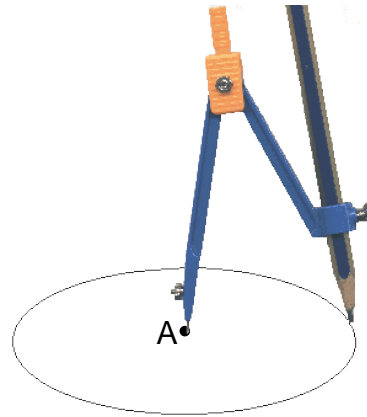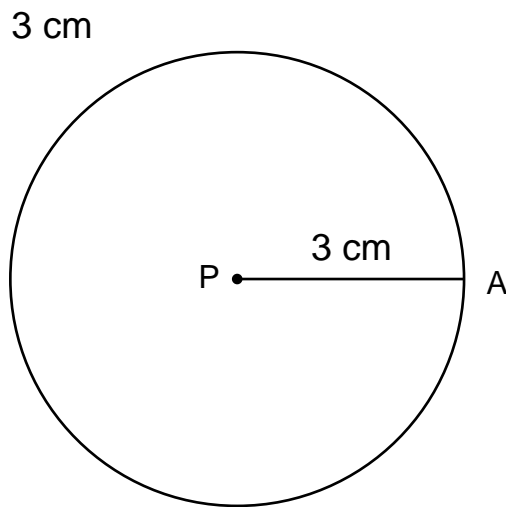# Constructions

Basic skills

1) Draw a line segment of 4 cm length using scale :

――――――――――

(Make sure that the starting point is at 0)

2) Draw a circle of given radius using compass :

3 cm

3) Draw a triangle when 3 sides are given :

- Draw base AB measuring one of the given side lengths of the triangle.
- Set the width of your compass equal to another given side length.
- Place the tip of the compass on one of the end points of the side AB (let's choose to place it on A) and draw an arc.
- Set the width of your compass equal to length of the third side.
- Place the tip of the compass on B and draw another arc which cuts the previously drawn arc at some point (say C).
- Join AC and BC.
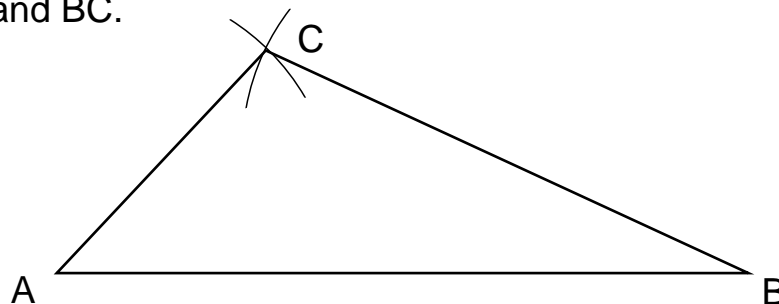
4) Draw the perpendicular bisector of a line segment :

- Draw segment AB of given lenth.
- Take some distance in compass needle and pencil. (approximately more than half of AB)
- Keep compass needle on A and draw arcs above and below the line.
- Keep compass needle on B by maintaining the same distance between the needle and the pencil and draw arcs cutting the earlier arcs in points C and D.
- Join CD.

