8 CHAPTER

TRIGONOMETRY, GEOMETRY AND MENSURATION

1. Two tangents are drawn to a circle of radius 10 cm. The tangents are parallel to each other. What is the distance between the two tangents?
   - (a) 10 cm
   - (b) 20 cm
   - (c) $10\sqrt{2}$ cm
   - (d) $10\sqrt{3}$ cm

   [RRB JE 2014 GREEN SHIFT]

2. Number of points on x – axis which are 2 units away from the point (4, 1) are
   - (a) 0
   - (b) 1
   - (c) 2
   - (d) infinite

   [RRB JE 2014 GREEN SHIFT]

3. If the ratio of height of tower to its shadow is 1: $\sqrt{3}$ the angle of elevation of sun is
   - (a) 30°
   - (b) 45°
   - (c) 60°
   - (d) $87\dfrac{1}{2}$

   [RRB JE 2014 GREEN SHIFT]

4. If two sides of a triangle are given and an angle not included by the two sides is also given, how many triangles can be drawn at the most?
   - (a) 0
   - (b) 1
   - (c) 2
   - (d) 3

   [RRB JE 2014 GREEN SHIFT]

5. The value of $\sin^2 30° + \sin^2 60°$ is
   - (a) 1
   - (b) $\dfrac{3}{2}$
   - (c) 2
   - (d) $\dfrac{3}{4}$

   [RRB JE 2014 GREEN SHIFT]

6. Distance between two buildings is 100 m. A surveyor is standing at a distance of 40 m from the taller building on a line joining them. If the angle of elevation measured by him for the taller building is 1.5 times the angle of elevation of the smaller building, what is the height of smaller building?
   - (a) 45.3 m
   - (b) 45.67 m
   - (c) 46.22 m
   - (d) Data insufficient

   [RRB JE 2014 GREEN SHIFT]

7. If circumference of a circle is increased by 10%, the area of the circle will increase by
   - (a) 5%
   - (b) 10%
   - (c) 20%
   - (d) 21%

   [RRB JE 2014 GREEN SHIFT]

8. A cylindrical shaped metal piece is converted into a wire. Out of the following, which parameter can be assumed to remain the same?
   - (a) volume
   - (b) cross-section area
   - (c) length
   - (d) diameter

   [RRB JE 2014 GREEN SHIFT]

9. In coordinate geometry, distance of the point (–4, 3) from origin is
   - (a) 3
   - (b) 4
   - (c) 5
   - (d) 25

   [RRB JE 2014 GREEN SHIFT]

10. tan 90° is undefined. As θ is increased from 89° towards 90°, value of tan θ tends to
    - (a) 0
    - (b) +oo
    - (c) 1
    - (d) undefined

    [RRB JE 2014 GREEN SHIFT]

11. One side of a rectangular field is 15 metres. The length of diagonal of this rectangular field is 17 metres. Find the area of this rectangular field.
    - (a) 120 m²
    - (b) 60 m²
    - (c) 255 m²
    - (d) $144\dfrac{1}{2}$ m²

    [RRB JE 2014 RED SHIFT]

12. Find the angle between the hour hand and the minute hand of a clock when the time is 10.25 hours i.e. 25 minutes past 10 ?
    - (a) 180°
    - (b) 165°
    - (c) $162\dfrac{1}{2}°$
    - (d) $152\dfrac{1}{2}°$

    [RRB JE 2014 RED SHIFT]

13. The angle of elevation of a ladder leaning against a wall is 60° i.e. ladder makes an angle of 60° with the ground. The foot of the ladder is 4.6 metres away from the wall. What is the length of this ladder ?

(a) 9.2 m   (b) 2.3 m

(c) 6.9 m   (d) 7.8 m

14. The area of an equilateral triangle is $24\sqrt{3}$ cm². What is the perimeter of this equilateral triangle?

(a) 96 cm   (b) $4\sqrt{6}$ cm

(c) $12\sqrt{6}$ cm   (d) $6\sqrt{6}$ cm

15. A circle and a rectangle have the same perimeter. The sides of the rectangle are 18 cm and 26 cm. What is the area of the circle ?

