Exercise - 13A

1.

Sol:

Steps of Construction:

Step 1: Draw a line segment $AB = 7\ cm$

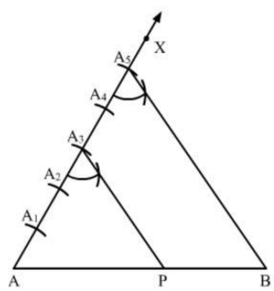
Step 2: Draw a ray *AX*, making an acute angle $\angle BAX$.

Step 3: Along *AX*, mark 5 points (greater of 3 and 5) A_1, A_2, A_3, A_4 and A_5 such that

$AA_1 = A_1A_2 = A_2A_3 = A_3A_4 = A_4A_5$

Step 4: Join A_5B.

Step 5: From A_3, draw A_3P parallel to A_5B (draw an angle equal to $\angle AA_5B$), meeting *AB* in P.



Here, P is the point on AB such that $\frac{AP}{PB} = \frac{3}{2}$ or $\frac{AP}{AB} = \frac{3}{5}$.

2.

Sol:

Steps of Construction:

Step 1: Draw a line segment $AB = 7.6cm$

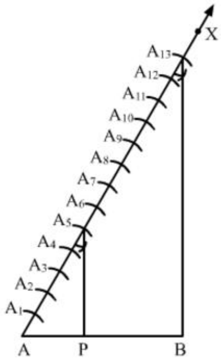
Step 2: Draw a ray *AX*, making an acute angle $\angle BAX$.

Step 3: Along *AX*, mark $(5+8=)13$points $A_1, A_2, A_3, A_4, A_5, A_6, A_7, A_8, A_9, A_{10}, A_{11}, A_{12}$ and A_{13} such that

$AA_1 = A_1A_2 = A_2A_3 = A_3A_4 = A_4A_5 = A_6A_7 = A_8A_9 = A_9A_{10} = A_{10}A_{11} = A_{11}A_{12} - A_{12}A_{13}$.

Step 4: Join $A_{13}B$.

Step 5: From A_5, draw A_5P parallel to $A_{13}B$ (draw an angle equal to $\angle AA_{13}B$), meeting *AB* in *P*.



Here, P is the point on AB which divides it in the ratio $5:8$.

$\therefore$ Length of $AP = 2.9\ cm$ (Approx)

Length of $BP = 4.7\ cm$ (Approx)

3.

Sol:

Steps of Construction

Step 1: Draw a line segment $QR = 7\,cm.$

Step 2: With Q as center and radius 6 cm, draw an arc.

Step 3: With R as center and radius 8cm, draw an arc cutting the previous arc at P

Step 4: Join PQ and PR. Thus, ΔPQR is the required triangle.

Step 5: Below QR, draw an acute angle $\angle RQX$.

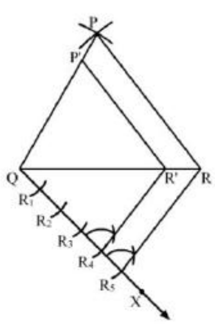
Step 6: Along OX, mark five points R_1, R_2, R_3, R_4 and R_5 such that

$QR_1 = R_1R_2 = R_2R_3 = R_3R_4 = R_4R_5$.

Step 7: Join RR_5.

Step 8: From R_4, draw $R_4R' \parallel RR_5$ meeting QR at R'.

Step 9: From R', draw $P'R' \parallel PR$ meeting PQ in P'.



Here, $\Delta P'QR'$ is the required triangle, each of whose sides are $\frac{4}{5}$ times the corresponding sides of ΔPQR.

4.

Sol:

Steps of Construction :

Step 1: Draw a line segment $BC = 4cm$.

Step 2: With B as center, draw an angle of $90°$.

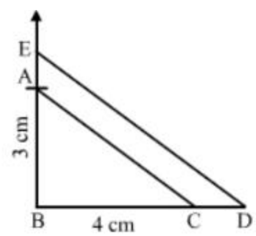
Step 3: With B as center and radius equal to 3 cm, cut an arc at the right angle and name it A.

Step 4: Join AB and AC.

Thus, Δ ABC is obtained.