CD $\perp$ AB

AE = EB
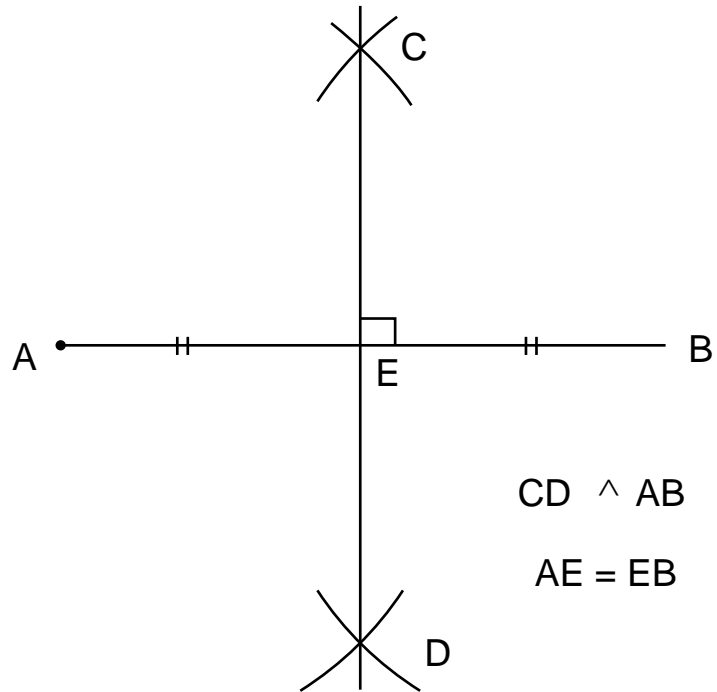
This is the perpendicular bisector of AB.

5) Draw a perpendicular from a point on the given line segment :

- Draw AB.
- Keeping compass needle at P draw two arcs on line AB.
- From point of intersection of one arc and AB, draw two arcs on the two sides of AB.
- From the other arc draw two more arcs cutting the earlier arcs in C and D.
- Join CD.

CD $\perp$ AB
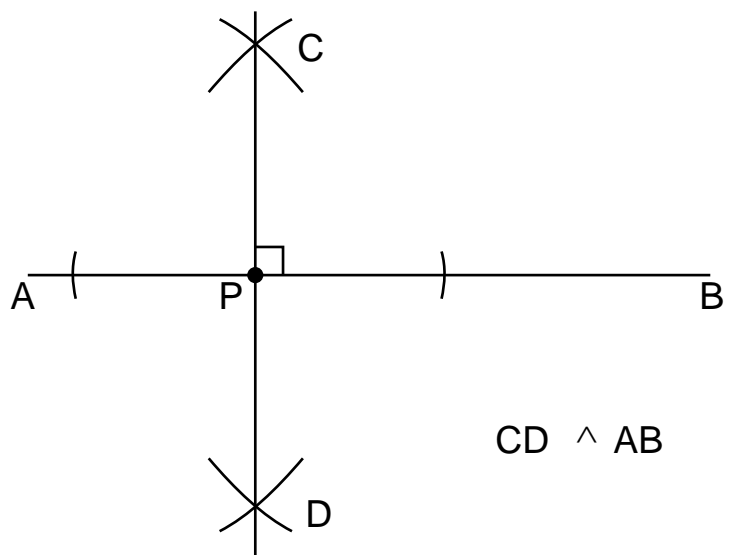
5) Draw a perpendicular from a point outside the given line segment :

- Draw AB. Draw point P outside AB.
- Taking P as center, draw two arcs on AB.
- From each of the arcs draw an arc on the
  other side of AB with some fixed distance in
 compass needle and pencil, cutting each
  other in point C.
- Join PC.

