CHAPTER 5

Trigonometry

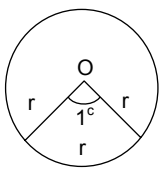
SYNOPSIS

Systems of Measurement of Angle

(i) **Sexagesimal system:** In this system, the angle is measured in degrees(°).
1 revolution = 360° ⇒ 1 right angle = 90°
1°= 60' (minutes) and 1' = 60'' (seconds)

(ii) **Centesimal system:** In this system, the angle is measured in grades.
1 revolution = 400 grades ⇒ 1 right angle = 100^g
$1^g = 100'$ (minutes) and 1' = 100'' (seconds)

(iii) **Circular system:** In this system, the angle is measured in radians. The angle subtended by an arc of length equal to the radius of a circle at its centre is said to have a measure of one radian. It is written as 1^c.
∴ 1 revolution = $2\pi^c$



Relation between the Units of the Three Systems

When a rotating ray completes one revolution, the measure of angle formed about the vertex is 360° or 400^g or $2\pi^c$ so,

$$360° = 400^g = 2\pi^c \text{ (or) } 90°$$
$$= 100^g = \frac{\pi^c}{2}$$

Note:

(i) $1° = \pi/180$ radians = 0.0175 radians (approx)

(ii) $1^c = 180/\pi$ degrees = 57°17'44'' (approx)

Relation between the Ratios

(i) $\operatorname{cosec}\theta = \frac{1}{\sin\theta}$, $\sec\theta = \frac{1}{\cos\theta}$ and $\cot\theta = \frac{1}{\tan\theta}$

(ii) $\tan\theta = \frac{\sin\theta}{\cos\theta}$ and $\cot\theta = \frac{1}{\tan\theta} = \frac{\cos\theta}{\sin\theta}$

Values of Trigonometric Ratios for Specific Angles

Ratio \ θ	0°	30°	45°	60°	90°
sinθ	0	1/2	$1/\sqrt{2}$	$\sqrt{3}/2$	1
cosθ	1	$\sqrt{3}/2$	$1/\sqrt{2}$	1/2	0
tanθ	0	$1/\sqrt{3}$	1	$\sqrt{3}$	∞
cosecθ	∞	2	$\sqrt{2}$	$2/\sqrt{3}$	1
secθ	1	$2/\sqrt{3}$	$\sqrt{2}$	2	∞
cotθ	∞	$\sqrt{3}$	1	$1/\sqrt{3}$	0

From the above table, we observe that

(i) $\sin\theta = \cos\theta$, $\tan\theta = \cot\theta$ and $\sec\theta = \operatorname{cosec}\theta$ if $\theta = 45°$
(ii) $\sin\theta$ and $\tan\theta$ are increasing functions when $0° \le \theta \le 90°$
(iii) $\cos\theta$ is a decreasing function when $0° \le \theta \le 90°$.

Trignometric Ratios of Compound Angles

(i) $\sin(A + B) = \sin A \cos B + \cos A \sin B$ and $\sin(A - B) = \sin A \cos B - \cos A \sin B$.
(ii) $\cos(A + B) = \cos A \cos B - \sin A \sin B$ and $\cos(A - B) = \cos A \cos B + \sin A \sin B$.
(iii) $\tan(A + B) = \dfrac{\tan A + \tan B}{1 - \tan A \tan B}$ and $\tan(A - B) = \dfrac{\tan A - \tan B}{1 + \tan A \tan B}$

Also, by taking A = B in the above relations, we get,

(i) $\sin 2A = 2\sin A \cos A$
(ii) $\cos 2A = \cos^2 A - \sin^2 A = 2\cos^2 A - 1 = 1 - 2\sin^2 A$.
(iii) $\tan 2A = \dfrac{2\tan A}{1 - \tan^2 A}$

Signs of Trigonometric Ratios

(i) If θ lies in the first quadrant, i.e., $0 < \theta < \pi/2$, then all the trigonometric ratios are taken positive.
(ii) If θ lies in the second quadrant, i.e., $\pi/2 < \theta < \pi$, then only $\sin\theta$ and $\operatorname{cosec}\theta$ are taken positive and all the other trigonometric ratios are taken negative.
(iii) If θ lies in the third quadrant, i.e., $\pi < \theta < \dfrac{3\pi}{2}$, then only $\tan\theta$ and $\cot\theta$ are taken positive and all the other trigonometric ratios are taken negative.
(iv) If θ lies in the fourth quadrant, i.e., $\dfrac{3\pi}{2} < \theta < 2\pi$, then only $\cos\theta$ and $\sec\theta$ are taken positive and all the other trigonometric ratios are taken negative.