(a) 88 cm²   (b) 154 cm²

(c) 616 cm²   (d) 1250 cm²

16. The height of a right circular cone is 84 cm and its base radius is 3.5 cm. Its volume is

(a) 3234 cm³   (b) 1078 cm³

(c) 2156 cm³   (d) 2496 cm³

17. If an angle is its own complementary angle, then its measure is

(a) 30°   (b) 45°

(c) 60°   (d) 90°

18. A kite is flying at a height of 75 m from the level ground, attached to a string inclined at 60° to the horizontal. The length of the string is

(a) $50\sqrt{2}$ m   (b) $50\sqrt{3}$ m

(c) $\dfrac{50}{\sqrt{2}}$ m   (d) $\dfrac{50}{\sqrt{3}}$ m

19. A tower stands vertically on the ground. From a point on the ground which is 30 m away from the foot of the lower, the angle of elevation of the top of the tower is 60°. The height of the tower is:

(a) $30\sqrt{3}$ m   (b) $10\sqrt{3}$ m

(c) 15 m   (d) 6 m

For the above question, User had specified 'ignore' during keys upload.

20. From a point on the bridge across a river the angles of depression of the banks on the opposite side of the river are 30° and 45° respectively. If the bridge is at a height of 4 m from the bank, the width of the river is

(a) $4(\sqrt{3}-1)$ m   (b) $2(2\sqrt{3}-1)$ m

(c) $4(\sqrt{3}+1)$ m   (d) $2(2\sqrt{3}+1)$ m

21. A ladder 15 m long just reaches the top of a vertical wall. If the ladder makes an angle of 60° with the wall, the height of the wall is

(a) 7.5 m   (b) $5\sqrt{3}$ m

(c) $\dfrac{15\sqrt{3}}{2}$ m   (d) $10\sqrt{3}$ m

22. From a point on the bridge across a river the angles of depression of the banks on the opposite side of the river are 30° and 45° respectively. If the bridge is at a height of 3m from the bank, the width of the river is

(a) $2(\sqrt{3}+1)$ m   (b) $3(\sqrt{3}+1)$ m

(c) $4(\sqrt{3}+1)$ m   (d) $2(2\sqrt{3}+1)$ m

23. A ladder just reaches the top of a wall. The foot of the ladder is 8 m away from the foot of the wall. The ladder makes an angle of 60° with the ground. The length of the ladder is

(a) 4 m   (b) 16 m

(c) $\dfrac{16\sqrt{3}}{3}$ m   (d) $16\sqrt{3}$ m

24. From a point on the bridge across a river the angle of depressions of the bank on the opposite side of the river are 60° and 45° respectively. If the bridge is at a height of 3 m from the bank, the width of the river is

(a) $2(\sqrt{3}+1)$ m   (b) $3(\sqrt{3}+1)$ m

(c) $3-\sqrt{3}$ m   (d) $3+\sqrt{3}$ m

25. A ladder 15 m long just reaches the top of a vertical wall. If the ladder makes an angle of 60° with the wall, the distance of the foot of the ladder from the wall is

(a) 7.5 m   (b) $5\sqrt{3}$ m

(c) $10\sqrt{3}$ m   (d) $\dfrac{15\sqrt{3}}{2}$ m

26. From a point on the bridge across a river the angles of depression of the bank on the opposite side of the river are 60° and 45° respectively. If the bridge is at a height of 4 m from the bank, the width of the river is

(a) $\dfrac{4\left(3+\sqrt{3}\right)}{3}$ m
(b) $4\left(\sqrt{3}+1\right)$ m

(c) $\dfrac{2\left(1+\sqrt{3}\right)}{3}$ m
(d) $2\left(2\sqrt{3}+1\right)$ m

[RRB JE 2015 27ᵗʰ AUG 1ˢᵗ SHIFT]

27. The angle of elevation of the top of a tower from a point on the ground Inch is 30 m away from the foot of the tower is 45°. The height of the tow t is

(a) 15 m
(b) $10\sqrt{3}$ m

(c) 30 m
(d) $30\sqrt{3}$ m

[RRB JE 2015 27ᵗʰ AUG 2ⁿᵈ SHIFT]

28. From a point on the bridge across a river the angle of depressions of the bank on the opposite side of the river are 30° and 60° respectively. If the bridge is at a height of 3 m from the bank, the width of the river is

(a) $4\sqrt{3}$ m
(b) $2\left(\sqrt{3}+1\right)$ m

(c) $2\left(\sqrt{3}+3\right)$ m
(d) $2\sqrt{3}$ m

[RRB JE 2015 27ᵗʰ AUG 2ⁿᵈ SHIFT]