PC ^ AB
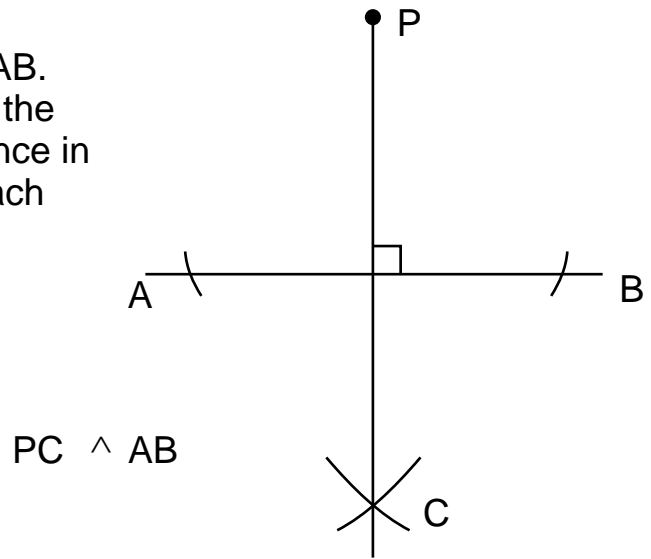
6) Draw the angle bisector of a given angle :
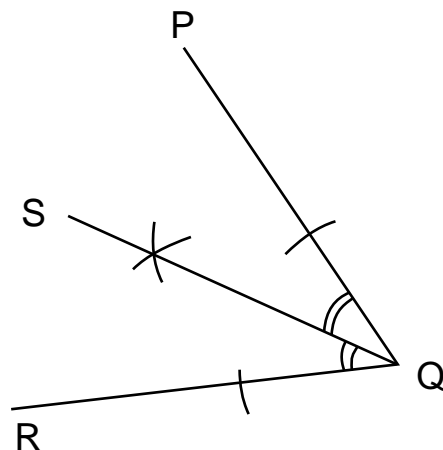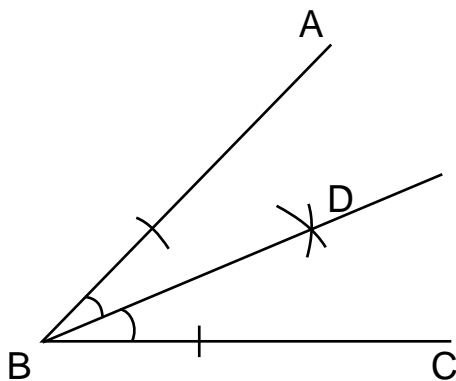
- Draw angle ABC.
- From point B, draw arcs on BA and BC.
- From each of these arcs draw an arc inside the angle keeping the same
  distance in compass.
- These arcs cut each other in point D.
- Join BD.
- BD is the angle bisector of angle ABC.

- Repeat the above process for angle PQR.

**7) Draw a parallel line to a given line :**
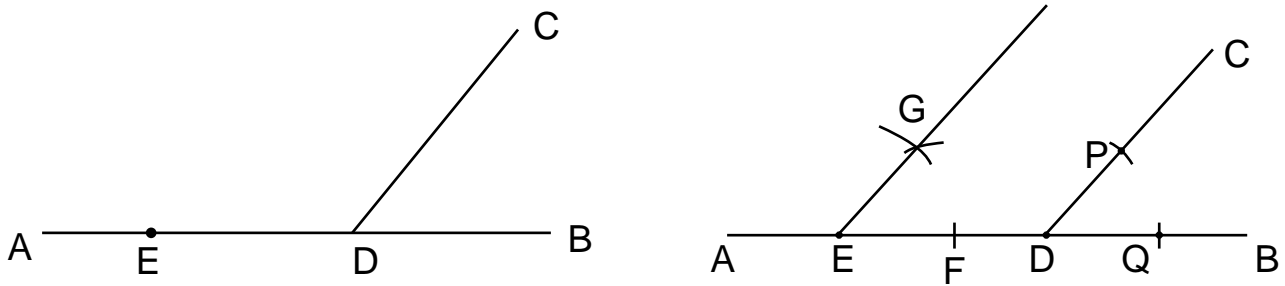
We want to draw a line parallel to CD, passing through point E.

For that, we have to construct an angle at E, which is equal to angle CDB.

- From point D, draw arcs on DC and DB with the same distance in the compass. Label these points as P and Q.
- With the same distance, draw two arcs from point E, one cutting ED at F, and the other bigger arc above AB .
- Measure the distance between points P and Q using compass.
- Maintain the same distance in compass, draw an arc from point F cutting the earlier bigger arc in G.
- Join EG.
- EG is parallel to CD.

