# CONSTRUCTIONS

## (A) Objective Type Questions — 1 Mark Each

### 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 ∠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 ∠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.**

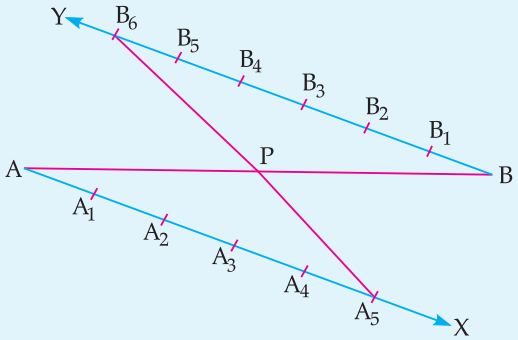
*Explanation:* We have to divide the line segment into 7 + 4 = 11 equal parts and $11^{th}$ part will be joined to B, here $A_{12}$ will never appear.

**3. To divide a line segment AB in the ratio 5 : 6 draw a ray AX such that ∠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:



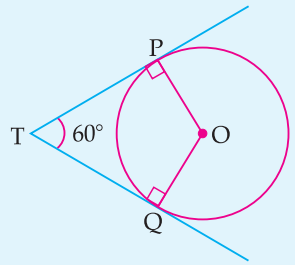

**(i)** Draw a line-segment AB of given length.
**(ii)** Draw an acute angle BAX as shown in figure.
**(iii)** Draw angle ∠ABY = ∠BAX on other side of AB.
**(iv)** Divide AX into 5 equal parts by using compass.
**(v)** Divide BX in at in 6 equal parts at as AX was divided.
**(vi)** Now, join $A_5$ and $B_6$ 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, ∠P and ∠Q in quadrilateral TPOQ formed by tangents and radii will be of 90° each.

So, the sum of

$$\angle T + \angle O = 180°$$

as $\angle T = 60°$ [Given]

$\therefore$ $\angle O = 180° - 60°$

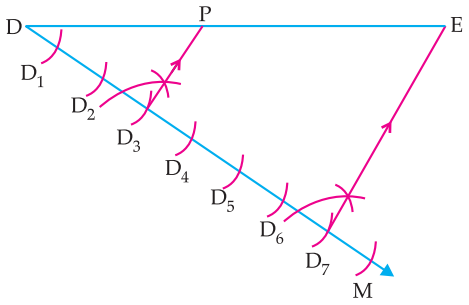
$= 120°$

### 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 $\Delta ED_7D$,
> $PD_3 \parallel ED_7$.

**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]
> $\therefore$ $\angle ED_7D = 82°$.

**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
> $DP : PE = 3 : 4$
> $\therefore$ $DE : DP = 7 : 3$

**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.**

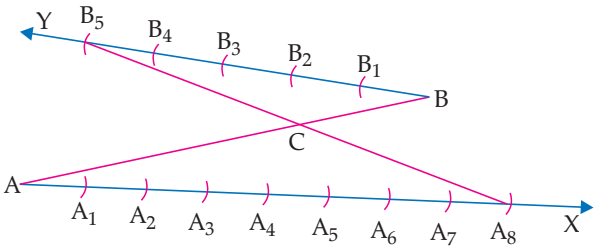
> *Explanation:* Since, 7 flower pots have been placed at a distance of 1 m from each other, then total distance = 7 m.

## (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]

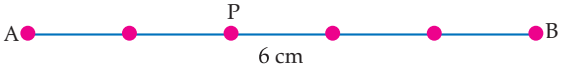



**Sol.** C divides AB internally in the ratio 8 : 5.

**2. To find a point P on the line segment $AB = 6$ cm, such that $\frac{AP}{AB} = \frac{2}{5}$, 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 $\frac{PB}{AB} = \frac{3}{7}$, then find the radio $AP : PB$.** A