29. The angle of elevation of top of a tower from a point on the groin 20 m away from the foot of the tower is 60°. The height of tower is

(a) $\dfrac{20\sqrt{3}}{3}$ m
(b) $\dfrac{40\sqrt{3}}{3}$ m

(c) 20 m
(d) $20\sqrt{3}$ m

[RRB JE 2015 27ᵗʰ AUG 3ʳᵈ SHIFT]

30. The angles of elevation of top of a tower, 30 m high, from two points on opposite side of the tower are 30° an 60° respectively. If the points and tower are in same line, the distance between two points is

(a) $20\sqrt{3}$ m

(b) $40\sqrt{3}$ m

(c) $20\left(\sqrt{3}+1\right)$ m

(d) $20\left(\sqrt{3}-1\right)$ m

[RRB JE 2015 27ᵗʰ AUG 3ʳᵈ SHIFT]

31. A vertical pole is tied with a string of length 20m on the ground. If string makes an angle of 30° with the ground, the length of pole is

(a) $10\sqrt{3}$ m
(b) 10m

(c) 15m
(d) $5\sqrt{3}$ m

[RRB JE 2015 28ᵗʰ AUG 1ˢᵗ SHIFT]

32. The angles of elevation of top of a tower, 30m high, from two points on same side of the tower are 30° and 60° respectively. If the two point and base of tower are in same line, the distance between two points is

(a) $20\sqrt{3}$ m
(b) $20(\sqrt{3}+1)$ m

(c) $40\sqrt{3}$ m
(d) $40(\sqrt{3}-1)$ m

[RRB JE 2015 28ᵗʰ AUG 1ˢᵗ SHIFT]

33. A vertical pole is tied with a string of length 20 m on the ground. If string makes an angle of 60° with the ground, the length of pole is

(a) 10 m
(b) $10\sqrt{3}$ m

(c) $\dfrac{10\sqrt{3}}{3}$ m
(d) 20 m

[RRB JE 2015 28ᵗʰ AUG 2ⁿᵈ SHIFT]

34. The angle of elevation of top of a tower, 30 m high, from two points on opposite side of the tower are respectively 60° and 45° If the point and tower are in same line, the distance between two points is

(a) $40\sqrt{3}$ m
(b) $10(3+\sqrt{3})$ m

(c) $20(\sqrt{3}-1)$ m
(d) $20(3-\sqrt{3})$ m

[RRB JE 2015 28ᵗʰ AUG 2ⁿᵈ SHIFT]

35. From the top of a tower, the angle of depression of a car on the ground is 60°. If height of the tower is 40 m, the distance of the car from the base of tower is

(a) $20\sqrt{3}$ m
(b) $30\sqrt{3}$ m

(c) $40\sqrt{3}$ m
(d) $\dfrac{40\sqrt{3}}{3}$ m

[RRB JE 2015 28ᵗʰ AUG 3ʳᵈ SHIFT]

36. The angle of elevation of top of a tower, 30 m high, from two points on same side of the tower are respectively 30° and 45°. If the point and tower are in same line, the distance between two points is

(a) $15(3+\sqrt{3})$ m
(b) $15(3-\sqrt{3})$ m

(c) $30(\sqrt{3}+1)$ m
(d) $30(\sqrt{3}-1)$ m

[RRB JE 2015 28ᵗʰ AUG 3ʳᵈ SHIFT]

37. The value of tan10° tan25° tan45° tan65° tan80°/ (Sin²69°+ Sin²21°) + (Cos²51°+ Cos²39°) is

(a) 2 (b) 1

(c) $\dfrac{1}{2}$ (d) $\dfrac{1}{4}$

38. An observer 1.5 m tall is 45 m away from a tower. The angle of elevation of the top of the tower from his eyes is 300. The height (in m) of the tower is approximately

(a) 25.9 (b) 27.5

(c) 27.8 (d) 29.9

39. The value of $\cos\theta\cdot\cot\theta\left[\dfrac{1}{\mathrm{cosec}\,\theta-1}+\dfrac{1}{\mathrm{cosec}\,\theta+1}\right]$ is

(a) $\dfrac{1}{2}$ (b) 1

(c) $\dfrac{3}{2}$ (d) 2

40. A tower of height 40 m stands vertically on the ground. From a point on the ground which is x m away from the foot of the tower, the angle of elevation of its top is found to be 60°. If y is the distance (in m) of the point from the top of the tower, then the value of (x + y) is

