प्र. क्र.
Q. No. 1 (A)

(i) (B) (ii) (D) (iii) (C) (iv) (C). *(1 mark each)*

1 (B)

Note : Here answers with solution are expected.

(i) Ans.

$\triangle ABD$ and $\triangle ABC$ have a common vertex A and their bases BD and BC lie on the same line BC.

$\therefore$ their areas are proportional to their corresponding bases.

$\dfrac{A(\triangle ABD)}{A(\triangle ABC)} = \dfrac{BD}{BC}$ *(½ mark)*

$= \dfrac{7}{20}$ *(½ mark)*

(ii) Ans.

$NQ^2 = MQ \times PQ$ ... (Theorem of geometric mean) *(½ mark)*

$= 9 \times 4$

$NQ = 3 \times 2$ ... (Taking square roots of both the sides) *(½ mark)*

$NQ = 6$.

(iii) Ans.

The angle made by the line with the positive direction of X-axis is 30°.

Slope of the line $= \tan\theta$ *(½ mark)*

$= \tan 30° = \dfrac{1}{\sqrt{3}}$

The slope of the line is $\dfrac{1}{\sqrt{3}}$. *(½ mark)*

(iv) Ans.

The opposite angles of a cyclic quadrilateral are supplementary.

$\therefore m\angle A + m\angle C = 180°$ *(½ mark)*

$\therefore 100° + m\angle C = 180°$

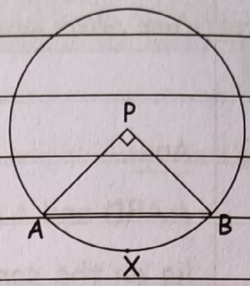
$\therefore m\angle C = 180° - 100°$

$m\angle C = 80°$. *(½ mark)*

प्र. क्र.
Q. No. 1 (B)

Note : In this question type, students are required to solve any 2 of 3 activities. However, solutions to all 3 activities are given here, for the guidance of the students.

(i) Activity : $r = 10$ cm, $\theta = 90°$, $\pi = 3.14$.



$A(P\text{–}AXB) = \dfrac{\theta}{360} \times \boxed{\pi r^2}$ (½ mark)

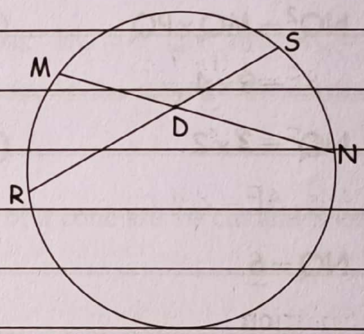
$= \dfrac{\boxed{90}}{360} \times 3.14 \times 10^2$ (½ mark)

$= \dfrac{1}{4} \times \boxed{314}$ (½ mark)

$\therefore A(P\text{–}AXB) = \boxed{78.5}$ sq cm.) (½ mark)

(ii) Activity : $MD \times DN = \boxed{RD} \times DS$ (½ mark)

... (Theorem of internal division of chords)



$\therefore \boxed{8} \times DN = 15 \times 4$ (½ mark)

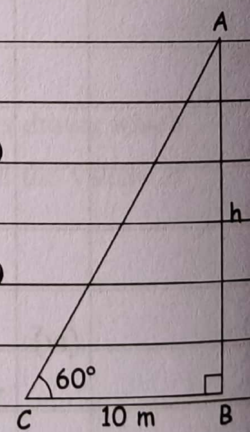
$\therefore DN = \dfrac{\boxed{60}}{8}$ (½ mark)

$\therefore DN = \boxed{7.5}$. (½ mark)

(iii) Activity :

In the given figure, $AB = h$ = height of the tree, distance of the observer from the tree, $BC = 10$ m,

Angle of elevation $(\theta) = \angle BCA = 60°$



$\tan\theta = \dfrac{\boxed{AB}}{BC}$ ... (1) (½ mark)