Heights and Distances

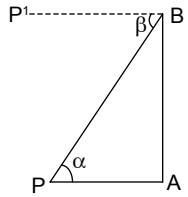
Let AB be a vertical line and PA and P^1B be two horizontal lines as shown in the figure.

Let $\angle APB = \alpha$ and $\angle PBP^1 = \beta$.

Then,

α is called the angle of elevation of the point B as seen from the point P and

β is called the angle of depression of the point P as seen from the point B.



Note: Angle of elevation is always equal to the angle of depression.

Important notes:

(i) $\sin^2\theta + \cos^2\theta = 1$
(ii) $\sec^2\theta - \tan^2\theta = 1$
(iii) $\operatorname{cosec}^2\theta - \cot^2\theta = 1$
(iv) $\sin(-\theta) = -\sin\theta$, $\cos(-\theta) = \cos\theta$ and $\tan(-\theta) = -\tan\theta$
(v) Maximum value of $a\sin\theta + b\cos\theta = \sqrt{a^2 + b^2}$
Minimum value of $a\sin\theta + b\cos\theta = -\sqrt{a^2 + b^2}$

Solved Examples

1. What is the sexagesimal measure of angle measuring $\dfrac{\pi^c}{3}$ and 300^g?

Solution: $\therefore \dfrac{\pi^c}{3} = \dfrac{180°}{3} = 60°$

$300^g = \dfrac{9}{10} \times 300 = 270°$

Hence, the sexagesimal measure of $\dfrac{\pi^c}{3}$ is 60° and 300^g is 270°.

2. Find the value of sin75°.

Solution: We have, $\sin 75° = \sin(45° + 30°)$

$= \sin 45° \cos 30° + \cos 45° \sin 30°$

$= \dfrac{1}{\sqrt{2}}\dfrac{\sqrt{3}}{2} + \dfrac{1}{\sqrt{2}}.\dfrac{1}{2} = \dfrac{\sqrt{3}+1}{2\sqrt{2}}.$

$\therefore \sin 75° = \dfrac{\sqrt{3}+1}{2\sqrt{2}}$

3. Find the relation obtained by eliminating θ from the equations $x = r\cos\theta + s\sin\theta$ and $y = r\sin\theta - s\cos\theta$.

Solution: Given, $x = r\cos\theta + s\sin\theta$

$\Rightarrow x^2 = (r\cos\theta + s\sin\theta)^2 = r^2\cos^2\theta + 2rs\cos\theta.\sin\theta + s^2\sin^2\theta$

Also $y = r\sin\theta - s\cos\theta \Rightarrow y^2 = r^2\sin^2\theta + s^2\cos^2\theta - 2rs\sin\theta.\cos\theta$

$\Rightarrow x^2 + y^2 = r^2(\cos^2\theta + \sin^2\theta) + s^2(\sin^2\theta + \cos^2\theta)$

$= r^2(1) + s^2(1)\ [\because \sin^2\theta + \cos^2\theta = 1] = r^2 + s^2$

Hence, the required relation is $x^2 + y^2 = r^2 + s^2$

4. If $\cos(A + B) = 1/2$ and $\sec B = \sqrt{2}$, then find A and B.

Solution: Given, $\cos(A + B) = 1/2$

$\cos(A + B) = \cos 60° \Rightarrow A + B = 60° \rightarrow (1)$

$\sec B = \sqrt{2} = \sec 45° \Rightarrow B = 45° \rightarrow (2)$

From (1) & (2), we have $A = 15°$ and $B = 45°$

5. If ABCD is a cyclic quadrilateral, then find the value of $\cos A\cos B - \cos C\cos D$.

Solution: Given, ABCD is a cyclic quadrilateral

$A + C = 180°$ and $B + D = 180°$ ……. (1)

$-\cos C\cos D = \cos A\cos B - \cos(180° - A)\cos(180° - B)$

$= \cos A - \cos B - \cos A(-\cos A)(-\cos B)$

$= \cos A\cos B - \cos A\cos B = 0$

6. Express $\sqrt{3}\cos\theta - \sin\theta$ as a single trigonometric ratio.

Solution: $\sqrt{3}\cos\theta - \sin\theta = 2\left(\frac{\sqrt{3}}{2}\cos\theta - \frac{1}{2}\sin\theta\right)$