Step 5: Extend BC to D, such that $BD = \frac{7}{5}BC = 75(4)cm = 5.6cm$.

Step 6: Draw $DE \parallel CA$, cutting AB produced to E.



Thus, ΔEBD is the required triangle, each of whose sides is $\frac{7}{5}$ the corresponding sides of ΔABC.

5.

Sol:

Steps of Construction

Step 1: Draw a line segment $BC = 7cm$.

Step 2: At B, draw $\angle XBC = 60°$.

Step 3: With B as center and radius 6 cm, draw an arc cutting the ray BX at A.

Step 4: Join AC. Thus, ΔABC is the required triangle.

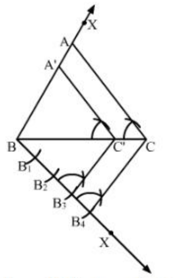
Step 5: Below BC, draw an acute angle $\angle YBC$.

Step 6: Along BY, mark four points B_1, B_2, B_3 and B_4 such that $BB_1 = B_1B_2 = B_2B_3 = B_3B_4$.

Step 7: Join CB_4.

Step 8: From B_3, draw $B_3C' \parallel CB_4$ meeting BC at C''.

Step 9: From C', Draw $A'C' \parallel AC$ meeting AB in A'.



Here. $\Delta A'BC'$ is the required triangle whose sides are $\frac{3}{4}$ times the corresponding sides of ΔABC.

6.

Sol:

Steps of Construction

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

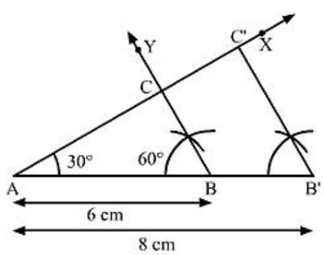
Step 2: At A, draw $\angle XAB = 30°$.

Step 3: At B, draw $\angle YBA = 60°$. Suppose AX and BY intersect at C.

Thus, ΔABC is the required triangle.

Step 4: Produce AB to B' such that $AB' = 8cm.$

Step 5: From B', draw $B'C' \parallel BC$ meeting AX at C'.



Here. AB'C' is the required triangle similar to ΔABC.

7.

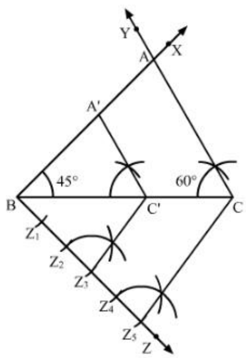
Sol:

Steps of Construction

Step 1: Draw a line segment $BC = 8cm.$

Step 2: At B, draw $\angle XBC = 45°$.

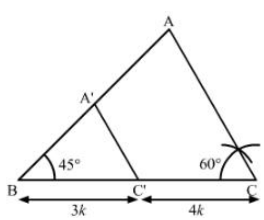
Step 3: At C, draw $\angle YCB = 60°$. Suppose BX and CY intersect at A.
Thus, ΔABC is the required triangle
Step 4: Below BC, draw an acute angle $\angle ZBC$.
Step 5: Along BZ, mark five points Z_1, Z_2, Z_3, Z_4 and Z_5 such that
$BZ_1 = Z_1Z_2 = Z_2Z_3 = Z_3Z_4 = Z_4Z_5.$
Step 6: Join CZ_5.
Step 7: From Z_3, draw $Z_3C' \parallel CZ_5$ meeting BC at C'.
Step 8: From C', draw $A'C' \parallel AC$ meeting AB in A'.



Here, $\Delta A'BC'$ is the required triangle whose sides are $\frac{3}{5}$ of the corresponding sides of ΔABC.

8.

Answer: (a) 3 : 4
Sol:
To construct a triangle similar to ΔABC in which $BC = 4.5cm$, $\angle B = 45°$ and $\angle C = 60°$, using a scale factor of $\frac{3}{7}$, BC will be divided in the ratio $3:4$.



Here, $\Delta ABC \sim \Delta A'BC'$
$BC' : C'C = 3:4$
or $BC' : BC = 3:7$
Hence, the correct answer is option A.

9.