Basics of Circles and Tangents

In how many ways can two circles be placed in a plane?
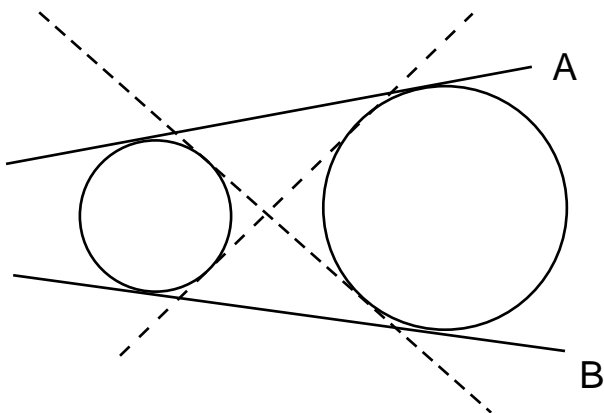
1.

2.

3.

4.

5
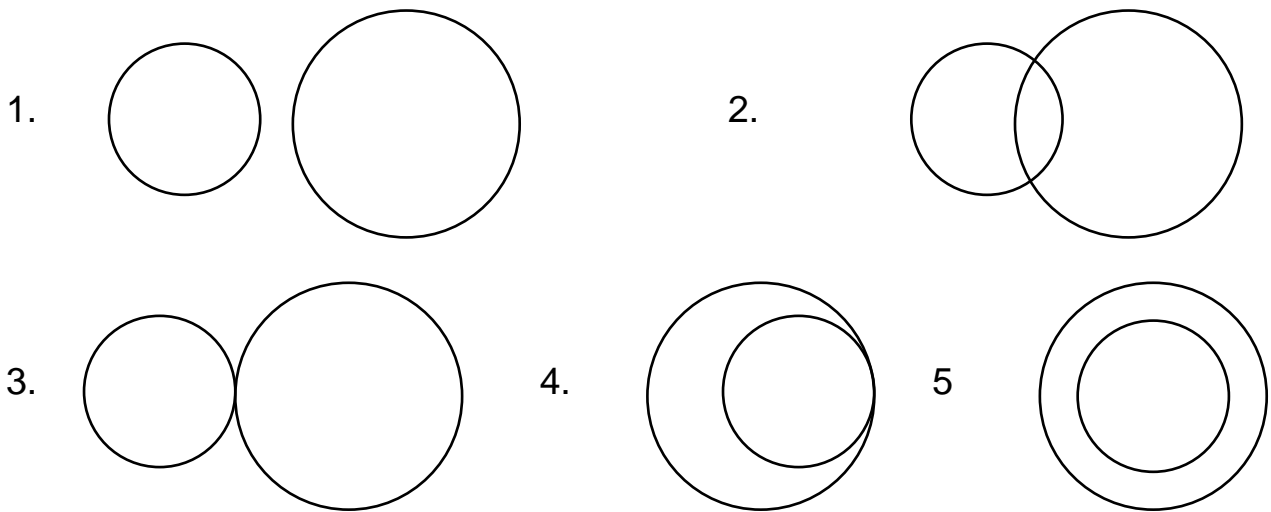
Common tangents of circles touching externally -
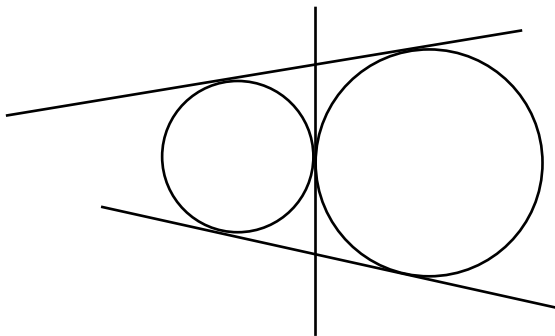
3 Common Tangents
as shown in the figure.

Common tangents of circles that are separate from each other :

A

B

Lines A and B are called as
Direct Common Tangents of
the two circles.

Constructions : Exam Questions : 5 marks each

1) Draw a triangle whose sides measure 5, 6 and 8. Draw incircle.