$= 2(\cos\theta.\cos 30° - \sin\theta.\sin 30°) = 2(\cos(\theta + 30°))$

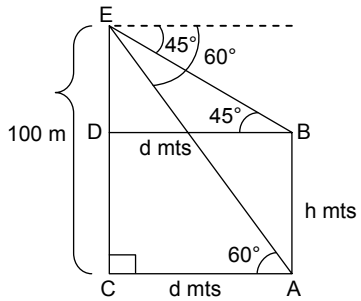
$\Rightarrow \sqrt{3}\cos\theta - \sin\theta = 2\cos(\theta + 30°)$

7. Simplify the following expression. $\sin 1°.\sin 2°..... \sin 181°$

Solution: We know that, $\sin 180° = 0$

$\sin 1°.\sin 2°.\sin 3° .....\sin 181° = \sin 1°.\sin 2° ..... \sin 180°.\sin 181° = 0$

8. From the top of a building 100 m high, the angles of depression of the bottom and the top of another building just opposite to it are observed to be 60° and 45° respectively. Find the height of the building.



Solution: Let the height of the building be h metres. Let AC = BD = d metres

From ΔBDE, $\tan 45° = \frac{ED}{BD}$

$\Rightarrow 1 = \frac{100 - h}{d}$

$\Rightarrow d = 100 - h$ ….. (1)

From Δ ACE, $\tan 60° = CE/AC$

$\Rightarrow \sqrt{3} = \frac{100}{d} \Rightarrow \sqrt{3}\,d = 100$

$\Rightarrow \sqrt{3}\ (100 - h) = 100$ (using (1))

Hence, the height of the tower is, $h = \frac{100(3 - \sqrt{3})}{3}$ m.

PRACTICE EXERCISE 5 (A)

Directions for questions 1 to 45: Select the correct alternative from the given choices.

1. The value of 144° in circular measure, is _____.

(1) $\frac{3\pi^c}{4}$ (2) $\frac{2\pi^c}{3}$

(3) $\frac{4\pi^c}{5}$ (4) $\frac{5\pi^c}{6}$

2. The value of 60^g in circular measure, is _____.

(1) $\frac{\pi^c}{10}$ (2) $\frac{3\pi^c}{10}$

(3) $\frac{2\pi^c}{5}$ (4) $\frac{\pi^c}{2}$

3. The value of 60° in centesimal system, is _____.

(1) $\frac{100^g}{3}$ (2) $\frac{200^g}{3}$

(3) $\frac{140^g}{3}$ (4) $\frac{160^g}{3}$

4. The angle measuring $\frac{\pi^c}{4}$ when expressed in centesimal system, is _____.

(1) 50^g (2) 60^g

(3) 75^g (4) 100^g

5. The value of $\frac{7\pi^c}{9}$ in sexagesimal measure is _____.

(1) 120° (2) 130°

(3) 140° (4) 150°

6. A wheel makes 240 revolutions in one minute. The measure of the angle it describes at the centre in 15 seconds is _____.

(1) $60\ \pi^c$ (2) $120\ \pi^c$

(3) $8\ \pi^c$ (4) π^c

7. If tan (89° 16') = x, then tan (269° 16') = _____.

(1) x/2 (2) x/3

(3) x (4) 2x

8. The value of 45° in centesimal system, is _____.

(1) 25^g (2) 50^g

(3) 75^g (4) 100^g

9. $\frac{\sin 36°}{\cos 54°} =$ _____.

(1) 0 (2) 1

(3) $\frac{2}{3}$ (4) $\frac{3}{2}$

10. $\sec^4\theta - \sec^2\theta$ in terms of $\tan\theta$ is _____.

