## SOLUTION

**Q.1. (A) For each of the following sub-questions four alternative answers are given. Choose the correct alternative and write its alphabet. [4]**

(1) The volume of a cube of side 10 cm is ............... . [1]

(a) 1 $cm^3$ (b) 10 $cm^3$ (c) 100 $cm^3$ (d) 1000 $cm^3$

(2) A line makes an angle of 30° with positive direction of X-axis, then the slope of the line is ............... . [1]

(a) $\frac{1}{2}$ (b) $\frac{\sqrt{3}}{2}$ (c) $\frac{1}{\sqrt{3}}$ (d) $\sqrt{3}$

(3) $\angle ACB$ is inscribed in arc ACB of a circle with centre O. If $\angle ACB = 65°$, find *m*(arc ACB): [1]

(a) 65° (b) 130° (c) 295° (d) 230°

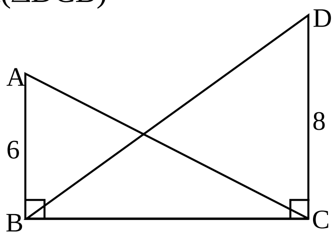
(4) Find the perimeter of a square if its diagonal is $10\sqrt{2}$ cm: [1]

(a) 10 cm (b) $40\sqrt{2}$ cm (c) 20 cm (d) 40 cm

**Ans.** (1) – (d), (2) – (c), (3) – (d), (4) – (d) [4]

**(B) Solve the following sub-questions.** **[4]**

(1) In the following figure, $\angle ABC = \angle DCB = 90°$, $AB = 6$, $DC = 8$, then $\frac{A(\Delta ABC)}{A(\Delta DCB)} = ?$



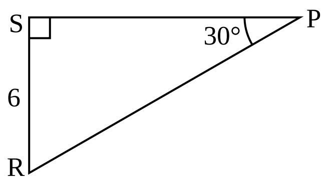

**Solution:**

$$\frac{A(\Delta ABC)}{A(\Delta DCB)} = \frac{AB}{DC}$$ (Ratio of the areas of two triangles with a common base) [1/2]

$$= \frac{6}{8}$$

**Ans.** $$= \frac{3}{4}$$ [1/2] [1]

(2) In the figure alongside, find the length of RP using the information given in $\Delta PSR$.




**Solution:**

In $\Delta PSR$, $\angle P = 30°$ and $\angle S = 90°$

$\therefore$ $\angle R = 60°$ (Remaining angle)

$\therefore$ $\Delta PSR$ is 30°–60°–90° triangle.
By 30°–60°–90° theorem,

side opposite the 30°angle = $\frac{1}{2}$ × hypotenuse [1/2]

$\therefore$ In $\Delta PSR$,

$$SR = \frac{1}{2} \times PR$$

$\therefore$ $$6 = \frac{1}{2} \times PR$$

**Ans.** $\therefore$ $$PR = 12$$ [1/2] [1]

(3) What is the distance between two parallel tangents of a circle having radius 4.5 cm?

**Solution:**

Radius of the circle = 4.5 cm

Distance between two parallel tangents of a circle = Diameter [1/2]

$$= 2r$$
$$= 2 \times 4.5$$
$$= 9 \text{ cm}$$

**Ans.** ∴ The distance between two parallel tangents is 9 cm. [1/2] [1]

(4) Find the co-ordinates of midpoint of the segment joining the points A(4, 6) and B(–2, 2).

**Solution:**

Let A(4, 6) $= (x_1, y_1)$

B(–2, 2) $= (x_2, y_2)$

$x = \dfrac{x_1 + x_2}{2}$ , $y = \dfrac{y_1 + y_2}{2}$ [1/2]

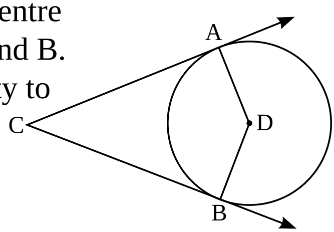
∴ $x = \dfrac{4 - 2}{2}$ , $y = \dfrac{6 + 2}{2}$

∴ $x = 1$ , $y = 4$

**Ans.** ∴ (1, 4) is the midpoint of the given segment. [1/2] [1]

**Q.2. (A) Complete the following activities and rewrite them. (Any *two*)** **[4]**

(1) In the figure alongside, circle with centre D touches the sides of ∠ACB at A and B. If ∠ACB = 52°, complete the activity to find the measure of ∠ADB.