$\tan 60° = \boxed{\sqrt{3}}$ ... (2) (½ mark)

$\therefore \dfrac{AB}{BC} = \sqrt{3}$ ... [From (1) and (2)]

$\therefore AB = \sqrt{3} \times BC = 10\sqrt{3}$

$\therefore AB = 10 \times 1.73 = \boxed{17.3}$ (½ mark)

$\therefore$ the height of the tree is $\boxed{17.3}$ m. (½ mark)

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प्र. क्र.
Q. No. 2 (A)

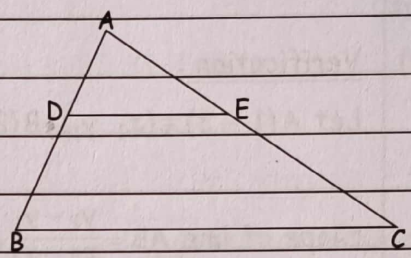
Note : In this question type, students are required to solve any 4 of 5 subquestions. However, solutions to all 5 subquestions are given here, for the guidance of the students.

(i) Solution :

In $\triangle ABC$, $DE \parallel BC$

By the basic proportionality theorem,

$\frac{AD}{DB} = \frac{AE}{EC}$ **(½ mark)**



$\therefore \frac{1.8}{5.4} = \frac{AE}{7.2}$ **(½ mark)**

$\therefore \frac{AE}{7.2} = \frac{1.8}{5.4}$

$\therefore AE = \frac{1.8 \times 7.2}{5.4}$ **(½ mark)**

$\therefore AE = 2.4$ **(½ mark)**

Ans. $AE = 2.4$ cm.

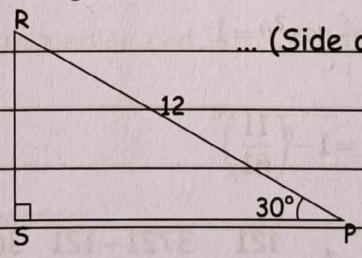
(ii) Solution :

In $\triangle RSP$, $\angle RSP = 90°$, $\angle RPS = 30°$,

$\therefore \angle SRP = 60°$ ... (The remaining angle of $\triangle RSP$)

By $30° - 60° - 90°$ triangle theorem,

$RS = \frac{1}{2} RP$ ... (Side opposite to 30°) **(½ mark)**



$= \frac{1}{2} \times 12 = 6$ **(½ mark)**

$PS = \frac{\sqrt{3}}{2} RP$ ... (Side opposite to 60°) **(½ mark)**

$= \frac{\sqrt{3}}{2} \times 12 = 6\sqrt{3}$ **(½ mark)**

Ans. $RS = 6$ and $PS = 6\sqrt{3}$.

प्र. क्र.
Q. No. 2 (A)

(iii) Solution :

$\angle CAD = \angle CBD = 90°$ ... (Tangent theorem) (½ mark)

$\angle ADB + \angle CBD + \angle ACB + \angle CAD = 360°$

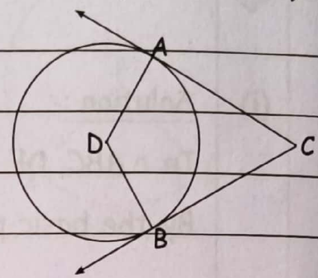
... (The sum of all the angles of a quadrilateral) (½ mark)

$\therefore \angle ADB + 90° + 52° + 90° = 360°$

$\therefore \angle ADB + 232° = 360°$

$\therefore \angle ADB = 360° - 232°$ (½ mark)

$\therefore \angle ADB = 128°$ (½ mark)



Ans. The measure of $\angle ADB$ is 128°.

(iv) Verification :

Let $A(1, -3) \equiv (x_1, y_1)$, $B(2, -5) \equiv (x_2, y_2)$, $C(-4, 7) \equiv (x_3, y_3)$.