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

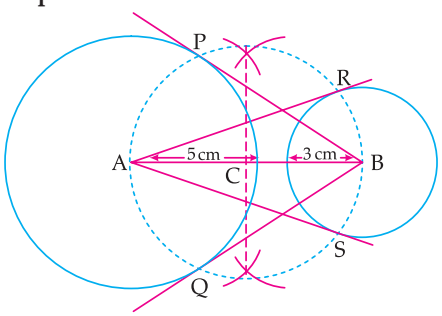
$\therefore$ $AP = AB - PB = 7 - 3 = 4$

$\therefore$ $AP : PB = 4 : 3$

### 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.

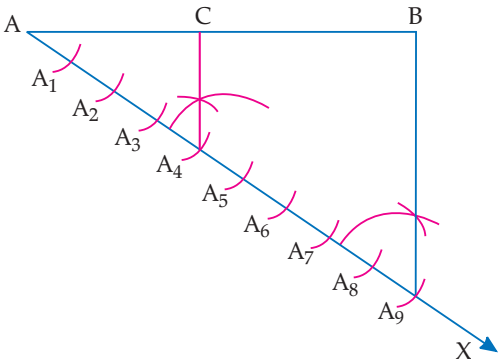
5. Join BP, BQ, AS and AR.

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.** U **[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 $A_1, A_2, A_3, \ldots\ldots A_9$ on AX such that $AA_1 = A_1A_2 = A_2A_3 \ldots\ldots\ldots = A_8A_9$.
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.

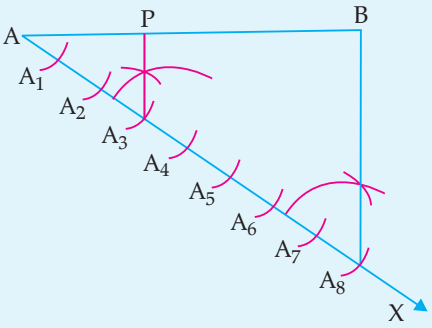



**3. Draw a line segment of length 7 cm. Find a point P on it which divides it in the ratio 3 : 5.**

U **[CBSE Term-II, 2015]**

**Sol. Steps of construction:**

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




**1**

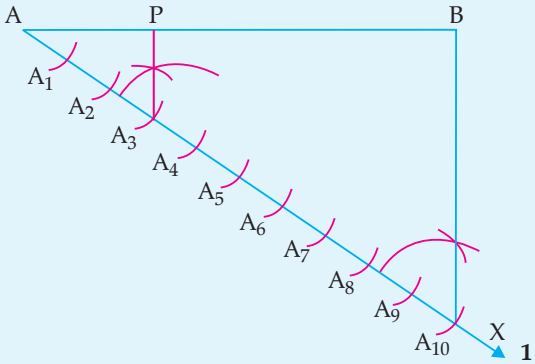
2. Draw any ray AX making an acute angle down ward with AB.
3. Mark the points $A_1, A_2, A_3, \ldots\ldots, A_8$ on AX such that $AA_1 = A_1A_2 = A_2A_3 = \ldots., A_7A_8$.
4. Join $BA_8$.
5. Through the point $A_3$, draw a line parallel to $BA_8$. To meet AB on P.

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.** U **[CBSE Term-II, 2015]**

**Sol. Steps of Construction:**




**1**

1. Draw a line segment $AB = 5$ cm.
2. Draw any ray AX making an acute angle downward with AB.
3. Mark the points $A_1, A_2, A_3, \ldots. A_{10}$ on $AX$ such that $AA_1 = A_1A_2 = \ldots. = A_9A_{10}$.
4. Join $BA_{10}$.
5. Through the point $A_3$ draw a line parallel to $BA_{10}$. To meet AB at P.

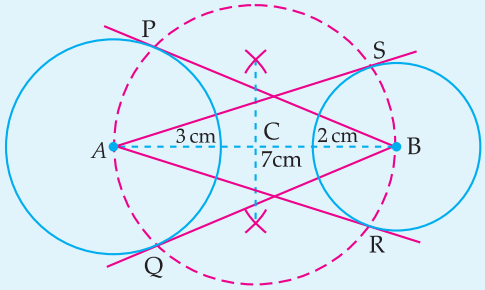
Hence $AP : PB = 3 : 7$. **1**

**[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.** A **[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]**

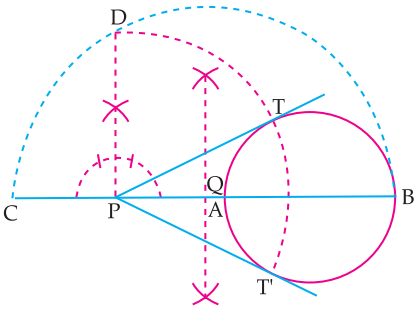
AI **6. Draw a circle of radius 1.5 cm. Take a point P outside it. Without using the centre draw two tangents to the circle from the point P.**