(a) $40\sqrt{3}$ m (b) $\dfrac{80\sqrt{3}}{3}$ m

(c) $80\sqrt{3}$ m (d) $120\sqrt{3}$ m

41. $\tan^4\theta+\tan^2\theta=1$, then the value of

$\dfrac{\cos^2\theta\left(1+\cos^2\theta\right)}{2}$ is

(a) 2 (b) 1

(c) $\dfrac{1}{2}$ (d) $\dfrac{1}{4}$

42. At a point 100 m away from the base of a tree, a surveyor measures the angle of elevation to the top of a tree to be 30°. The sum of the distance from the point to the top of the tree and the height of the tree is

(a) $\dfrac{200\sqrt{3}}{3}$ (b) $100\sqrt{3}$ m

(c) $200\sqrt{3}$ (d) $300\sqrt{3}$ m

43. The minute hand of a big wall-clock is 35 cm long. Taking π = 22/7, length of the arc, its extremity moves in 18 seconds is

(a) 11 cm (b) 1.1 cm

(c) 6.6 cm (d) 6 cm

44. A tower is 30 m high. An bserver from the top of the tower makes an angle of depression 60° at the base of the building and angle of depression of 45° at the top of the building, what is he height of the building (in metres)

(a) 18 (b) 15.68

(c) $10\sqrt{3}$ (d) 12.68

45. The simplified value of (sec A – cos A)² + (cosec A – sin A)² – (cot A – tan A)² is

(a) 0 (b) 1/2

(c) 1 (d) 2

46. The angle of elevation of the sun, when the length of the shadow of a tree is $\sqrt{3}$ times the height of the tree, is

(a) 30° (b) 45°

(c) 60° (d) 90°

47. The surface area of a pipe, open at both ends is 1 to 628 m². Difference between its radius and its length is 15 m. If the pipe was closed at one end. What amount of water can it hold

(a) 1750 m³ (b) 7150 m³

(c) 1570 m³ (d) 7510 m³

ANSWERS

1. (b)	**2.** (c)	**3.** (a)	**4.** (c)	**5.** (a)	**6.** (d)	**7.** (d)	**8.** (a)	**9.** (c)	**10.** (b)
11. (a)	**12.** (c)	**13.** (a)	**14.** (c)	**15.** (c)	**16.** (b)	**17.** (b)	**18.** (b)	**19.** (a)	**20.** (c)
21. (a)	**22.** (b)	**23.** (b)	**24.** (d)	**25.** (d)	**26.** (a)	**27.** (c)	**28.** (a)	**29.** (d)	**30.** (b)
31. (b)	**32.** (a)	**33.** (b)	**34.** (b)	**35.** (d)	**36.** (d)	**37.** (c)	**38.** (b)	**39.** (d)	**40.** (a)
41. (c)	**42.** (b)	**43.** (b)	**44.** (d)	**45.** (c)	**46.** (a)	**47.** (c)			

EXPLANATIONS

1. Distance between the two tangents = length of diameter = 2 × 10 = 20 cm.

2. There will be 2 such points (i.e) one to the right and one to the left of (4, 1).

3. Given $\tan \theta = \dfrac{1}{\sqrt{3}}$

$\Rightarrow \theta = 30°$

4. There will be two such triangles where the angle will be made by each of the two sides and the base.

5. $\sin^2 30° + \sin^2 60° = \sin^2 30° + \cos^2 30° = 1$

6. It is not known whether the surveyor is standing between the two buildings on away from the tailor building. Hence, we cannot find the exact answer.