**Activity:**

In □ABCD,

∠CAD = ∠CBD = $\boxed{90}$° ......... Tangent theorem [1/2]

∴ ∠ACB + ∠CAD + ∠CBD + ∠ADB = $\boxed{360}$° [1/2]

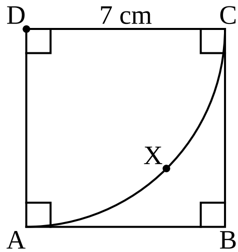
∴ 52° + 90° + 90° + ∠ADB = 360°

∴ ∠ADB + $\boxed{232}$° = 360° [1/2]

∴ ∠ADB = 360° – 232°

**Ans.** ∴ ∠ADB = $\boxed{128°}$ [1/2] [2]

(2) In the figure alongside, side of square ABCD is 7 cm. With centre D and radius DA sector D–AXC is drawn. Complete the following activity to find the area of square ABCD and sector D–AXC.




**Activity:**

Area of square = $\boxed{(\text{side})^2}$ ...... formula [1/2]

$= (7)^2$

$= 49\ \text{cm}^2$

Area of sector (D – AXC) = $\boxed{\dfrac{\theta}{360} \times \pi r^2}$ ...... formula [1/2]

$= \dfrac{\boxed{90}}{360} \times \dfrac{22}{7} \times \boxed{7^2}$ [1/2 + 1/2] [2]

$= 38.5\ \text{cm}^2$

(3) Complete the following activity to prove $\cot\theta + \tan\theta = \operatorname{cosec}\theta \times \sec\theta$.

**Activity:**

L.H.S. $= \cot\theta + \tan\theta$

$= \dfrac{\boxed{\cos\theta}}{\sin\theta} + \dfrac{\sin\theta}{\cos\theta}$ [1/2]

$= \dfrac{\boxed{\cos^2\theta} + \boxed{\sin^2\theta}}{\sin\theta \cdot \cos\theta}$ [1/2 + 1/2]

$= \dfrac{1}{\sin\theta \cdot \cos\theta}$ $(\because \sin^2\theta + \cos^2\theta = 1)$

$= \dfrac{1}{\sin\theta} \times \dfrac{1}{\cos\theta}$

$= \boxed{\operatorname{cosec}\theta} \times \sec\theta$ [1/2] [2]

$\therefore$ = R.H.S.

$\therefore$ $\cot\theta + \tan\theta = \operatorname{cosec}\theta \times \sec\theta$

**(B) Solve the following sub-questions. (Any *four*)** **[8]**

(1) If $\cos\theta = \frac{3}{5}$, then find $\sin\theta$.

**Solution:**

$$\cos\theta = \frac{3}{5} \quad \text{....... (given)}$$

$$\sin^2\theta + \cos^2\theta = 1 \quad [1/2]$$

$$\therefore \quad \sin^2\theta + \left(\frac{3}{5}\right)^2 = 1$$

$$\therefore \quad \sin^2\theta + \frac{9}{25} = 1$$

$$\therefore \quad \sin^2\theta = 1 - \frac{9}{25} \quad [1/2]$$

$$\therefore \quad \sin^2\theta = \frac{25-9}{25}$$

$$\therefore \quad \sin^2\theta = \frac{16}{25} \quad [1/2]$$

**Ans.** $\therefore \quad \sin\theta = \frac{4}{5}$ (taking square root of both sides) [1/2] [2]

(2) Find the slope of line EF, where co-ordinates of E are (–4, –2) and co-ordinates of F are (6, 3).