A **[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'

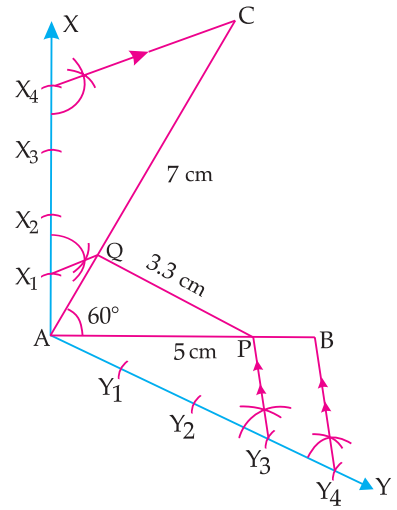
   Hence, PT and PT′ are the required tangents.




**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 $AP = \frac{3}{4} AB$ and $AQ = \frac{1}{4} AC$. 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 $X_1Q \parallel X_4C$.



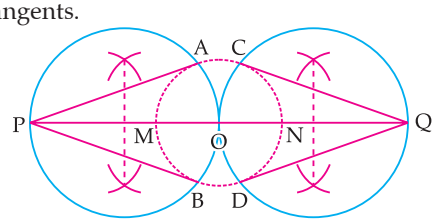

5. Similarly, draw $\angle BAY$ and divide AY in 4 equal parts, *i.e.*, $Y_1$, $Y_2$, $Y_3$ and $Y_4$.
6. Join $Y_4B$ and draw $Y_3P \parallel Y_4B$.
7. Join PQ and measure it.
8. PQ is equal to 3.3 cm.

## 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.



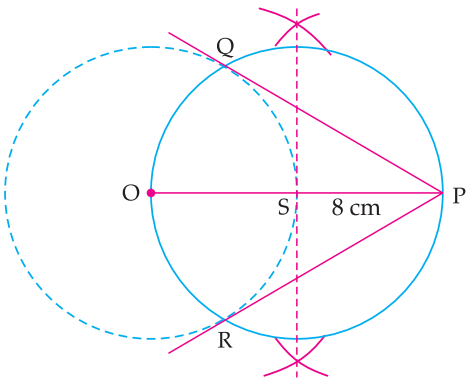

**2. Construct a pair of tangents PQ and PR to a circle of radius 4 cm from a point P outside the circle 8 cm away from the centre. Measure PQ and PR.** A **[CBSE Term-II, 2015]**

**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

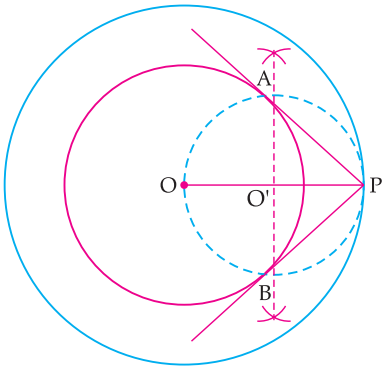
   $PQ = PR = 6.92$ cm (Approx.)



**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.

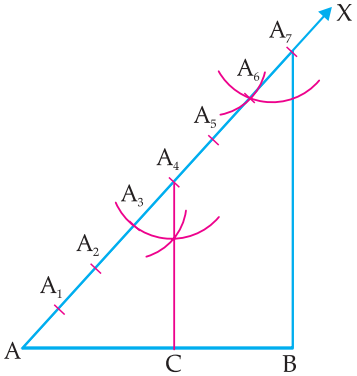



**4. Draw a line segment of length 6 cm and divide it internally in the ratio 4 : 3. Prove your assertion.**

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 ∠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 $\Delta BAA_7$, we have $CA_4 \parallel BA_7$