Incircle is a circle that touches all sides of the triangle, and therefore it is inside the triangle.

- Draw triangle ABC.
- Draw angle bisectors of angles A and B.
- The point of intersection of angle bisectors is P.
- P is the center of incircle.
- From P, drop a perpendicular on AB.
- PD is the radius of incircle.
- With P as a center and radius as PD draw the incircle.
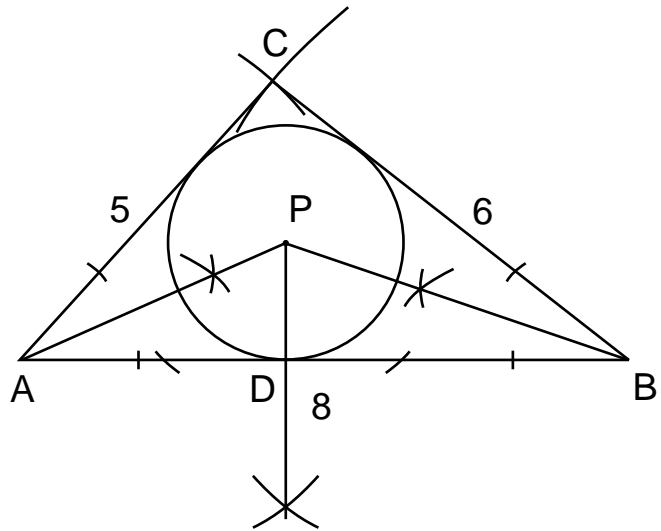
2) Draw Circumcircle :

Circumcircle is a circle that touches all vertices of the triangle. Therefore it is outside of the triangle.

- Draw triangle ABC.
- Draw perpendicular bisectors of sides AB and AC.
- The point of intersection of perpendicular bisectors is P.
- P is the center of circumcircle.
- Points A, B and C are at the same distance from P.
- With P as center and PA as radius draw a circle.
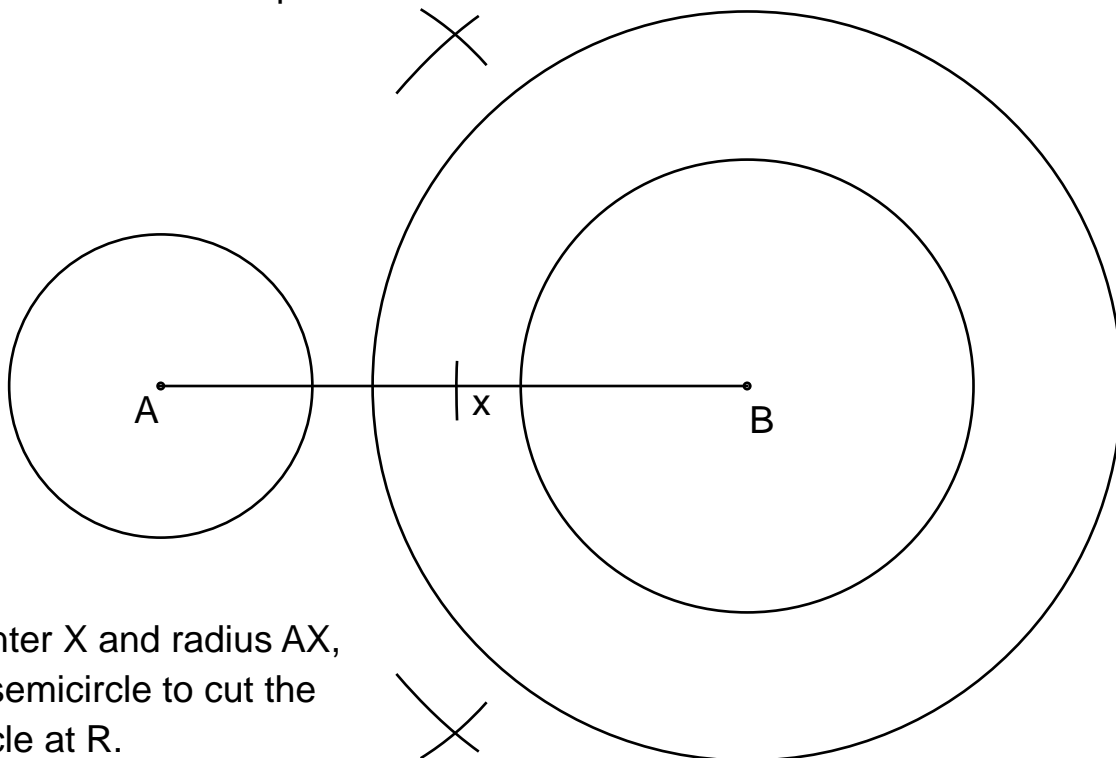- This is the circumcircle of triangle ABC.
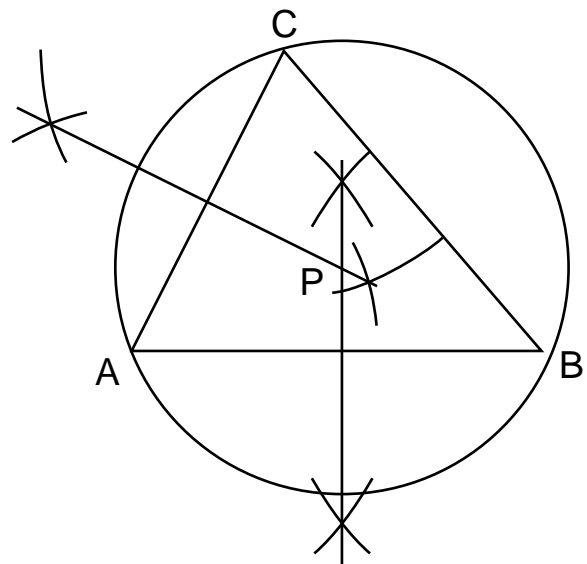
3) Draw a direct common tangent to two circles :