Sol:

Steps of Construction

Step 1: Draw a line segment $BC = 8cm.$

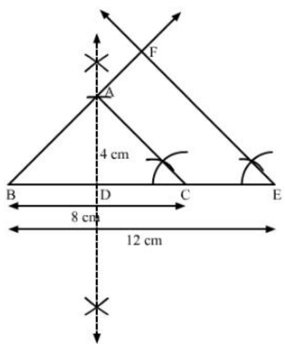
Step 2: Draw the perpendicular bisector *XY* of *BC*, cutting *BC* at *D*.

Step 3: With *D* as center and radius 4 cm, draw an arc cutting *XY* at A.

Step 4: Join *AB* and *AC*. Thus, an isosceles ΔABC whose base is 8 cm and altitude 4 cm is obtained.

Step 5: Extend *BC* to E such that $BE = \frac{3}{2}BC = \frac{3}{2} \times 8cm = 12cm.$

Step 6: Draw $EF \parallel CA$, cutting *BA* produced in *F*.



Here, ΔBEF is the required triangle similar to ΔABC such that each side of ΔBEF is $1\frac{1}{2}$ (or $\frac{3}{2}$) times the corresponding side of ΔABC.

10.

Sol:

Steps of Construction

Step 1: Draw a line segment $BC = 3cm.$

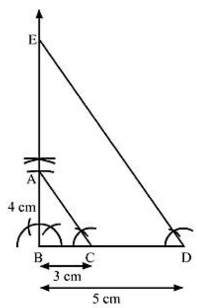
Step 2: At *B*, draw $\angle XBC = 90°$.

Step 3: With *B* as center and radius 4 cm, draw an arc cutting *BX* at *A*.

Step 4: Join *AC*. Thus, a right ΔABC is obtained.

Step 5: Extend BC to D such that $BD = \frac{5}{3}BC = \frac{5}{3} \times 3cm = 5cm.$

Step 6: Draw $DE \parallel CA$, cutting *BX* in *E*.

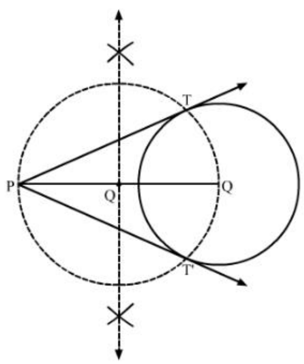


Here. ΔBDE is the required triangle similar to ΔABC such that each side of ΔBDE is $\frac{5}{3}$ times the corresponding side of ΔABC.

Exercise – 13B

1.

Sol:
Steps of Construction
Step 1: Draw a circle with O as center and radius 3 cm.
Step 2: Mark a point *P* outside the circle such that $OP = 7\,cm$.
Step 3: Join *OP*. Draw the perpendicular bisector *XY* of *OP*. cutting *OP* at *Q*.
Step 4: Draw a circle with *Q* as center and radius *PQ* (or *OQ*), to intersect the given circle at the points *T* and *T*'.
Step 5: Join *PT* and *PT*'.



Here, *PT* and *PT'* are the required tangents.
$PT = PT' = 6.3\,cm$ (Approx)

2.

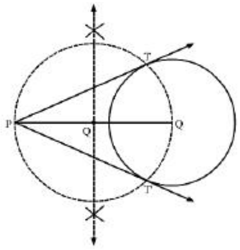
Sol:
Steps of Construction
Step 1: Draw a circle with O as center and radius 3.5 cm.

Step 2: Mark a point P outside the circle such that $OP = 6.2\,cm$.

Step 3: Join OP. Draw the perpendicular bisector XY of OP, cutting OP at Q.

Step 4: Draw a circle with Q as center and radius PQ (or 0Q), to intersect the given circle at the points T and T'.

Step 5: Join PT and PT'.



Here, PT and PT' are the required tangents.

3.

Sol:

Steps of Construction

Step 1: Draw a circle with center O and radius 3.5 cm.

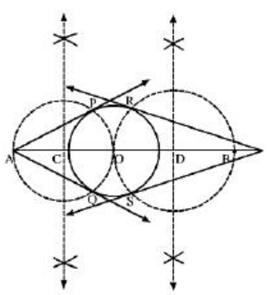
Step 2: Extends its diameter on both sides and mark two points A and B on it such that $OA = OB = 5\ cm$.