7. If circumference of a circle is increasing by 10% then it means radius is increasing by 10%.

Hence, are a will increase by

$\left(10 + 10 + \dfrac{10 \times 10}{100}\right) = 21\%.$

8. Volume will remain same if there is no lose of metal.

9. Required distance

$= \sqrt{(-4-0)^2 + (3-0)^2}$

$= \sqrt{16+9} = \sqrt{25} = 5$

10. Value of tan q will ten A to + ∞ as tan 90° is + ∞.

11. $x = \sqrt{17^2 - 15^2} = \sqrt{289 - 225}$

$\boxed{x = 8m}$

y = 15 m

Area = 15 × 8 = 120 m²

12. Required angle

$= 30 \times 7 - 25 \times \dfrac{1}{2} = 162\dfrac{1}{2}^{\circ}$

13. $\dfrac{4.2}{L} = \cos 60°$

$\Rightarrow L = 4.6 \times 2 = 9.2$ m

14. $\dfrac{\sqrt{3}}{4} x^2 = 24\sqrt{3}$

$\Rightarrow x = \sqrt{96} = 4\sqrt{6}$ cm

Hence, perimeter

$= 4\sqrt{6} \times 3 = 12\sqrt{6}$ cm

15. $2\pi r = (18 + 26) \times 2$

$\Rightarrow \pi r = 44$

$\Rightarrow r = 14$

Hence, required area $= \dfrac{22}{7} \times 14 \times 14 = 616$ cm²

16. Volume $= \dfrac{1}{3} \times \pi \times 3.5 \times 3.5 \times 84 = 1078$ cm³

17. Angle has to be 45° if it's its Qun complimentary and 90° if it's its own supliment.

18. $\dfrac{75}{L} = \sin 60°$

$\Rightarrow L = \dfrac{75 \times 2}{\sqrt{3}} = 50\sqrt{3}$ m

19. Figure

tan 60° = Height / 30

$\Rightarrow$ Height of the tower = $30\sqrt{3}$ meter.

20. Figure

In triangle ABD, tan 30° = $\dfrac{DB}{AB}$

$\Rightarrow AB = 4\sqrt{3}$ meter

Similarly, in triangle CBD, tan 45° = $\dfrac{DB}{BC}$

$\Rightarrow$ BC = DB = 4 meter

Hence, required distance AC = $4\sqrt{3} + 4$

$= 4(\sqrt{3} + 1)$ meter.

21. $\cos 60° = \dfrac{h}{15}$

$\Rightarrow h = 15 \times \dfrac{1}{2} = 7.5m$

22.
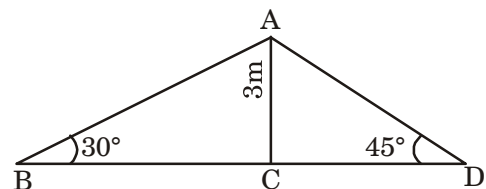
According to the figure.

In $\triangle ACD$, $\dfrac{AC}{CD} = \tan 45°$

$\Rightarrow \qquad AC = CD$

or CD = 3 m

Again in $\triangle ACB$, $\dfrac{AC}{BC} = \tan 30°$

$\Rightarrow BC = 3\sqrt{3}$
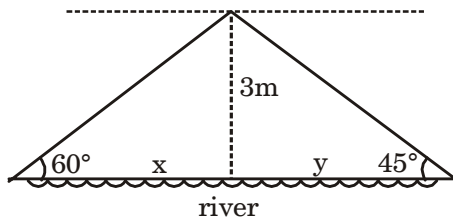
Hence, $BD = 3\sqrt{3} + 3 \quad 3(\sqrt{3} + 1)$ m.

23.
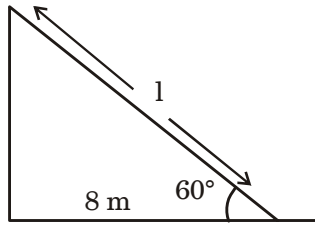
Let length of Ladder = l

$\cos 60° = \dfrac{8}{l}$

$\Rightarrow \dfrac{1}{2} = \dfrac{8}{2} \Rightarrow l = 16m$

24.

From the figure, $\tan 60° = \dfrac{3}{x} = \sqrt{3}$

$\Rightarrow x = \sqrt{3}$

$\tan 45° = \dfrac{3}{y} = 1 \Rightarrow y = 3$

$\therefore$ Width of river = n + y = $3 + \sqrt{3}$ m

25.
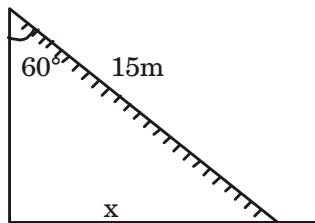
Let distance of foot of ladder from wall = x