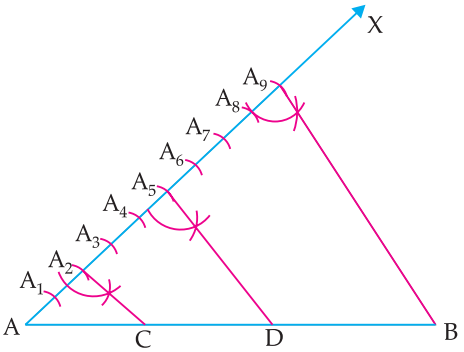
$$\therefore \quad \frac{AC}{CB} = \frac{AA_4}{A_4A_7} = \frac{4x}{3x} = \frac{4}{3}$$

[By using Thale's theorem]

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

**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 ∠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 $DB = 4x$

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

$$\Rightarrow \quad 9x = 13.5$$

$$\Rightarrow \quad x = 1.5$$

$$\text{Sum of ratio} = 2 + 3 + 4 = 9$$

$$\therefore \quad AC = \frac{2x}{9x} \times 13.5 = 3 \text{ cm}$$

$$CD = \frac{3x}{9x} \times 13.5 = 4.5 \text{ cm}$$

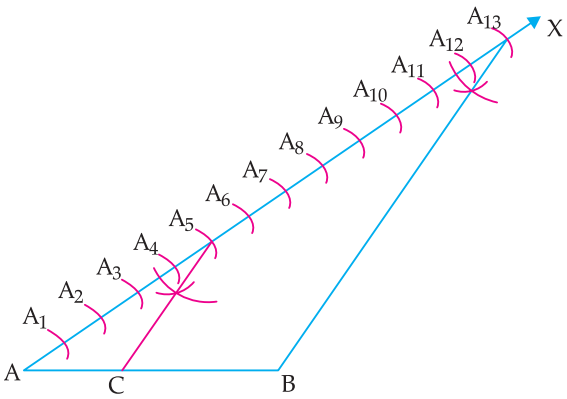
$$\text{and} \quad DB = \frac{4x}{9x} \times 13.5 = 6 \text{ cm}$$

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

$= 13.5$ 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 $\Delta ACX_5$ and $\Delta ABX_{13}$, we have,

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

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

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

## Long Answer Type Questions

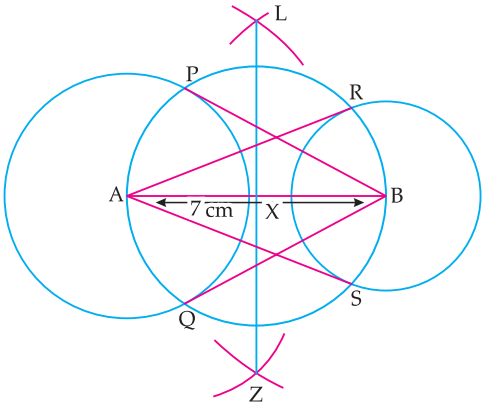
**(5 Marks Each)**

**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:**

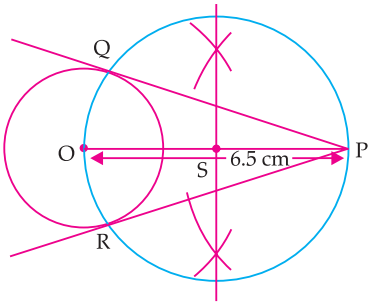
1. Draw a line segment $AB = 7$ cm.
2. With A as centre and radius 3 cm draw a circle.
3. With B as centre and radius 2 cm draw another circle.
4. Taking AB as diameter draw another circle, which intersects first two circles at P and Q, R and S.
5. Join B to P and Q, and A to R and S.

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.

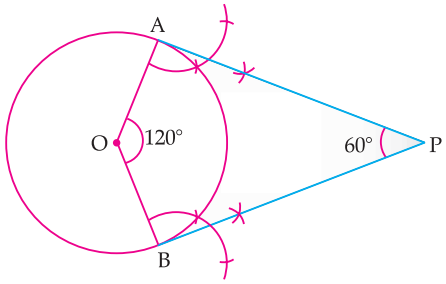
Hence, PQ and PR are two tangents.

**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

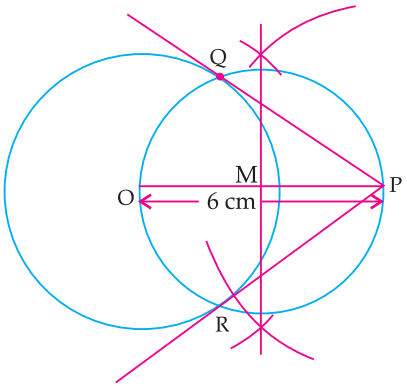
- Read the construction based questions carefully and solve them as per requirement.