Step 3: Draw the perpendicular bisectors of OA and OB. Let C and D be the mid-points of OA and OB, respectively.

Step 4: Draw a circle with C as center and radius OC (or AC), to intersect the circle with center O, at the points P and Q.

Step 5: Draw another circle with D as center and radius OD (or BD), to intersect the circle with center O at the points R and S.

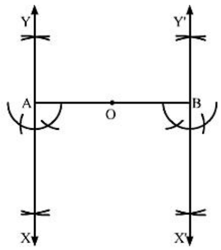
Step 6: Join AP and AQ, Also, join BR and BS.



Here, AP and AQ are the tangents to the circle from A, Also, BR and BS are the tangents to the circle from B.

4.

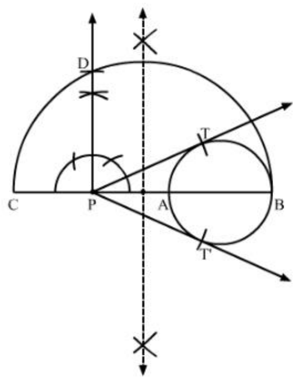
Sol:
Step 1: Draw a circle with center *O* and radius 4 cm.
Step 2: Draw any diameter *AOB* of the circle.
Step 3: At *A*, draw $\angle OAX = 90°$. Produce $XA = Y$.
Step 4: At *B*, draw $\angle OBX' = 90°$. Produce $X'B$ to Y'.



Here, XAY *and* $X'BY'$ are the tangents to the circle at the end points of the diameter *AB*.

5.

Sol:
Steps of Construction
Step 1: Draw a circle with the help of a bangle.
Step 2: Mark a point *P* outside the circle.
Step 3: Through *P*. draw a secant *PAB* to intersect the circle at *A* and *B*.
Step 4: Produce *AP* to *C* such that *PA* = *PC*.
Step 5: Draw a semicircle with *CB* as diameter.
Step 6: Draw $PD \perp BC$, intersecting the semicircle at *D*.
Step 7: With *P* as center and *PD* as radius, draw arcs to intersect the circle at T and T'.
Step 8: Join *PT* and *PT'S*.



Here, *PT* and *PT*' are the required pair of tangents.

6.

Sol:

Steps of Construction

Step 1: Draw a line segment *AB* = *8* cm.

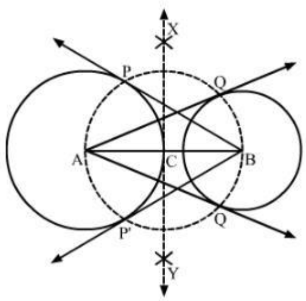
Step 2: With A as center and radius 4 cm, draw a circle.

Step 3: With B as center and radius 3 cm, draw another circle.

Step 4: Draw the perpendicular bisector *XY* of *AB*, cuffing *AB* at *C*.

Step 5: With *C* as center and radius *AC* (or *BC*), draw a circle intersecting the circle with center A at P and P': and the circle with center B at Q and Q'.

Step 6: Join BP and BP' Also, join *AQ* and *AQ'*.



Here. AQ and AQ' are the tangents from A to the circle with center B. Also, BP and BP' are the tangents from B to the circle with center A.

7.

Sol:

Steps of Construction:

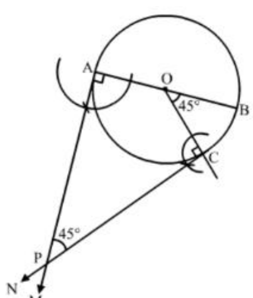
Step 1: Draw a circle with center *O* and radius = 4.2 cm.

Step 2: Draw any diameter *AOB* of this circle.

Step 3: Construct $\angle BOC = 45°$. such that the radius *OC* meets the circle at *C*.

Step4: Draw $AM \perp AB$ and $CN \perp OC$.

