PQ and PR.**
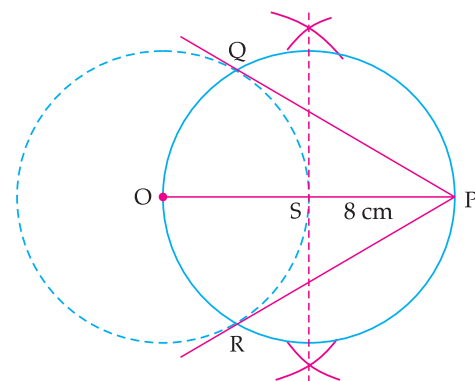   [A] **[CBSE Term-II, 2015]**

Sol. Steps of construction:

1. Draw a line segment $OP = 8$ cm

2. Taking O as centre and radius 4 cm, draw a circle.

3. Taking OP as diameter draw another circle which intersects the first circle at Q and R.

4. Join P to Q and P to R.

   On measuring, we get

   $$PQ = PR = 6.92 \text{ cm (Approx.)}$$

3. Construct a tangent to a circle of radius 4 cm from a point on the concentric circle of radius 6 cm. [A] **[CBSE Term-II, 2013]**

**Sol. Steps of construction:**

1. Draw a circle of radius 4 cm with centre O.

2. Draw another circle of radius 6 cm with same centre O.

3. Take a point P on second circle and join OP.

4. Draw perpendicular bisector of OP which intersect OP at O′.

5. Draw a circle with centre O′ which intersects the inner circle at points A and B.

6. Join PA and PB, which are the required tangents.
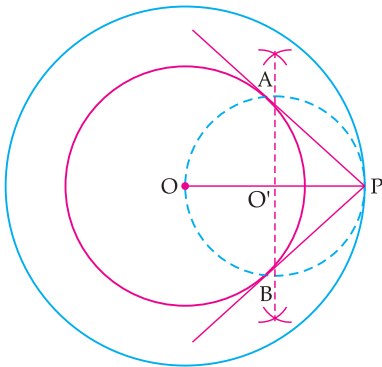
4. Draw a line segment of length 6 cm and divide it internally in the ratio 4 : 3. Prove your assertion.

[C] + [AE] ⚡ **[O.E.B.]**

Sol. Steps of Construction:

1. Draw a line segment $AB = 6$ cm.

2. Draw a ray AX, making an acute $\angle BAX$.

3. Along AX, mark $(4 + 3) = 7$ points $A_1, A_2, A_3, ..., A_7$ such that $AA_1 = A_1A_2 = ... = A_6A_7$.

4. Join BA_7.

5. Through the point A_4 draw a line parallel to BA_7, to meet AB at C. Hence, $AC : CB = 4 : 3$.
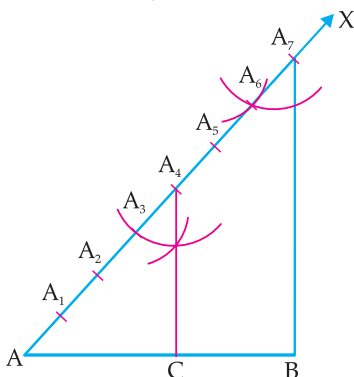
Proof: Suppose $AA_1 = A_1A_2 = ... = A_6A_7 = x$
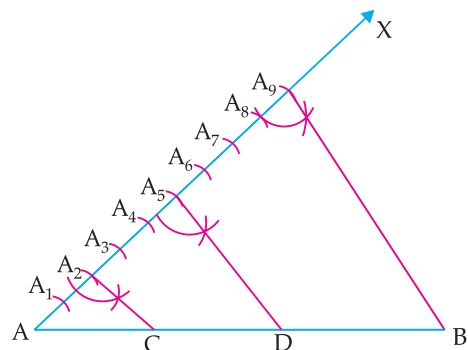
In ΔBAA_7, we have $CA_4 \parallel BA_7$

$\therefore \qquad \dfrac{AC}{CB} = \dfrac{AA_4}{A_4A_7} = \dfrac{4x}{3x} = \dfrac{4}{3}$

[By using Thale's theorem]

Hence, $\qquad AC : CB = 4 : 3$.

5. Draw a line segment of length 13.5 cm and divide it internally in the ratio 2 : 3 : 4. Measure each part and verify it. [C] + [AE] ⚡ **[O.E.B.]**

Sol.