**Solution:**

Let $E(-4, -2) = (x_1, y_1)$

$F(6, 3) = (x_2, y_2)$

$$\text{Slope of line EF} = \frac{y_2 - y_1}{x_2 - x_1} \quad [1/2]$$

$$= \frac{3-(-2)}{6-(-4)} \quad [1/2]$$

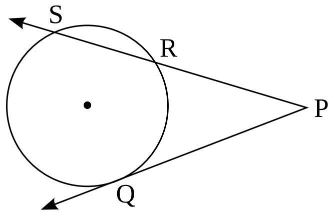
$$= \frac{3+2}{6+4}$$

$$= \frac{5}{10} \quad [1/2]$$

$$= \frac{1}{2}$$

**Ans.** $\therefore$ Slope of line EF $= \frac{1}{2}$ [1/2] [2]

(3) In the figure alongside, ray PQ touches the circle at point Q. If PQ = 12, PR = 8, find the length of seg PS.




**Solution:**

$PQ^2 = PR \times PS$ (Tangent secant segments theorem) [1/2]

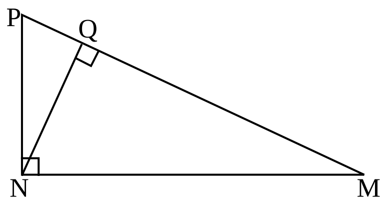
$\therefore 12^2 = 8 \times PS$ [1/2]

$\therefore 144 = 8 \times PS$ [1/2]

$\therefore PS = \frac{144}{8}$

**Ans.** $\therefore PS = 18$ [1/2] [2]

(4) In the figure alongside, $\angle MNP = 90°$, seg NQ ⊥ seg MP. MQ = 9, QP = 4. Find NQ.




**Solution:**

In ΔMNP, $\angle N = 90^0$ and NQ ⊥ PM.

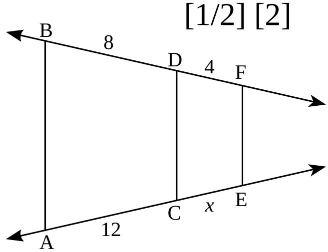
$\therefore NQ^2 = QP \times MQ$ (Theorem of geometric mean) [1/2]

$\therefore NQ^2 = 4 \times 9$ [1/2]

$\therefore NQ^2 = 36$ [1/2]

**Ans.** $\therefore NQ = 6$ [1/2] [2]

(5) In the figure alongside, if AB || CD || EF, then find $x$ and AE by using the information given in the figure.




**Solution:**

AB || CD || EF and FB, EA are transversals.

$\therefore \frac{BD}{DF} = \frac{AC}{CE}$ (Intercepts made by three parallel lines) [1/2]

$\therefore \frac{8}{4} = \frac{12}{x}$

$\therefore 8x = 4 \times 12$

$\therefore \quad x = \frac{4 \times 12}{8}$

$\therefore \quad x = 6$ [1/2]

AE = AC + CE (A-C-E)

$\therefore$ AE = 12 + $x$

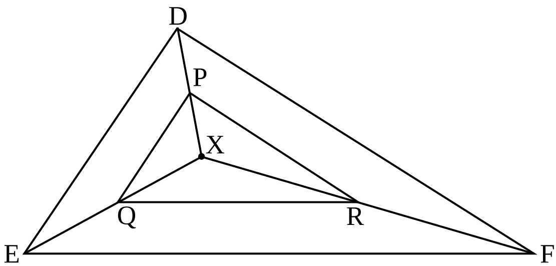
$\therefore$ AE = 12 + 6

$\therefore$ AE = 18 [1/2] [2]

**Ans.** $x$ = 6 and AE =18

**Q.3. (A) Complete the following activity and rewrite it. (Any *one*)** **[3]**

(1)




In the above figure, X is any point in the interior of triangle.

Point X is joined to vertices of triangle. seg PQ || seg DE, seg QR || seg EF. Complete the following activity to prove seg PR || seg DF.