$\sin 60° = \dfrac{x}{15} = \dfrac{\sqrt{3}}{2}$

$\Rightarrow x = 15\dfrac{\sqrt{3}}{2}$

26.
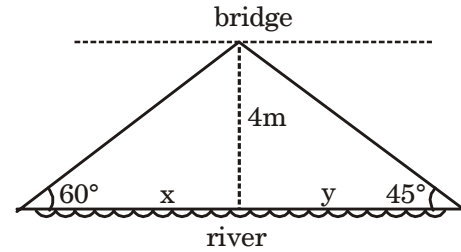
From the figure,

$\tan 60° = \dfrac{4}{x} = \sqrt{3}$

$\Rightarrow x = \dfrac{4}{\sqrt{3}}$

$\tan 45° = \dfrac{4}{y} = 1$

$\Rightarrow \qquad y = 4$

$\therefore$ width of river = x + y

$= \dfrac{4}{\sqrt{3}} + 4$

$= \dfrac{4(3 + \sqrt{3})}{3}$ m

27.
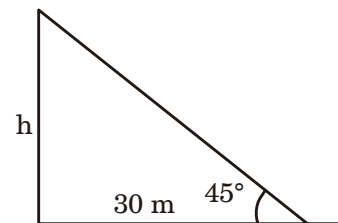
$\tan 45° = \dfrac{h}{30} = 1$

$\Rightarrow \qquad h = 30$ m

28.

$$\tan 60° = \frac{3}{x} = \sqrt{3}$$

$$\Rightarrow x = \sqrt{3}$$
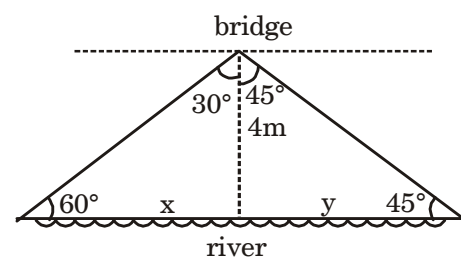
$$\tan 45° = \frac{3}{y} = 1$$

$$\Rightarrow \qquad\qquad y = 3$$

$$\therefore \text{ width of river} = x + y = 4\sqrt{3}$$

29.
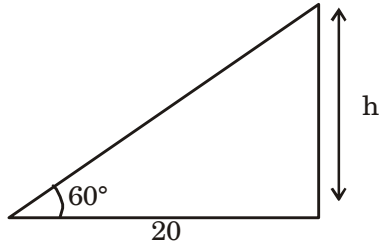
$$\tan 60° = \sqrt{3} = \frac{n}{20} \Rightarrow n = 20\sqrt{3}$$

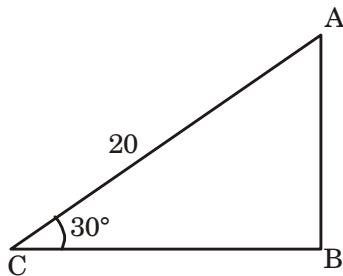**30.**
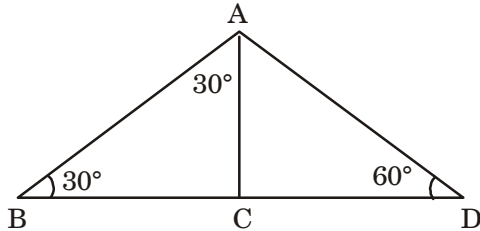
$$\tan 30° = \frac{1}{\sqrt{3}} = \frac{30}{BC}$$

$$\Rightarrow BC = 30\sqrt{3}$$

$$\tan 60° = \sqrt{3} = \frac{30}{CD}$$

$$\Rightarrow CD = \frac{30}{\sqrt{3}}$$

$$\therefore BD = 30\sqrt{3} + \frac{30}{\sqrt{3}} = 40\sqrt{3}$$

31.

$$\sin 30° = \frac{1}{2} = \frac{AB}{20}$$

$$\Rightarrow AB = 10 \text{ m}$$

32.
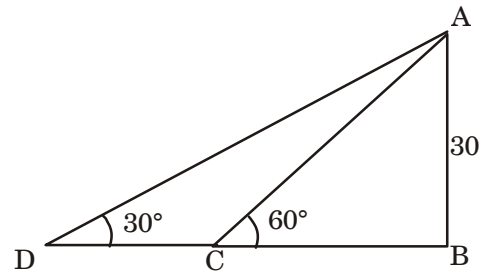
$$\tan 30° = \frac{1}{\sqrt{3}} = \frac{30}{BD}$$

$$\Rightarrow BD = 30\sqrt{3}$$

$$\tan 60° = \sqrt{3} = \frac{30}{BC}$$

$$\Rightarrow BC = \frac{30}{\sqrt{3}}$$

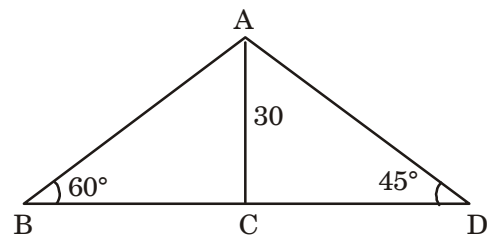A/Q $CD = 30\sqrt{3} - \dfrac{30}{\sqrt{3}} = 20\sqrt{3}$