$r_1 = 2$ cm $r_2 = 5$ cm
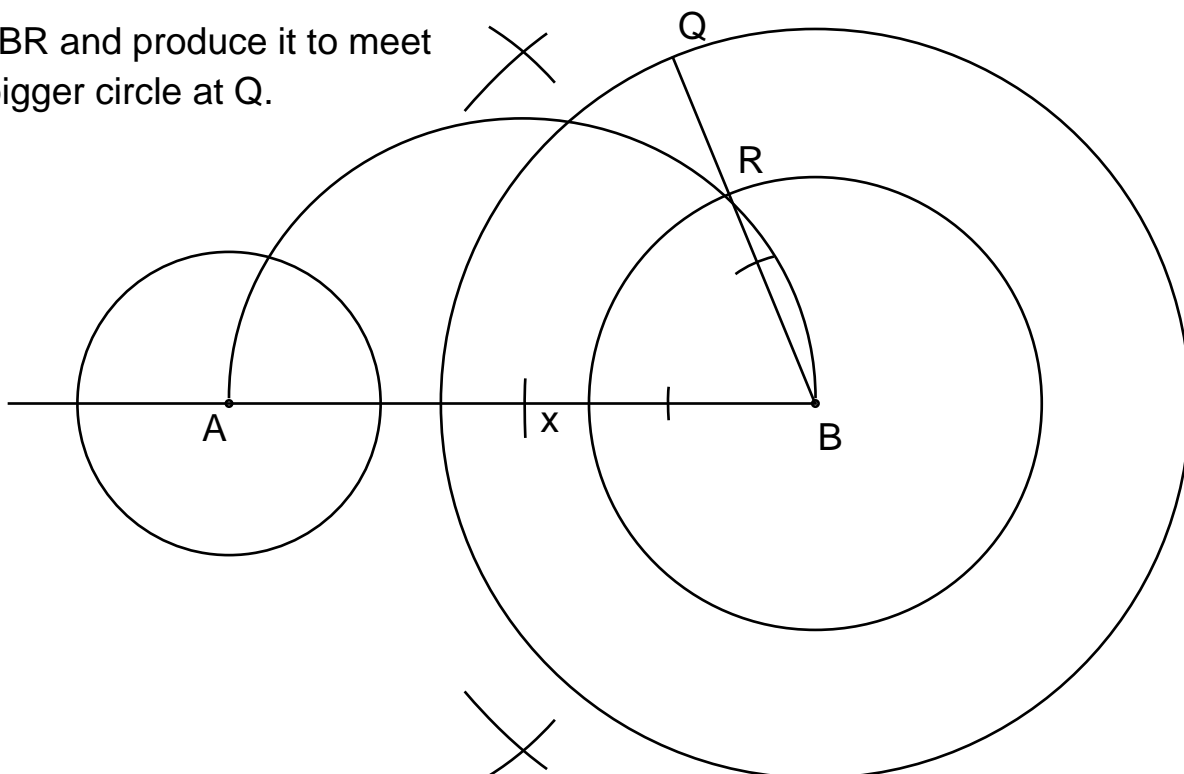
Find $r_2 - r_1 = 5 - 2 = 3$ cm