Steps of Construction:

1. Draw a line segment $AB = 13.5$ cm.

2. Draw a ray AX, making an acute $\angle BAX$.

3. Along AX, mark $(2 + 3 + 4) = 9$ points $A_1, A_2, A_3, ..., A_9$ such that $AA_1 = A_1A_2 = A_2A_3 = ... = A_8A_9$.

4. Join BA_9.

5. Through the points A_2 and A_5, draw $BA_9 \parallel CA_2$ and $BA_9 \parallel DA_5$. To meet AB at C and D respectively.

6. On measuring the three parts, we get $AC = 3$ cm, $CD = 4.5$ cm and $DB = 6$ cm.

Verification: $AC = 2x, CD = 3x$ and $DB = 4x$

$\therefore \qquad 2x + 3x + 4x = 13.5$

$\Rightarrow \qquad 9x = 13.5$

$\Rightarrow \qquad x = 1.5$

Sum of ratio $= 2 + 3 + 4 = 9$

$\therefore \qquad AC = \dfrac{2x}{9x} \times 13.5 = 3$ cm

$\qquad CD = \dfrac{3x}{9x} \times 13.5 = 4.5$ cm

and $\qquad DB = \dfrac{4x}{9x} \times 13.5 = 6$ cm

Hence, $AC + CD + DB = (3 + 4.5 + 6)$ cm

$\qquad\qquad = 13.5$ cm.

6. Draw a line segment of length 7.6 cm and divide it in the ratio 5 : 8 and verify it. [A] ⚡ **[O.E.B.]**

Sol.
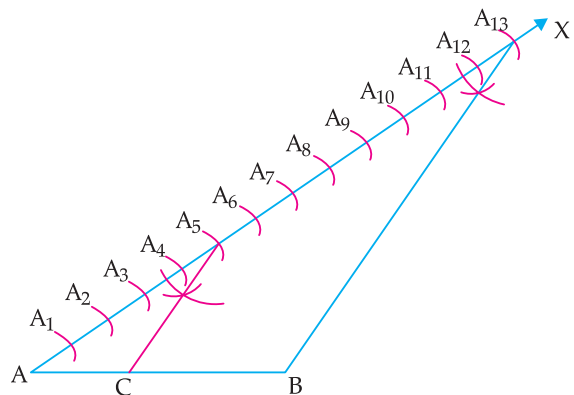
Steps of Construction:

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

(ii) Draw a ray AX, making an acute $\angle BAX$.

(iii) Along AX, make $(5 + 8) = 13$ points $A_1, A_2, A_3, ...,$ A_{13} such that $AA_1 = A_1A_2 = A_2A_3 = ... = A_{12}A_{13}$.

(iv) Join BA_{13}.

(v) Through the point A_5 draw a line parallel to BA_{13}, to meet AB at C.

Hence, $AC : CB = 5 : 8$.

(vi) On measuring the two parts, we get $AC = 4.7$ cm and $BC = 2.9$ cm.

Verification:

In ΔACX_5 and ΔABX_{13}, we have,

$$BA_{13} \parallel CA_5.$$

$$\therefore \qquad \frac{AC}{CB} = \frac{AA_5}{A_5A_{13}} = \frac{5}{8}$$

$$\Rightarrow \qquad AC : CB = 5 : 8$$

## Long Answer Type Questions

(5 Marks Each)

1. Draw a line segment AB of length 7 cm. Taking A as centre, draw a circle of radius 3 cm and taking B as centre, draw another circle of radius 2 cm. Construct tangents to each circle from the centre of the other circle. A [CBSE Delhi Set-I, 2020]
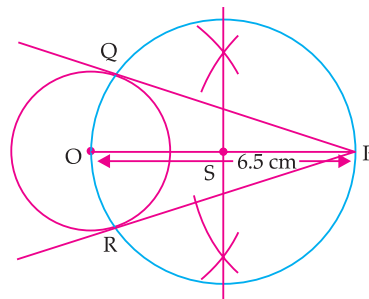
Sol. Steps of construction:

1. Draw a line segment $AB = 7$ cm.
2. With A as centre and radius 3 cm draw a circle.
3. With B as centre and radius 2 cm draw another circle.
4. Taking AB as diameter draw another circle, which intersects first two circles at P and Q, R and S.
5. Join B to P and Q, and A to R and S.