33.
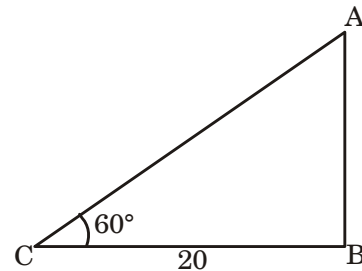
$$\sin 60° \frac{\sqrt{3}}{2} = \frac{AB}{20}$$
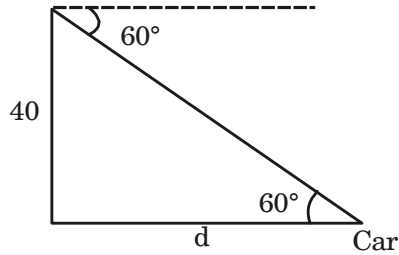
$$\Rightarrow AB = 10\sqrt{3}$$

34.

$$\tan 45° = 1 = \frac{30}{CD} \Rightarrow CD = 30M$$

$$\tan 60° = \sqrt{3} = \frac{30}{BC} \Rightarrow BC \frac{30}{\sqrt{3}}$$

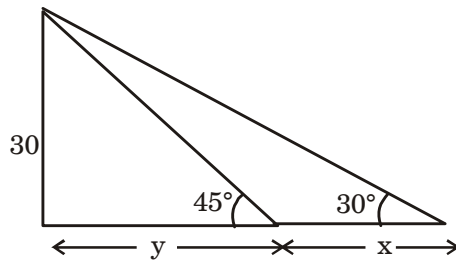$$\Rightarrow BD = \frac{30}{\sqrt{3}} + 30 = 10\left(3 + \sqrt{3}\right)$$

35.

$$\tan 60° = \frac{40}{d}$$

$$\Rightarrow \sqrt{3} = \frac{40}{d}$$

$$\Rightarrow d = \frac{40}{\sqrt{3}} = \frac{40\sqrt{3}}{3} m$$

36.

$$\tan 30° = \frac{30}{x+y} = \frac{1}{\sqrt{3}}$$

$$\tan 45° = \frac{30}{y} = 1$$

$$\therefore \quad \frac{1}{\sqrt{3}} = \frac{30}{x+30}$$

$$\Rightarrow x = 30\left(\sqrt{3}-1\right)m$$

37.

$$\frac{\tan 10° \tan 25° \tan 65° \tan 80°}{\left(\sin^2 69° + \sin^2 21°\right) + \left(\cos^2 51° + \cos^2 39°\right)}$$

Using tan (90 − 8) = co + θ,
sin (90 − θ) = cos θ

$$\Rightarrow \frac{\cot 80° \cot 65° \tan 45° \tan 80°}{\left(\sin^2 69° + \cos^2 69°\right) + \left(\cos^2 51° + \sin^2 51°\right)}$$

$$\Rightarrow \frac{\tan 45°}{1+1} \text{ , since } \sin2\,θ + \cos2\,θ = 1$$

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

38.
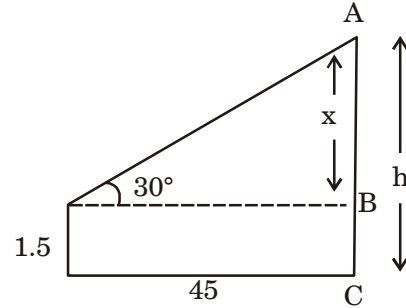
$$\tan 30° = \frac{x}{45} = \frac{1}{\sqrt{3}}$$

$$\Rightarrow x = 15\sqrt{3} = 25.9 \text{ m}$$

∴ Height of the tower from A to B i.e. from top to the height of the observer is 25.9 m
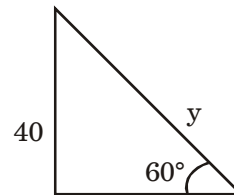The total height of tower from A to C will be 25.95 + 1.5 = 27.5m