**Activity:**

In ΔXDE, PQ || DE ........ (given)

$\therefore \quad \frac{XP}{\boxed{PD}} = \frac{\boxed{XQ}}{QE}$ ........(I) Basic proportionality theorem [1/2 + 1/2]

In ΔXEF, QR || EF ... (given)

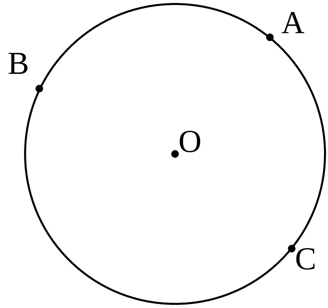
$\therefore \quad \frac{XQ}{QE} = \frac{\boxed{XR}}{RF}$ ........(II) $\boxed{\text{Basic proportionality theorem}}$ [1/2 + 1/2]

$\therefore \quad \frac{XP}{PD} = \frac{\boxed{XR}}{\boxed{RF}}$ ........ from (I) and (II) [1/2 + 1/2] [3]

$\therefore$ seg PR || seg DF ........ Converse of basic proportionality theorem

(2) A, B, C are any points on the circle with centre O.

If $m(\text{arc BC}) = 110°$ and $m(\text{arc AB}) = 125°$, complete the following activity to find $m(\text{arc ABC})$, $m(\text{arc AC})$, $m(\text{arc ACB})$ and $m(\text{arc BAC})$.




**Activity:**

$m(\text{arc ABC}) = m(\text{arc AB}) + \boxed{m(\text{arc BC})}$ [1/2]

$= \boxed{125°} + 110°$ [1/2]

$= 235°$

$m(\text{arc AC}) = 360° - m(\text{arc } \boxed{\text{ABC}})$ [1/2]

$= 360° - \boxed{235°}$ [1/2]

$= 125°$

Similarly,

$m(\text{arc ACB}) = 360° - \boxed{125°}$ [1/2]

$= 235°$

and $m(\text{arc BAC}) = 360° - \boxed{110°}$ [1/2] [3]

$= 250°$

**(B) Solve the following sub-questions. (Any *two*)** **[6]**

(1) The radius of a circle is 6 cm, the area of a sector of this circle is 15 π sq. cm. Find the measure of the arc and the length of the arc corresponding to that sector.

**Solution:**

(i) Area of a sector $= \dfrac{l \times r}{2}$ [1/2]

$\therefore \quad 15\pi = \dfrac{l \times 6}{2}$ [1/2]

$\therefore \quad l = \dfrac{15\pi \times 2}{6}$

$\therefore \quad l = 5\pi$

**Ans.** Length of the arc = 5π cm [1/2]

(ii) Area of the sector $= \dfrac{\theta}{360} \pi r^2$ [1/2]

$\therefore\quad 15\pi = \dfrac{\theta}{360} \times \pi \times 6^2$ [1/2]

$\therefore\quad \theta = \dfrac{15\pi \times 360}{\pi \times 6 \times 6}$

$\therefore\quad \theta = 15 \times 10$

$\therefore\quad \theta = 150°$ [1/2] [3]

**Ans.** Measure of the arc is 150°.

(2) If A(3, 5) and B(7, 9), point Q divides seg AB in the ratio 2:3, find the co-ordinates of point Q.

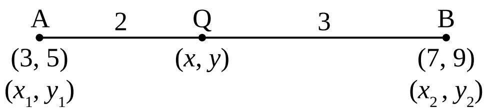
**Solution:**

Let Q = $(x, y)$ and

A(3, 5) = $(x_1, y_1)$

B(7, 9) = $(x_2, y_2)$

$m:n = 2:3$




By section formula,

$x = \dfrac{mx_2 + nx_1}{m+n}$; $\quad y = \dfrac{my_2 + ny_1}{m+n}$ [1/2 + 1/2]

$= \dfrac{2 \times 7 + 3 \times 3}{2+3}$; $\quad = \dfrac{2 \times 9 + 3 \times 5}{2+3}$ [1/2 + 1/2]

$= \dfrac{14+9}{5}$; $\quad = \dfrac{18+15}{5}$

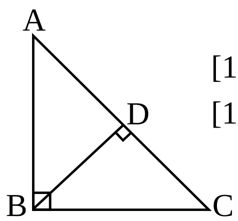
$= \dfrac{23}{5}$; $\quad = \dfrac{33}{5}$ [1/2 + 1/2] [3]

**Ans.** $\therefore\quad Q\left(\dfrac{23}{5}, \dfrac{33}{5}\right)$

(3) Prove that:

"In a right-angled triangle, the square of the hypotenuse is equal to the sum of the squares of remaining two sides."