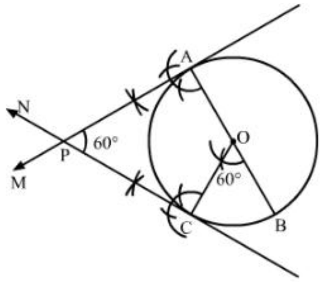
AM and CN intersect at P.



Thus, *PA* and *PC* are the required tangents to the given circle inclined at an angle of $45°$.

8.

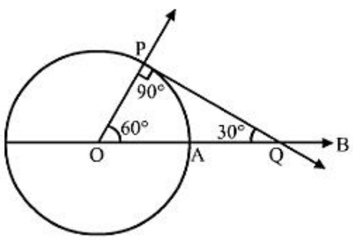
Sol:
Steps of Construction
Step 1: Draw a circle with center O and radius 3c m.
Step 2: Draw any diameter AOB of the circle.
Step 3: Construct $\angle BOC = 60°$ such that radius OC cuts the circle at C.
Step 4: Draw $AM \perp AB$ and $CN \perp OC$. Suppose AM and CN intersect each other at P.



Here, AP and CP are the pair of tangents to the circle inclined to each other at an angle of 60°.

9.

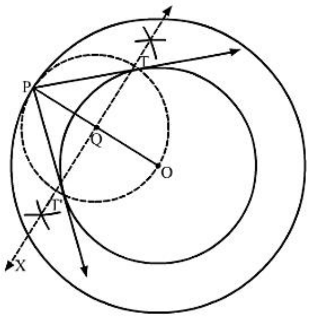
Sol:
Steps Of construction:
Step 1: Draw a circle with center O and radius 3 cm.
Step 2: Draw radius OA and produce it to B.
Step 3: Make $\angle AOP = 60°$
Step 4: Draw $PQ \perp OP$, meeting OB at Q.
Step 5: Then, PQ is the desired tangent, such that $\angle OQP = 30°$



10.

Sol:
Steps of Construction
Step 1: Mark a point O on the paper
Step 2: With O as center and radii 4cm and 6cm, draw two concentric circles.

Step 3: Mark a point P on the outer circle.
Step 4: Join OP.
Step 5: Draw the perpendicular bisector *XY* of OP, cutting *OP* at *Q*.
Step 6: Draw a circle with *Q* as center and radius *OQ* (or *PQ*), to intersect the inner circle in points T and T'.
Step 7: Join PT and PT'.



Here, PT and PT' are the required tangents.
PT = PT' 4.5 cm (Approx)
Verification by actual calculation
Join OT to form a right ΔOTP (Radius is perpendicular to the tangent at the point of contact)
In right ΔOTP,

$OP^2 = OT^2 + PT^2$ (Pythagoras Theorem)

$\Rightarrow PT = \sqrt{OP^2 - OT^2}$

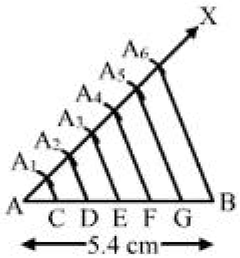
$\Rightarrow PT = \sqrt{6^2 - 4^2} = \sqrt{36-16} = \sqrt{20} \approx 4.5\ cm$

$(OP = 6\ cm\ and\ OT = 4\ cm)$

Exercise - Formative Assessment

11.

Sol:
Steps of Construction:
Step 1: Draw a line segment $AB = 5.4 cm.$
Step 2: Draw a ray AX, making an acute angle, $\angle BAX$.
Step 3: Jong *AX*, mark 6 points A_1, A_2, A_3, A_4, A_5 such that,
$AA_1 = A_1A_2 = A_2A_3 = A_3A_4 = A_4A_5 = A_5A_6.$
Step 4: Join $A_6B.$
Step 5: Draw $A_1C\ A_2D,\ A_3D,\ A_4F\ and\ A_5A_6.$



Thus, AB is divided into six equal parts.

12.