Slope of line $AB = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-5-(-3)}{2-1} = \frac{-5+3}{1} = -2$ (½ mark)

Slope of line $BC = \frac{y_3 - y_2}{x_3 - x_2} = \frac{7-(-5)}{-4-2} = \frac{7+5}{-6} = \frac{12}{-6} = -2$ (½ mark)

Slope of line AB = slope of line BC and point B is common to both the lines.

$\therefore$ points $A(1, -3)$, $B(2, -5)$ and $C(-4, 7)$ are collinear. (½ mark)

(v) Solution :

$\sin^2\theta + \cos^2\theta = 1$ ... (Trigonometric identity) (½ mark)

$\therefore \left(\frac{11}{61}\right)^2 + \cos^2\theta = 1$

$\therefore \cos^2\theta = 1 - \left(\frac{11}{61}\right)^2$ (½ mark)

$= 1 - \frac{121}{3721} = \frac{3721-121}{3721} = \frac{3600}{3721}$ (½ mark)

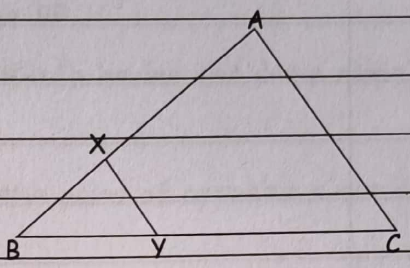
$\therefore \cos\theta = \frac{60}{61}$ ... (Taking square roots of both the sides) (½ mark)

Ans. The value of $\cos\theta$ is $\frac{60}{61}$.

प्र. क्र.
Q. No. 2 (B)

Note : In this question type, students are required to attempt any 1 of 2 activities. However, solutions to both the activities are given here, for the guidance of the students.

(i) Activity :



$2AX = 3BX$ ... (Given)

$\therefore \frac{AX}{BX} = \frac{3}{\boxed{2}}$ *(½ mark)*

$\therefore \frac{AX+BX}{BX} = \frac{3+2}{2}$ ... (By componendo)

$\therefore \frac{\boxed{AB}}{BX} = \frac{5}{2}$ ... (1) *(½ mark)*

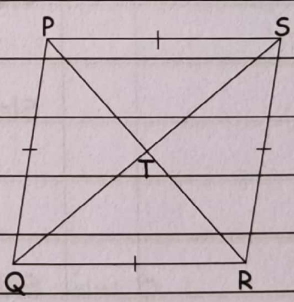
Now, $\triangle BCA \sim \triangle BYX$ ... ($\boxed{AA}$ test of similarity) *(½ mark)*

$\therefore \frac{BA}{BX} = \frac{AC}{XY}$ ... (Corresponding sides of similar triangles)

$\therefore \frac{\boxed{5}}{\boxed{2}} = \frac{AC}{9}$ *(½ + ½ mark)*

$\therefore AC = \boxed{22.5}$ ... [From (1)] *(½ mark)*

(ii) Activity :



The diagonals of a rhombus bisect each other.

In $\triangle PQS$, PT is the median and in $\triangle QRS$, RT is the median.

$\therefore$ by Apollonius theorem,

$PQ^2 + PS^2 = \boxed{2PT^2} + 2QT^2$ ... (1) *(½ mark)*

and $QR^2 + SR^2 = \boxed{2RT^2} + 2QT^2$ ... (2) *(½ mark)*

प्र. क्र.
Q. No. 2 (B)

Adding (1) and (2),

$PQ^2+PS^2+QR^2+SR^2=2\left(PT^2+\boxed{RT^2}\right)+4QT^2$ (½ mark)

$=2\left(PT^2+\boxed{PT^2}\right)+4QT^2$ ... $(RT=PT)$ (½ mark)

$=4PT^2+4QT^2$

$=\left(\boxed{2PT}\right)^2+(2QT)^2$ (½ mark)

$\therefore PQ^2+PS^2+QR^2+SR^2=PR^2+\boxed{QS^2}$. (½ mark)

Note : *In this question type, students are required to solve any 2 of 4 subquestions. However, solutions to all 4 subquestions are given here, for the guidance of the students.*

(i) Proof :

$P(1, -2)\equiv(x_1, y_1)$, $Q(5, 2)\equiv(x_2, y_2)$, $R(3, -1)\equiv(x_3, y_3)$, $S(-1, -5)\equiv(x_4, y_4)$.