**Solution:**




**Given:** In ΔABC, ∠B = 90° [1/2]

**To prove:** $AC^2 = AB^2 + BC^2$ [1/2]

**Construction:** Draw BD ⊥ AC

**Proof:**

$\Delta ABC \sim \Delta ADB$ (Similarity in right-angled triangles)

$\therefore \quad \dfrac{AB}{AD} = \dfrac{AC}{AB}$ (c.s.s.t)

$\therefore \quad AB^2 = AC \times AD$ ..........(I) [1/2]

$\Delta ABC \sim \Delta BDC$ (Similarity in right angled triangles)

$\therefore \quad \dfrac{BC}{DC} = \dfrac{AC}{BC}$

$\therefore \quad BC^2 = AC \times DC$ ..........(II) [1/2]

Adding equation (I) and (II),

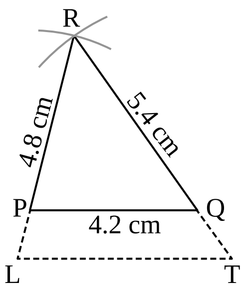
$AB^2 + BC^2 = AC \times AD + AC \times DC$ [1/2]

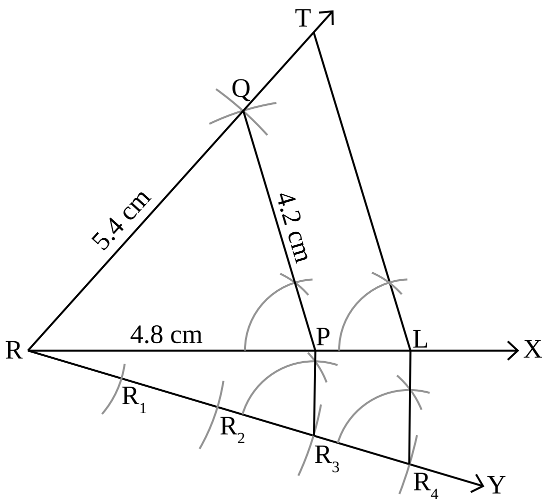
$= AC(AD + DC)$

$= AC \times AC$ .....($\because$ A–D–C) [1/2]

$\therefore \quad AB^2 + BC^2 = AC^2$

(4) $\Delta PQR \sim \Delta LTR$. In $\Delta PQR$, PQ = 4.2 cm, QR = 5.4 cm, PR = 4.8 cm. Construct $\Delta PQR$ and $\Delta LTR$ such that $\dfrac{PQ}{LT} = \dfrac{3}{4}$.




- Draw $\Delta PQR$ of given measure [1]
- Draw acute angle at R [1/2]
- Mark points $R_1$, $R_2$, $R_3$, $R_4$ on Ray RY at equal distance from point R [1/2]

- Draw seg $R_3Q$ and draw line $R_4T$ parallel to it [1/2]
- Draw a line parallel to PQ through T [1/2] [3]

**Q.4. Solve the following sub-questions. (Any *two*) [8]**

(1) A bucket is in the form of a frustum of a cone. It holds 28.490 litres of water. The radii of the top and the bottom are 28 cm and 21 cm respectively. Find the height of the bucket.

$$\left[\pi = \frac{22}{7}\right]$$

**Solution:**

Volume of the frustum i.e. bucket (V) = 28.490 liters

= 28490 $cm^3$ [1/2]

$r_1 = 28$ cm, $r_2 = 21$ cm

Volume of the bucket $= \frac{1}{3}\pi h(r_1^2 + r_2^2 + r_1 \times r_2)$ [1/2]