Sol:

Steps of Construction:

Step 1: Draw a line segment $AB = 6.5cm.$

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

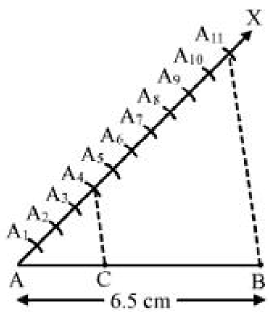
Step 3: Jong AX, mark $(4+7)=11$ points $A_1, A_2, A_3, A_4, A_5, A_6, A_7, A_8, A_9, A_{10}, A_{11}$ such that

$AA_1 = A_1A_2 = A_2A_3 = A_3A_4 = A_4A_5 = A_5A_6 = A_6A_7 = A_7A_8 = A_8A_9 = A_9A_{10} = A_{10}A_{11}$

Step 4: Join $A_{11}B.$

Step 5: From A_4, draw $A_4C \parallel A_{11}B,$ meeting AB at C.

Thus, C is the point on AB, which divides it in the ratio 4 : 7.



Thus, $AC : CB = 4 : 7$

From the figure,

$AC = 2.36cm$

$CB = 4.14cm$

13.

Sol:

Steps of Construction:

Step 1: Draw a line segment $BC = 6.5\ cm.$

Step 2: With B as center, draw an angle of 60°.

Step 3: With B as center and radius equal to 4.5 cm, draw an arc, cutting the angle at A

Step 4: Join AB and AC.

Thus, ΔABC is obtained.

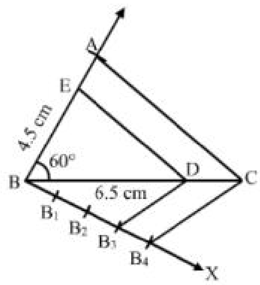
Step 5: Below BC, draw an acute $\angle CBX$.

Step 6: Along BX, mark off four points B_1, B_2, B_3, B_4.such that $BB_1 = B_1B_2 = B_2B_3 = B_3B_4$.

Step 7: Join B_4C.

Step 8: From B_3.draw $B_3D \parallel B_4C$, meeting BC at D.

Step 9: From D, draw $DE \parallel CA$, meeting AB at E.



Thus, ΔEBD is the required triangle, each of whose sides is $\frac{3}{4}$ the corresponding sides of ΔABC.

14.

Sol:

Steps of Construction:

Step 1: Draw a line l.

Step 2: Draw an angle of 90° at M on l

Step 3: Cut an arc of radius 3 cm on the perpendicular. Mark the point as A

Step 4: With A as center, make an angle of 30° and let it cut l at C. We get $\angle ACB = 60°$.

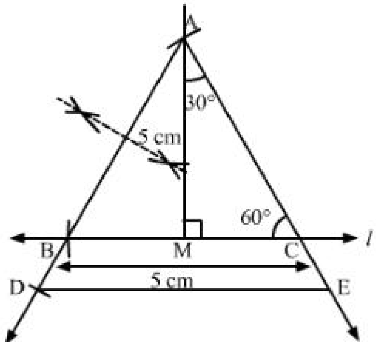
Step 5: Cut an arc of 5 cm from C on l and mark the point as B.

Step 6: Join AB.

Thus, ΔABC is obtained

Step 7: Extend AB to D, such that $BD = BC$.

Step 8: Draw $DE \parallel BC$, cutting AC produced to E.



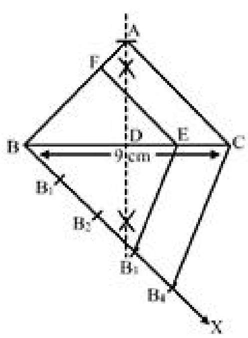
Then, ΔADE is the required triangle, each of whose sides is of the corresponding sides of ΔABC.

15.

Sol:
Steps of Construction:
Step 1: Draw a line segment $BC = 9cm$
Step 2: With B as center, draw an arc each above and below BC.
Step 3: With C as center, draw an arc each above and below BC.
Step 4: Join their points of intersection to obtain the perpendicular bisector of BC. Let it intersect BC at D
Step 5: From D, cut an arc of radius 5 cm and mark the point as A
Step 6: Join AB and AC

Thus ΔABC is obtained

Step 5: Below BC. make an acute $\angle CBX$.
Step 6: Along BX, mark off four points B_1, B_2, B_3, B_4 such that $BB_1 = B_1B_2 = B_2B_3 = B_3B_4$
Step 7: Join B_4C.
Step 8: From B_3. draw $B_2E \parallel B_4C$ meeting BC at E.
Step 9: From E. draw $EF \parallel CA$ meeting AB al F.