Slope of line PQ $=\frac{y_2-y_1}{x_2-x_1}=\frac{2-(-2)}{5-1}=\frac{2+2}{4}=\frac{4}{4}=1$ ... (1) (½ mark)

Slope of line QR $=\frac{y_3-y_2}{x_3-x_2}=\frac{-1-2}{3-5}=\frac{-3}{-2}=\frac{3}{2}$ ... (2) (½ mark)

Slope of line RS $=\frac{y_4-y_3}{x_4-x_3}=\frac{-5-(-1)}{-1-3}=\frac{-5+1}{-4}=\frac{-4}{-4}=1$ ... (3) (½ mark)

Slope of line SP $=\frac{y_4-y_1}{x_4-x_1}=\frac{-5-(-2)}{-1-1}=\frac{-5+2}{-2}=\frac{-3}{-2}=\frac{3}{2}$ ... (4) (½ mark)

From (1) and (3),

slope of line PQ = slope of line RS

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प्र. क्र. Q. No. 2 (B)

$\therefore$ line PQ $\parallel$ line RS ... (Both having the same slope) *(½ mark)*

From (2) and (4),

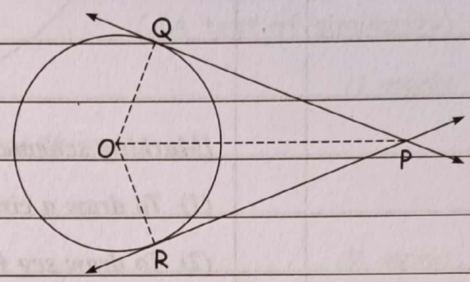
slope of line QR = slope of line SP

$\therefore$ line QR $\parallel$ line SP ... (Both having the same slope) *(½ mark)*

$\therefore$ □PQRS is a parallelogram

... (Both the pairs of opposite sides are parallel)

(ii)



Given : (1) A circle with centre O.

(2) Lines PQ and PR are tangents to the circle at points Q and R respectively. *(½ mark)*

(Fig. : ½ mark)

To prove : seg PQ $\cong$ seg PR. *(½ mark)*

Construction : Draw seg OP, seg OQ and seg OR.

Proof : In $\triangle$OQP and $\triangle$ORP,

$\angle OQP = \angle ORP = 90°$ ... (Tangent theorem)

Hypotenuse OP $\cong$ Hypotenuse OP ... (Common side) *(½ mark)*

side OQ $\cong$ side OR ... (Radii of the same circle)

$\therefore \triangle OQP \cong \triangle ORP$ ... (Hypotenuse side test) *(½ mark)*

$\therefore$ seg PQ $\cong$ seg PR ... (c.s.c.t.) *(½ mark)*

(iii) Steps of construction :

(1) Draw a circle with centre O and radius 4.1 cm.

(2) Take a point P at a distance of 7.3 cm from the point O.

(3) Draw the perpendicular bisector of seg PO intersecting seg PO in the point M.