$\therefore \quad 28490 = \frac{1}{3}\pi \times h(28^2 + 21^2 + 28 \times 21)$ [1/2]

$\therefore \quad 28490 = \frac{1}{3} \times \frac{22}{7} \times h(784 + 441 + 588)$ [1/2]

$\therefore \quad 28490 = \frac{1}{3} \times \frac{22}{7} \times h \times 1813$ [1/2]

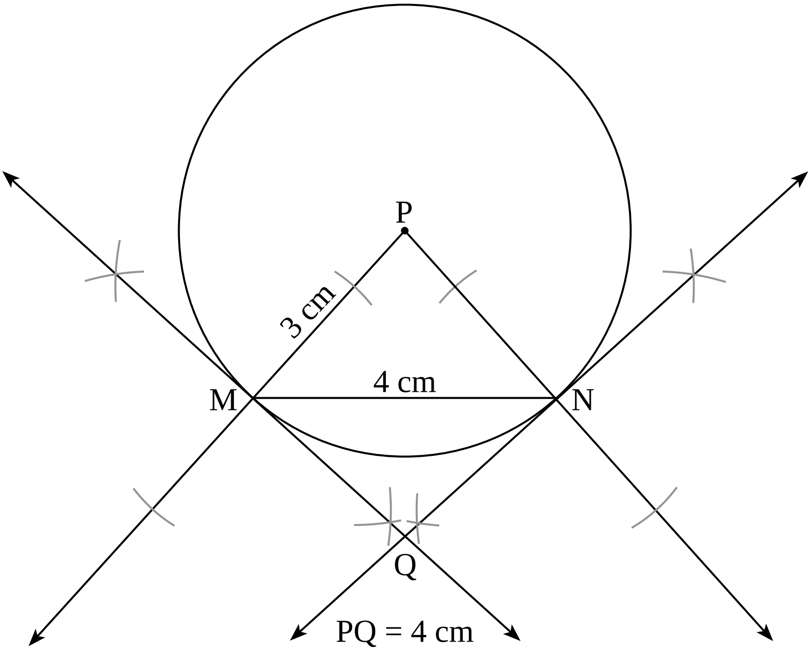
$\therefore \quad h = \frac{28490 \times 3 \times 7}{22 \times 1813}$ [1/2]

$\therefore \quad h = 15$ [1/2]

**Ans.** $\therefore$ The height of the bucket is 15 cm. [1/2] [4]

(2) Draw a circle with centre P and radius 3 cm. Draw a chord MN of length 4 cm. Draw tangents to the circle through points M and N which intersect in point Q. Measure the length of seg PQ.

**Solution:**

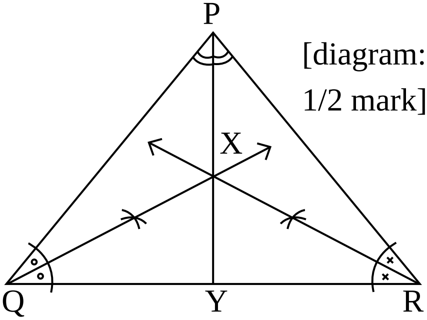



- To draw a circle with centre P and radius 3 cm [1]
- To chord MN of length 4 cm [1]
- To draw tangents at M and N [1]
- To measure the length PQ [1]

(3) In ΔPQR, bisectors of ∠Q and ∠R intersect in point X. Line PX intersects side QR in point Y, then prove that:

$$\frac{PQ + PR}{QR} = \frac{PX}{XY}$$

**Solution:**




[diagram: 1/2 mark]

**Given:** In ΔPQR, rays QX and RX are angle bisectors of ∠Q and ∠R respectively.

**To prove:** $\frac{PQ + PR}{QR} = \frac{PX}{XY}$ [1/2]

**Proof:** In ΔPQY, ray QX is a angle bisector of ∠PQY.

$\therefore \quad \frac{PX}{XY} = \frac{PQ}{QY}$ ...........(I) (Angle bisector theorem) [1]

In ΔPRY, ray RX is an angle bisector of ∠PRY.