- Join AB.
- Inside the bigger circle, with B as center, draw a circle with radius 3 cm.
- Bisect AB. X is the midpoint of AB.

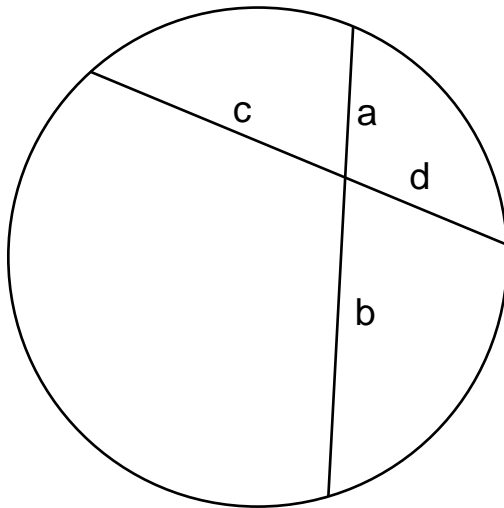With center X and radius AX, draw a semicircle to cut the third circle at R.

Join BR and produce it to meet the bigger circle at Q.

Draw AP parallel to BQ.
Join PQ.
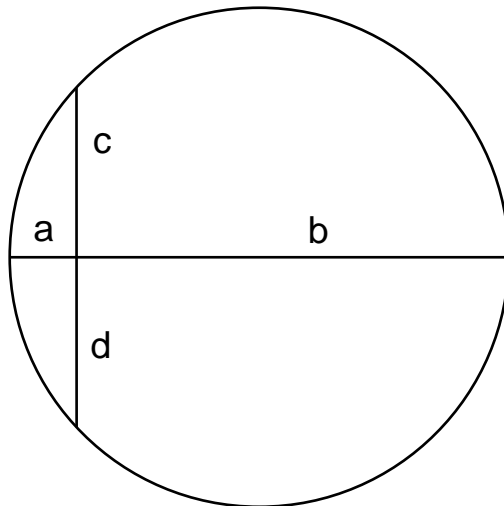PQ is the direct common tangent of the two circles.