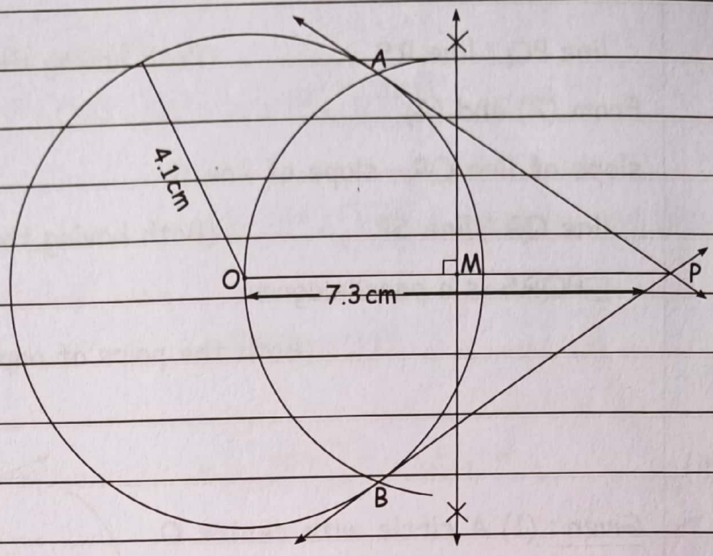
(4) With M as centre and radius equal to seg MO draw an arc intersecting the circle with centre O in the points A and B.

(5) Draw lines PA and PB.

These lines are tangents to the circle.

प्र. क्र.
Q. No. 3 (A)

Ans.



[Marking scheme :

(1) To draw a circle of radius 4.1 cm *(1 mark)*

(2) To draw seg OP of length 7.3 cm *(½ mark)*

(3) To draw bisector of seg OP *(½ mark)*

(4) To draw tangent PA *(½ mark)*

(5) To draw tangent PB *(½ mark)]*

(Here the steps of the constructions are given for the guidance of the students. Do not write it in the exam.)

(iv) Solution :

For cylinder : $r = 10$ cm, $h = 6$ cm

For sphere : $R = 30$ cm

The number of solid cylinders that can be made by melting a solid sphere $= \dfrac{\text{The volume of the sphere}}{\text{The volume of one cylinder}}$ *(½ mark)*

$$= \frac{\frac{4}{3}\pi R^3}{\pi r^2 h}$$ *(½ + ½ mark)*

$$= \frac{\frac{4}{3} \times 30 \times 30 \times 30}{10 \times 10 \times 6}$$ *(½ mark)*

$$= \frac{4 \times 30 \times 30 \times 30}{3 \times 10 \times 10 \times 6}$$ *(½ mark)*

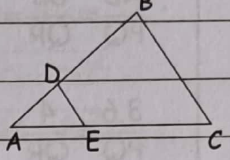
$$= 60$$ *(½ mark)*

Ans. 60 solid cylinders can be made.

प्र. क्र.
Q. No. 4

Note : In this question type, students are required to attempt any 2 of 3 subquestions. However, solutions to all 3 subquestions are given here, for the guidance of the students.

(i) Solution :



(a) $DE \parallel BC$ ... (Given)

$\therefore \angle ADE \cong \angle ABC$ and $\angle AED \cong \angle ACB$ ... (Corresponding angles)

$\therefore \triangle ADE \sim \triangle ABC$ ... (AA test of similarity)

(1 mark)

By the theorem of areas of similar triangles,

$$\frac{A(\triangle ADE)}{A(\triangle ABC)} = \frac{DE^2}{BC^2}$$ *(½ mark)*

$$\therefore \frac{25}{A(\triangle ABC)} = \frac{(4)^2}{(8)^2}$$

$$\therefore A(\triangle ABC) = \frac{25 \times (8)^2}{(4)^2} = 25 \times 4 = 100$$ *(½ mark)*

(b) By the theorem of areas of similar triangles,

$$\frac{A(\triangle ABC)}{A(\triangle ADE)} = \frac{BC^2}{DE^2} = \frac{5^2}{3^2}$$ *(½ mark)*

$$\frac{A(\triangle ABC)}{A(\triangle ADE)} = \left(\frac{5}{3}\right)^2 = \frac{25}{9}$$ *(½ mark)*

$$\therefore \frac{A(\triangle ABC) - A(\triangle ADE)}{A(\triangle ADE)} = \frac{25-9}{9}$$ ... (By dividendo)

(½ mark)

$$\therefore \frac{A(\square DBCE)}{A(\triangle ADE)} = \frac{16}{9}$$

$$\therefore \frac{A(\square ADE)}{A(\triangle DBCE)} = \frac{9}{16}$$ ... (By invertendo)

(½ mark)

Ans. (a) $A(\triangle ABC) = 100\ cm^2$

(b) $\triangle ADE : A(\square DBCE) = 9 : 16$.