(1) $\tan^4\theta - \tan^2\theta$

(2) $\tan^4\theta + \tan^2\theta$

(3) $\tan^2\theta - \tan^4\theta$

(4) None of these

11. If A + B = 60°, then the value of sinA cosB + cosA sinB is _____.

(1) $\frac{1}{2}$ (2) $\frac{1}{\sqrt{2}}$

(3) $\frac{\sqrt{3}}{2}$ (4) 1

12. The value of sin30°. sin45°. cosec45°. cos30° is _____.

(1) $\sqrt{3}$ (2) $\frac{1}{\sqrt{3}}$

(3) $\frac{\sqrt{3}}{2}$ (4) $\frac{\sqrt{3}}{4}$

13. If $\tan\theta = \frac{5}{6}$ and $\tan\phi = \frac{1}{11}$, then $\theta + \phi =$ _____.

(1) 30° (2) 45°

(3) 60° (4) 90°

14. If $\operatorname{cosec}\theta - \cot\theta = x$, then $\operatorname{cosec}\theta + \cot\theta =$ _____.

(1) x (2) 2x

(3) 1/x (4) 1/2x

15. The value of $(\sin A - \cos A)^2 + (\sin A + \cos A)^2$ is _____.

(1) 1 (2) 3

(3) 2 (4) 4

16. If $\sin A = \frac{\sqrt{3}}{2}$ and A is an acute angle, then find the value of $\frac{\tan A - \cot A}{\sqrt{3} + \operatorname{cosec} A}$.

(1) $\frac{-2}{5}$ (2) $\frac{2}{5}$

(3) $\frac{2}{3+2\sqrt{3}}$ (4) -2

17. The simplified value of $\operatorname{cosec}^2\alpha\left(1+\frac{1}{\sec\alpha}\right)\left(1-\frac{1}{\sec\alpha}\right)$ is _____.

(1) 1 (2) 0

(3) 2 (4) -1

18. If $\cos\alpha = \frac{12}{13}$ and $\sin\beta = \frac{4}{5}$, then find $\sin(\alpha + \beta)$.

(1) $\frac{63}{65}$ (2) $\frac{58}{65}$

(3) $\frac{47}{65}$ (4) $\frac{39}{65}$

19. Eliminate θ from the equations, $x = 2\cos\theta$ and $y = -2\sin\theta$.

(1) $x^2 - y^2 = 4$ (2) $x^2 - y^2 = 2$

(3) $x^2 + y^2 = 4$ (4) $x^2 + y^2 = 2$

20. If $3\cos^2A = \cos60° + \sin^245°$, then find the value of $\sec^2A$.

(1) 1 (2) 0

(3) 2 (4) 3

21. If $\frac{1+\tan\theta}{1-\tan\theta} = \sqrt{3}$, then find the value of θ.

(1) 15° (2) 30°

(3) 45° (4) 60°

22. Find the value of sin18° cosec54° cosec36° sec72° cos54° cos36°.

(1) 1 (2) 0

(3) 2 (4) –1

23. Find the relation obtained by eliminating θ from the equation $x = a\cos\theta + b\sin\theta$ and $y = a\sin\theta - b\cos\theta$.

(1) $x^2 + y^2 = a^2 - b^2$

(2) $x^2 - y^2 = a^2 + b^2$

(3) $x^2 - y^2 = a^2 - b^2$

(4) $x^2 + y^2 = a^2 + b^2$

24. The simplified value of

$$\left(\frac{1-\sin\alpha}{\cos\alpha} + \frac{\cos\alpha}{1+\sin\alpha}\right)\left(\sec\alpha + \frac{1}{\cot\alpha}\right)$$ is _____.

(1) 0 (2) 1

(3) 2 (4) 3

25. If $\operatorname{cosec}\theta - \cot\theta = 2$, then find the value of $\operatorname{cosec}^2\theta + \cot^2\theta$.

(1) $\frac{8}{15}$ (2) $\frac{15}{8}$

(3) $\frac{8}{17}$ (4) $\frac{17}{8}$

26. Solve for θ: $\frac{\cos^2\theta}{1-\sin\theta} - \frac{3}{2} = 0$

(1) 30° (2) 45°

(3) 60° (4) 90°

27. If $25\sin^2\theta + 10\cos^2\theta = 15$, then find $\cot^2\theta$.

(1) 1 (2) 2

(3) 3 (4) 4

28. If $\cos\theta + \left(\frac{1}{\sqrt{3}}\right)\sin\theta = \frac{2}{\sqrt{3}}$, then find θ in circular measure.

(1) $\frac{\pi^2}{2}$ (2) $\frac{\pi^2}{3}$

(3) $\frac{\pi^2}{4}$ (4) $\frac{\pi^2}{6}$

29. $\operatorname{cosec}(7\pi + \theta)\sin(8\pi + \theta)$ = _____.