$\therefore \quad \frac{PX}{XY} = \frac{PR}{RY}$ .......(II) (Angle bisector theorem) [1/2]

$\therefore \quad \frac{PX}{XY} = \frac{PQ}{QY} = \frac{PR}{RY}$ .......[From (I) & (II)] [1/2]

$\therefore \quad \frac{PX}{XY} = \frac{PQ + PR}{QY + RY}$ .......(Theorem on equal ratio) [1/2]

$\therefore \quad \frac{PX}{XY} = \frac{PQ + PR}{QR}$ .......(Q-Y-C) [1/2] [4]

**Q.5. Solve the following sub-questions. (Any *one*)** **[3]**

(1) From top of the building, Ramesh is looking at a bicycle parked at some distance away from the building on the road.

If

AB → Height of building is 40 m

C → Position of bicycle

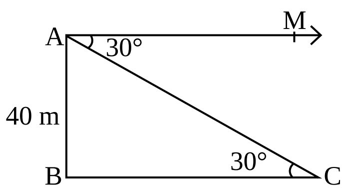
A → Position of Ramesh on top of the building

∠MAC is the angle of depression and $m\angle MAC = 30°$, then:

(a) Draw a figure with the given information.

(b) Find the distance between building and the bicycle ($\sqrt{3} = 1.73$).

**Solution:**




[diagram: 1 mark]

$\angle MAC = 30^0$

$\therefore \angle ACB = 30^0$ (alternate angles)

ΔABC is a right-angled triangle.

$\tan 30° = \frac{AB}{BC}$ [1/2]

$\therefore \quad \frac{1}{\sqrt{3}} = \frac{40}{BC}$

$\therefore$ BC = $40\sqrt{3}$ [1/2]

$\therefore$ BC = 40 × 1.73 [1/2]

$\therefore$ BC = 69.20 m

**Ans.** $\therefore$ The distance between the building and the bicycle is 69.20 m. [1/2] [3]

(2) $\square$ABCD is a cyclic quadrilateral where side AB ≅ side BC, $\angle$ADC = 110°, AC is the diagonal, then:

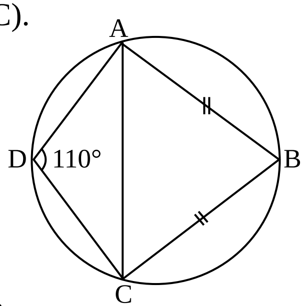
(a) Draw the figure using given information.

(b) Find measure of $\angle$ABC.

(c) Find measure of $\angle$BAC.

(d) Find measure of (arc ABC).

(a)




[1/2]

(b) In cyclic quadrilateral ABCD,

$m\angle ADC + m\angle ABC = 180°$

(opposite angles of cyclic quadrilateral)

[1/2]

$\therefore$ $110 + m\angle ABC = 180°$

$\therefore$ $m\angle ABC = 180° - 110°$

$\therefore$ $m\angle ABC = 70°$ [1/2]

(c) $\Delta$ABC is an isoceles triangle. ($\because$ AB = BC)

$\therefore$ $m\angle ACB = m\angle BAC$ (Base angles of an isosceles triangle)

[1/2]

$\therefore$ $m\angle BAC + m\angle ACB + m\angle ABC = 180°$

$\therefore$ $m\angle BAC + m\angle BAC + 70° = 180°$

$\therefore$ $2\angle BAC = 180° - 70°$

$\therefore \quad \angle BAC = \dfrac{110°}{2}$

$\therefore \quad \angle BAC = 55°$ [1/2]

(d) $m\angle ADC = \dfrac{1}{2} m(\text{arcABC})$ (Inscribed angle theorem)

$\therefore \quad 110° = \dfrac{1}{2} \; m(\text{arc ABC})$

$\therefore \quad m(\text{arc ABC}) = 2 \times 110°$

$\therefore \quad m(\text{arc ABC}) = 220°$ [1/2] [3]

★★★