प्र. क्र. Q. No. 3 (B) (ii) Solution :

$\triangle ABC \sim \triangle PQR$ ... (Given)

$\therefore \frac{AB}{PQ}=\frac{BC}{QR}=\frac{AC}{PR}$ ... (Corresponding sides of similar triangles)

(½ mark)

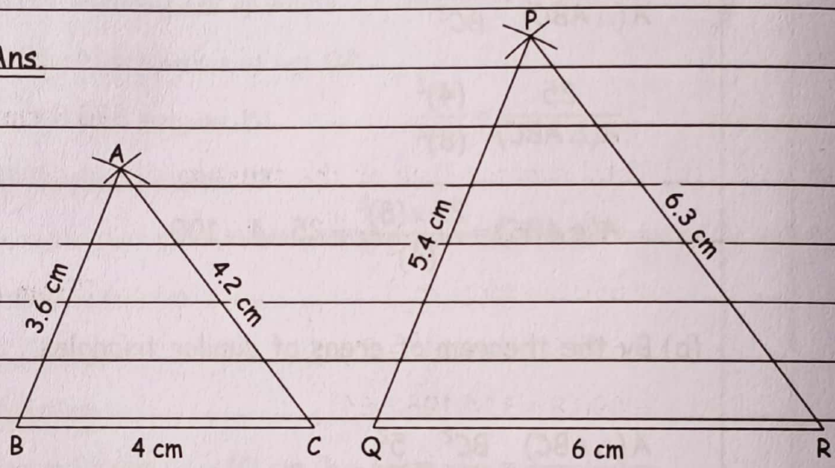
$\therefore \frac{3.6}{PQ}=\frac{4}{QR}=\frac{4.2}{PR}=\frac{2}{3}$ ... (Given : Ratio of sides 2 : 3)

$\therefore \frac{3.6}{PQ}=\frac{2}{3}$ $\therefore PQ=5.4$ cm, *(½ mark)*

$\therefore \frac{4}{QR}=\frac{2}{3}$ $\therefore QR=6$ cm, *(½ mark)*

$\therefore \frac{4.2}{PR}=\frac{2}{3}$ $\therefore PR=6.3$ cm *(½ mark)*

Ans.



[Marking scheme :

(1) To draw $\triangle ABC$ *(1 mark)*

(2) To draw $\triangle PQR$ *(1 mark)]*

प्र. क्र.
Q. No. 4

(iii) Solution :

The radii of the circular ends of a frustum are 14 cm and 8 cm.

Let $r_1 = 14$ cm and $r_2 = 8$ cm. Height $(h) = 8$ cm.

Slant height ℓ of the frustum $= \sqrt{h^2 + (r_1 - r_2)^2}$ *(½ mark)*

$= \sqrt{8^2 + (14-8)^2}$

$= \sqrt{8^2 + 6^2}$

$= \sqrt{64+36}$

$= \sqrt{100}$

$= 10$ cm *(½ mark)*

$\therefore \ell = 10$ cm,

(a) Curved surface area of the frustum $= \pi\ell(r_1 + r_2)$ *(½ mark)*

$= 3.14 \times 10 \times (14+8)$

$= 3.14 \times 10 \times 22$

$= 690.8 \text{ cm}^2$ ... (1) *(½ mark)*

(b) Total surface area of the frustum

$= \pi\ell(r_1+r_2) + \pi r_1^2 + \pi r_2^2$ *(½ mark)*

$= 690.8 + \pi(r_1^2 + r_2^2)$ ... [From (1)]