Hence, BP, BQ, AR and AS are the required tangents.
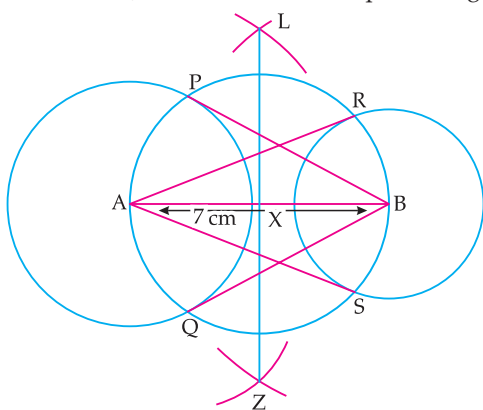
AI **2. Draw a circle of radius 2 cm with centre O and take a point P outside the circle such that OP = 6.5 cm. From P, draw two tangents to the circle.** A [CBSE OD Set-I, 2016, 2020]

[CBSE Foreign set-I, II, III 2015]

Sol.

Steps of construction:

1. Draw a line segment $OP = 6.5$ cm.
2. Taking O as centre and radius 2 cm, draw a circle.
3. Taking OP as diameter draw another circle which intersects the first circle at Q and R.
4. Join P to Q and R.

Hence, PQ and PR are two tangents.

3. Draw two tangents to a circle of radius 4 cm, which are inclined to each other at an angle of 60°.

A [CBSE OD Set-II, 2020]

Sol. Steps of construction:

1. Draw a circle of radius 4 cm with O as centre.
2. Draw two radii OA and OB inclined to each other at an angle of 120°.
3. Draw $AP \perp OA$ at A and $BP \perp OB$ at B, which meet at P.
4. PA and PB are the required tangents inclined to each other an angle of 60°.
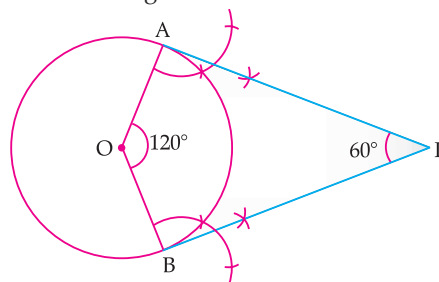
COMMONLY MADE ERROR

⮞ Some candidates follow incorrect methods for construction.

ANSWERING TIP

⮞ Read the construction based questions carefully and solve them as per requirement.

4. Draw a circle of radius 3.5 cm. From a point P, 6 cm from its centre, draw two tangents to the circle.

A [CBSE OD Set-III, 2020]

Sol. Steps of construction:

1. Draw a line segment OP = 6 cm.
2. From the point O, draw a circle of radius = 3.5 cm.
3. Draw the perpendicular bisector of OP. Let M be the mid point of OP.
4. Taking M as centre and OM as radius draw a circle.
5. This circle intersects the given circle at Q and R.
6. Join PQ and PR, which are the required tangents to the circle.
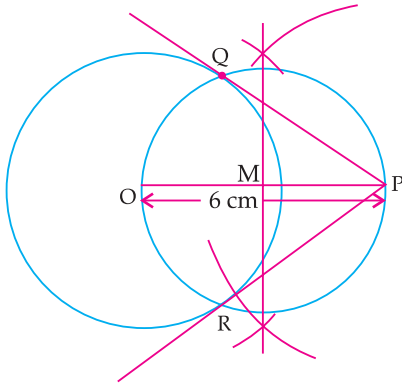
AI 5. Construct a pair of tangents to a circle of radius 3 cm which are inclined to each other at an angle of 60°. **A [CBSE SQP, 2020]**

Sol. Correct construction of given circle	2
Correct construction of two tangents	3

[CBSE SQP Marking Scheme, 2020]

Detailed Solution:

Try yourself similar to Q. No. 3. L.A.T.Q.