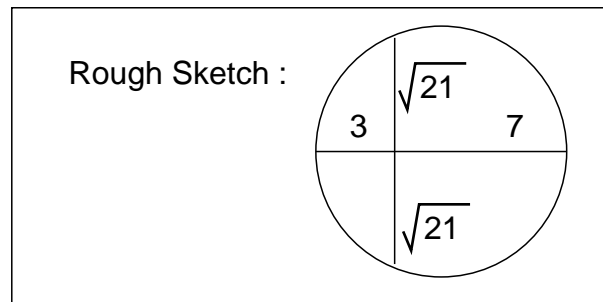**Theorem of two chords of a circle :**

$$ab = cd$$

We can take diameter as one of the chords.

$$ab = cd$$

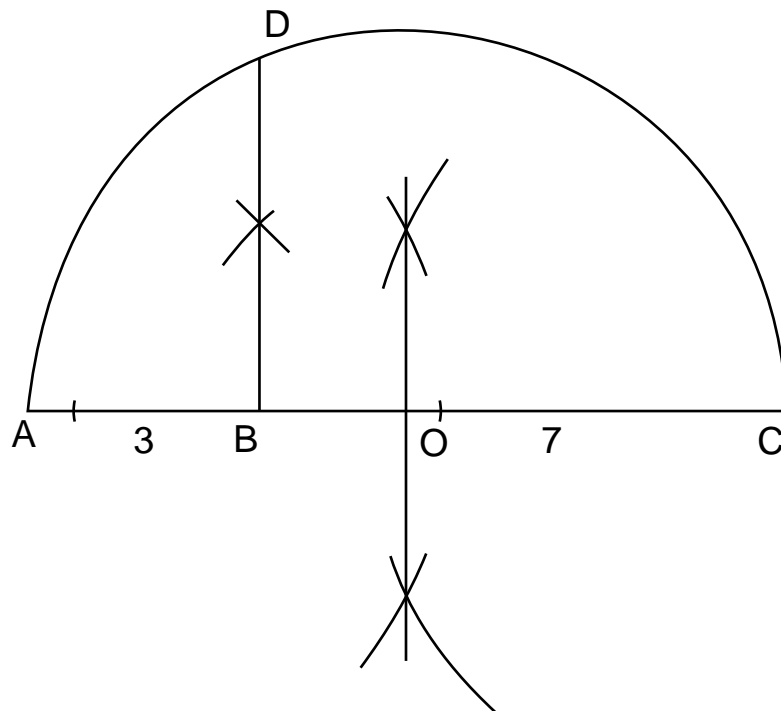This principle is used in the next two problems.

4) Find geometrically the value of $\sqrt{21}$

Rough Sketch :

$\sqrt{21}$

3   7

$\sqrt{21}$

Construction :
- 21 = 3 x 7
- Draw a line ABC where AB is 3 and BC is 7.
- Bisect AC to get O.
- With O as center and AO as radius draw semicircle.
- Draw a perpendicular from point B to AC.
- That cuts the semicircle in point D.
- Distance BD = $\sqrt{21}$

D
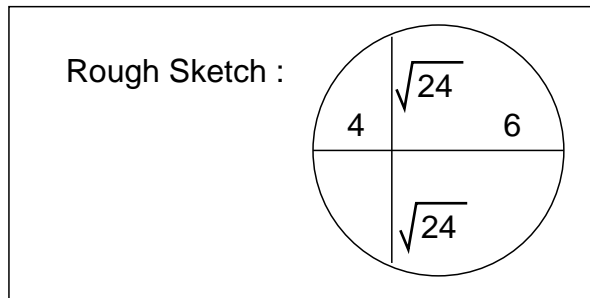
A   3   B   O   7   C

5) Draw two line segments of lengths 4 cm and 6 cm. Find the mean proportion of these segments. Measure using scale the number corresponding to this mean proportion.

a
_____

b
_____

$$\frac{a}{x} = \frac{x}{b} \qquad x^2 = ab$$

Rough Sketch :

$\sqrt{24}$

4   6

$\sqrt{24}$

Construction :
- Draw a line ABC where AB is 4 and BC is 6.
- Bisect AC to get O.
- With O as center and AO as radius draw semicircle.
- Draw a perpendicular from point B to AC.
- That cuts the semicircle in point D.
- Length BD = Mean Proportion = 4.9 cm as measured by scale.

D

A   B   O   C