**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]**

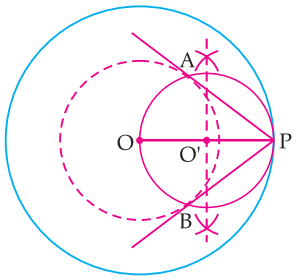
**Detailed Solution:**

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

**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:**

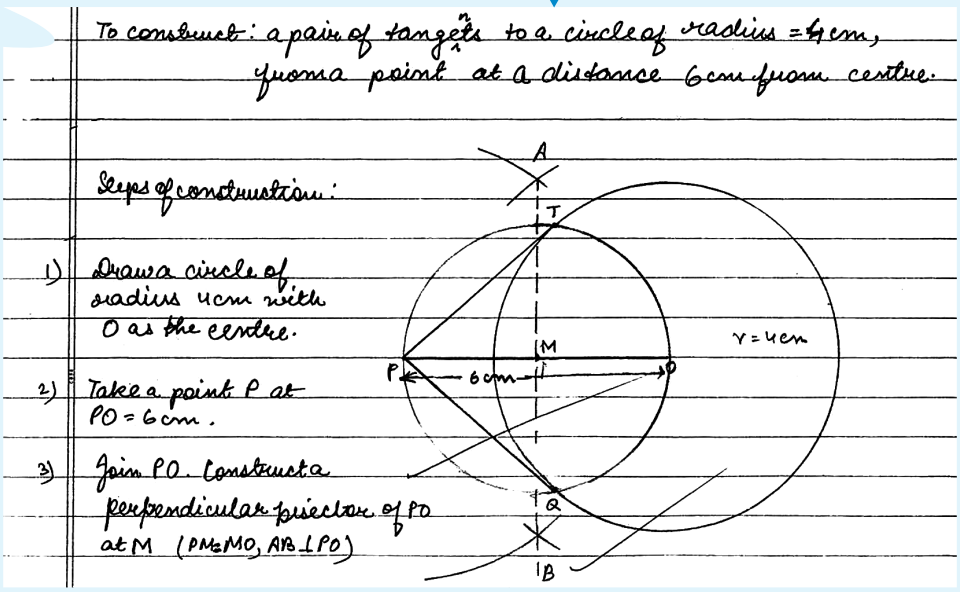



**Steps of construction:**

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.)

**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]**

## Topper Answer, 2019



4) With M as centre and PM (= MO) as radius, draw a circle touching the circle with centre O at T and Q

5) Join PT and PQ

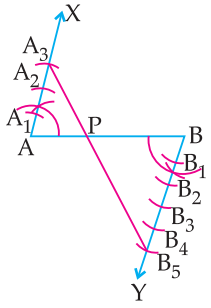
∴ PT and PQ are required tangents.

5

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 $\Delta AA_3P$ and $\Delta BB_5P$,

$AX \parallel BY$ [By construction]

$\angle A = \angle B$ [Alternate angles]

$\angle A_3PA = \angle B_5PB$ [Vertically opposite angles]

$\therefore \quad \Delta AA_3P \sim \Delta BB_5P$ [By AA criterion of similarity]

$\Rightarrow \quad \frac{AA_3}{BB_5} = \frac{AP}{BP}$

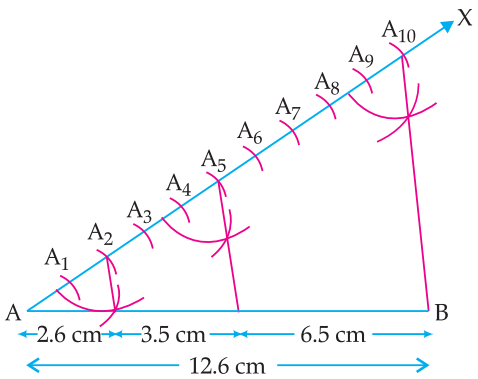
$\Rightarrow \quad AP : BP = 3x : 5x$ [Let each equal part be $x$ cm]

or $\quad AP : BP = 3 : 5$

**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.