7. Construct a pair of tangents to a circle of radius 4 cm from an external point at a distance 6 cm from the centre of the circle. **A [CBSE Delhi Region, 2019]**

6. **Drawn two concentric circles of radii 2 cm and 5 cm. Take a point P on the outer circle construct a pair of tangents PA and PB to the smaller circle. Measure PA.** **A [CBSE OD Set-I, 2019]**

Sol. Constructing two concentric circle of radii 2 cm and 5 cm	1½
Drawing two tangents PA and PB	2
PA = 4.5 cm (approx.)	1½

[CBSE Marking Scheme, 2019]

Detailed Solution:
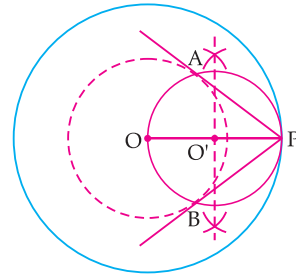
Steps of construction:

1. Draw a circle with radius 2 cm and centre O.
2. Draw another circle with radius 5 cm same centre O.
3. Take a point P on the circumference of larger circle and join O to P.
4. Taking OP as diameter draw another circle which intersects the smaller circle at A and B.
5. Join A and B to P.
   Hence PA and PB are the required tangents.
   On measuring PA = 4.6 cm (Approx.)

Topper Answer, 2019

To construct : a pair of tangents to a circle of radius = 4 cm, from a point at a distance 6 cm from centre.

Steps of construction :

1) Draw a circle of radius 4 cm with O as the centre.

2) Take a point P at PO = 6 cm.

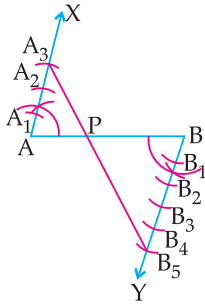3) Join PO. Construct a perpendicular bisector of PO at M (PM=MO, AB⊥PO)

r = 4 cm

AI **8.** Draw a line segment of length 8 cm. Find a point P on it which divides it in the ratio 3 : 5. Write the measurement of each part and give Justification.

C ⌐💡 **[O.E.B.]**

Sol. Steps of Construction:

1. Draw a line segment AB = 8 cm.

2. Draw AX ∥ BY such that $\angle A$ and $\angle B$ are acute.

3. 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.

4. Join A_3B_5 which intersect AB at P and divides it, $AP : PB = 3 : 5$.

Measurement of each part:

AP = 3 cm and PB = 5 cm.

Justification: In ΔAA_3P and ΔBB_5P,

$$AX \parallel BY \qquad \text{[By construction]}$$
$$\angle A = \angle B \qquad \text{[Alternate angles]}$$
$$\angle A_3PA = \angle B_5PB$$
$$\text{[Vertically opposite angles]}$$
∴ $$\Delta AA_3P \sim \Delta BB_5P$$
$$\text{[By AA criterion of similarity]}$$
⇒ $$\frac{AA_3}{BB_5} = \frac{AP}{BP}$$
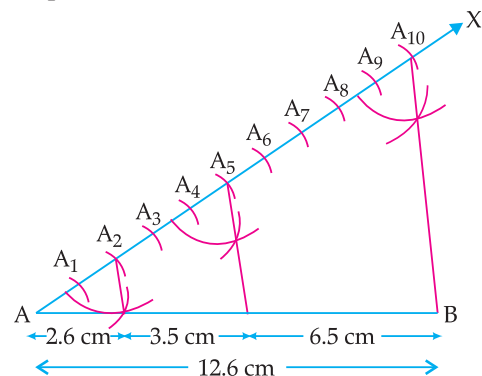⇒ $$AP : BP = 3x : 5x$$
$$\text{[Let each equal part be } x \text{ cm]}$$
or $$AP : BP = 3 : 5$$

9. Draw a line segment 12.6 cm long with ruler and compass divide it into three line segments in the ratio 2 : 3 : 5. Measure each of the three parts. C

⌐💡 **[O.E.B.]**

Sol. Steps of Construction:

1. Draw a line segment AB = 12.6 cm.

2. At A, draw an acute angle BAX.

3. On AX mark 10 (2 + 3 + 5) points A_1, A_2, A_3, ..., A_{10} such that $AA_1 = A_1A_2 = A_2A_3 = ... = A_9A_{10}$.

4. Join $A_{10}B$.

5. Through A_2 and A_5 draw two line parallel to $A_{10}B$ intersecting AB at points P and Q respectively, which divide AB in the ratio 2 : 3 : 5. *i.e.*,

$AP : PQ : QB = 2 : 3 : 5$.

Measurement of each part:

AP = 2.6 cm, PQ = 3.5 cm and QB = 6.5 cm.

10. Draw a line segment of length 11 cm. Find a point R on it which divides it in the ratio 4 : 5. Write the measurements of each part and give Justification.

R + C ⌐💡 **[O.E.B.]**

Sol. Try yourself similar to Q.No. 9 of LATQ.