Thus, ΔFBE is the required triangle, each of whose sides is $\frac{3}{4}$ the corresponding sides of the first triangle.

16.

Sol:

Steps of Construction

Sept 1: Draw a line segment $BC = 4cm$

Sept 2: With B as center draw an angle of $90°$

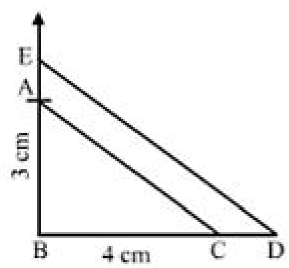
Step 3: With B as center and radius equal to 3cm cat an arc at the night angle and name it A

Step 4: Join AB and AC

Thus, ΔABC is obtained

Step 5: Extend BC to D, such that $BD = \frac{7}{5}BC = \frac{7}{5}(4)cm = 5.6cm$

Step 6: Draw $DE \| CA$ cutting AB produced to E



Thus, ΔEBD is the required triangle, each of whose sides is $\frac{7}{5}$ the corresponding sides of ΔABC.

17.

Sol:

Steps of Construction:

Step 1: Draw a circle of radius 4.8 cm.

Step 2: Mark a point P on it.

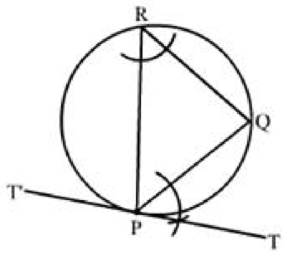
Step 3: Draw any chord PQ.

Step 4: Take a point R on the major arc QP

Step 5: Join PR and RQ.

Step6: Draw $\angle QPT = \angle PRQ$

Step 7: Produce *TP* to *T*', as shown in the figure.



TPT is the required tangent.

18.

Sol:

Steps of Construction:

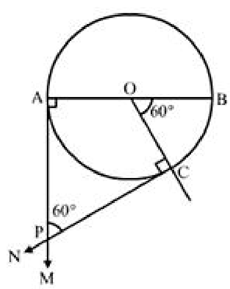
Step 1: Draw a circle with center O and radius = 3.5cm

Step 2: Draw any diameter AOB of this circle

Step 3: Construct $\angle BOC = 60°$, such that the radius OC meets the circle at C.

Step 4: Draw $MA \perp AB$ and $NC \perp OC$.

Let AM and CN intersect at P.



Then, PA and PC are the required tangents to the given circle that are inclined at an angle of $60°$

19.

Sol:

Steps of construction

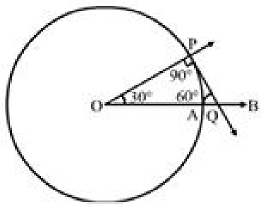
Step 1: Draw a circle with center O and radius 4cm

Step 2: Draw radius OA and produce it to B.

Step 3: Make $\angle AOP = 30°$

Step 4: Draw $PQ \perp OP$, meeting OB at Q.

Step 5: Then, PQ is the desired tangent, such that $\angle OQP = 60°$



20.

Sol:

Step of Construction:

Step 1: Draw a circle with *O* as center and radius 6 cm

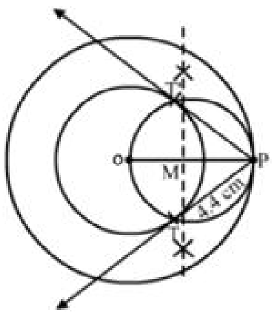
Step 2: Draw another circle with *O* as center and radius 4 cm

Step2: Mark a point P on the circle with radius 6 cm

Step 3: Join *OP* and bisect it at *M*.

Step 4: Draw a circle with *M* as center and radius equal to *MP* to intersect the given circle with radius 4 cm at points T and T'.

Step5: Join PT and PT'.



Thus, PT or PT' the required tangents and measure 4.4 cm each.