$= 690.8 + 3.14(14^2 + 8^2)$

$= 690.8 + 3.14(196 + 64)$

$= 690.8 + 3.14 \times 260$

$= 690.8 + 816.4$

$= 1507.2 \text{ cm}^2$ *(½ mark)*

(c) Volume of the frustum

$= \frac{1}{3}\pi h(r_1^2 + r_2^2 + r_1 \times r_2)$ *(½ mark)*

$= \frac{1}{3} \times 3.14 \times 8 \times (14^2 + 8^2 + 14 \times 8)$

$= \frac{1}{3} \times 3.14 \times 8 \times (196 + 64 + 112)$

$= \frac{1}{3} \times 3.14 \times 8 \times 372$

$= 3114.88 \text{ cm}^3$ *(½ mark)*

Ans. (a) 690.8 cm^2 (b) 1507.2 cm^2 (c) 3114.88 cm^3

प्र. क्र.
Q. No. 5

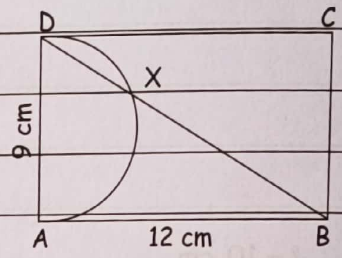
Note : In this question type, students are required to solve any 1 of 2 subquestions. However, solutions to both the subquestions are given here, for the guidance of the students.

(i) Solution :

$\angle AXD = 90°$ ... (Angle in a semicircle)

In $\triangle DAB$, $\angle DAB = 90°$ ... (Angle of a rectangle)

By Pythagoras theorem,



$BD^2 = AB^2 + AD^2$ *(½ mark)*

$= (12)^2 + (9)^2$

$= 144 + 81 = 225$

(Fig. : 1 mark)

$\therefore BD = 15$ cm ... (Taking square roots of both the sides)

(½ mark)

AD is the diameter of the semicircle and $\angle BAD = 90°$

$\therefore$ BA is a tangent. BD is a secant.

By tangent-secant segments theorem,

$BA^2 = BX \times BD$ *(½ mark)*

$\therefore (12)^2 = BX \times 15$

$\therefore BX = \dfrac{144}{15}$

$\therefore BX = 9.6$ cm *(½ mark)*

Ans. The value of BD is 15 cm, the value of BX is 9.6 cm.

प्र. क्र.
Q. No. 5

(ii) Verification :

$\theta = 30°$

(a) LHS $= \sin^2\theta + \cos^2\theta$

$= \sin^2 30° + \cos^2 30°$

$= \left(\frac{1}{2}\right)^2 + \left(\frac{\sqrt{3}}{2}\right)^2$ (½ mark)

$= \frac{1}{4} + \frac{3}{4} = 1 = \text{RHS}$ (½ mark)

LHS $=$ RHS

$\therefore \sin^2\theta + \cos^2\theta = 1$

(b) LHS $= 1 + \tan^2\theta$

$= 1 + \tan^2 30°$

$= 1 + \left(\frac{1}{\sqrt{3}}\right)^2$

$= 1 + \frac{1}{3} = \frac{4}{3}$ (½ mark)

RHS $= \sec^2\theta$

$= \sec^2 30°$

$= \left(\frac{2}{\sqrt{3}}\right)^2 = \frac{4}{3}$ (½ mark)

$\therefore$ LHS $=$ RHS $\quad \therefore 1 + \tan^2\theta = \sec^2\theta$

(c) LHS $= 1 + \cot^2\theta$

$= 1 + \cot^2 30°$

$= 1 + (\sqrt{3})^2 = 1 + 3 = 4$ (½ mark)

RHS $= \operatorname{cosec}^2\theta$

$= \operatorname{cosec}^2 30°$

$= (2)^2 = 4$ (½ mark)

$\therefore$ LHS $=$ RHS $\quad \therefore 1 + \cot^2\theta = \operatorname{cosec}^2\theta$.