39. Let $θ = 45°$, then $\frac{1}{\sqrt{2}} \cdot 1 \left[\frac{1}{\left(\sqrt{2}-1\right)} + \frac{1}{\left(\sqrt{2}+1\right)}\right]$

$$\frac{1}{\sqrt{2}} \cdot \frac{\sqrt{2}+1+\sqrt{2}-1}{1} = \frac{1}{\sqrt{2}} \cdot \frac{2\sqrt{2}}{1} = 2$$

40.

$$\cos 60° = \frac{x}{y} = \frac{1}{2} = \frac{x}{y} \text{ or } x : y$$

$$\sin 60° = \frac{40}{y} \text{ or } y = \frac{80}{\sqrt{3}}$$

$$\text{or } x + y = \frac{120}{\sqrt{3}} = 40\sqrt{3}.$$

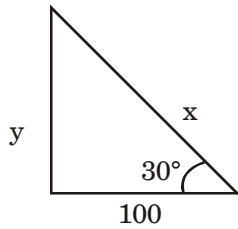**41.** $\tan^4 x + \tan^2 x = 1$ or $\tan^2 x\,(1 + \tan^2 x) = 1$
$\tan^2 x \sec^2 x = 1$ or $\sin^2 x = \cos^4 x$
$\cos^4 x = 1 - \cos^2 x$

$$\text{or } \frac{\cos^2 θ(1+\cos^2 θ)}{2} = \frac{\cos^2 θ + \cos^4 θ}{2}$$

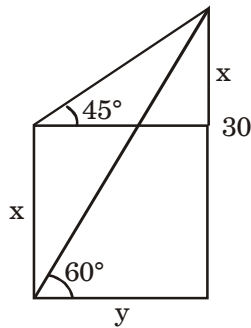$$\frac{\cos^2 θ + \cos^4 θ}{2} = \frac{\cos^2 θ + 1 - \cos^2 θ}{2} = \frac{1}{2}.$$

42.

$$\cos 30 = \frac{100}{x} \text{ or } x = \frac{200}{\sqrt{3}}$$

$$\sin 30 = \frac{y}{x} \text{ or } y = \frac{100}{\sqrt{3}}$$

$$x + y = \frac{300}{\sqrt{3}} = 100\sqrt{3}.$$

43. Length of arc = $\dfrac{2\pi R \times 18}{3600}$ = 1.1 cm.

44.

$$\tan 60 = \frac{30}{y} \text{ or } y = 10\sqrt{3}$$

$$\tan 45 = \frac{a}{y} \text{ or } a = 10\sqrt{3}$$
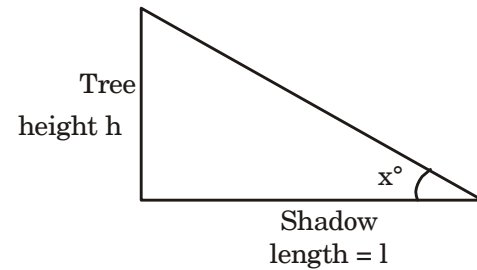
$$x = 30 - 10\sqrt{3} = 10\left(3 - \sqrt{3}\right) = 12.68.$$

45. Putting A = 45°

Hence, $(\sec A - \cos A)^2 + (\csc A - \sin a)^2$
$$- (\cot A - \tan A)^2$$

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

$$= \frac{1}{2} + \frac{1}{2} - 0 = 1$$

46.

Length of shadow $l = \sqrt{3}h$

$$\tan x = \frac{h}{l} = \frac{h}{\sqrt{3}h} = \frac{1}{\sqrt{3}}$$

$$\Rightarrow \qquad x = 30°$$

47. Let length of pipe = h
radius of pipe = r
given h – r = 15
$\Rightarrow$ h = 15 + r   ....(i)
surface area = 2πrh = 628

$$\Rightarrow r(15 + r) = \frac{314}{3.14}$$

(using (1) & putting π = 3.14)
$\Rightarrow$ $r^2 + 15r - 100 = 0$
$\Rightarrow$ r = 5, – 20
∴Radius = 5 m, Length = 15 + 5 = 20 m
∴Volume of water = $\pi r^2 h$ = 2.14 × 5² × 20
$$= 1570 \text{ m}^3.$$