(1) 0 (2) 1

(3) –1 (4) 2

30. If A and B are two supplementary angles, then $\sec^2A - \tan^2B$ = _____.

(1) 0 (2) 1

(3) –1 (4) 2

31. The possibility among the following is _____.

(1) $\sin^2\theta = 4$ (2) $\cos^2\theta = 8$

(3) $\sin\theta = -8$ (4) $\operatorname{cosec}^2\theta = 4$

32. $\sin 25° + \cos 115°$ = _____.

(1) 1 (2) 0

(3) –1 (4) $\sqrt{3}/2$

33. Find the value of cos 420°.

(1) 1 (2) 0

(3) –1 (4) $\frac{1}{2}$

34. Which of the following statements are false?

(a) $\sin^2\theta = 1.44$ (2) $\cos^2\theta = 1.69$

(c) $\operatorname{cosec}^2\theta = 0.25$ (4) All of these

35. If $x = \tan1° + \tan2° + \ldots\ldots\ldots + \tan45°$ and $y = -(\cot46° + \cot47° + \ldots\ldots\ldots + \cot89°)$, then find the value of $x + y$.

(1) 1 (2) 0

(3) –1 (4) $\sqrt{3}/2$

36. If $\sin 53° 21' = 0.8$, then $\cos 36° 39'$ = _____.

(1) 0.2 (2) 0.4

(3) 0.6 (4) 0.8

37. A tower subtends an angle θ at a point P on the same level as the foot of the tower, and from a point h m above P, the depression of the foot of the tower is α. The height of the tower is (in m)

(1) $h\tan\theta\tan\alpha$ (2) $h\cot\theta\cot\alpha$
(3) $h\tan\theta\cot\alpha$ (4) $h\cot\theta\tan\alpha$

38. A vertically straight tree 12 m tall, is broken by wind in such a fashion that its top just touches the ground making an angle with the ground such that the cosine of the angle is 0×6. At what height from the top did the tree break? (in m)
(1) 20/3 (2) 10/3
(3) 16/3 (4) 8/3

39. The angles of depression of the top and the bottom of a 10 m tall building, observed from the top of a tower are 30° and 45° respectively. Find the height of the tower. (in m)
(1) $20 + 5\sqrt{2}$ (2) $12 + 10\sqrt{2}$
(3) $15 + 5\sqrt{3}$ (4) $18 + 3\sqrt{3}$

40. The angles of depression of two points from the top of the tower are 30° and 60°. If the height of the tower is 30 m, then find the maximum possible distance between the two points. (in m)
(1) $20\sqrt{3}$ (2) $30\sqrt{3}$
(3) $40\sqrt{3}$ (4) $50\sqrt{3}$

PRACTICE EXERCISE 5 (B)

Directions for questions 1 to 40: Select the correct alternative from the given choices.

1. If the angles of a quadrilateral are in the ratio 1 : 2 : 3 : 4, then the smallest angle in the centesimal system is _____.
(1) 30^g (2) 40^g
(3) 50^g (4) 60^g

2. $\frac{\pi^c}{5}$ in sexagesimal measure, is _____.
(1) 18° (2) 36°
(3) 54° (4) 72°

3. 160^g in circular measure, is _____.
(1) $\frac{2\pi^c}{5}$ (2) $\frac{3\pi^c}{5}$
(3) $\frac{4\pi^c}{5}$ (4) πc

4. 30° in centesimal measure, is _____.
(1) $\frac{50^g}{3}$ (2) $\frac{100^g}{3}$
(3) $\frac{160^g}{3}$ (4) $\frac{200^g}{3}$

5. The value of $\frac{6\pi^c}{5}$ in sexagesimal measure is
(1) 144° (2) 216°
(3) 240^g (4) 120^g

6. A wheel makes 12 revolutions per hour. The radians it turns through in 20 minutes is _____.
(1) $8\pi^c$ (2) $16\pi^c$
(3) $24\pi^c$ (4) $32\pi^c$

7. The value of 108° in circular measure is _____.
(1) $5\pi^c/3$ (2) $3\pi^c/5$
(3) $\pi^c/5$ (4) $6\pi^c/7$

8. 1° = _____ (approximately).
(1) 0.0175^c (2) 57^c
(3) 45^c (4) 1.75^c

9. The value of $\frac{\tan 29° + \tan 31°}{1 - \tan 29°.\tan 31°}$ is _____.
(1) 1 (2) $\frac{1}{\sqrt{3}}$
(3) $\sqrt{3}$ (4) 0

10. $\sin^2 85° + \sin^2 5°$ = _____.
(1) 0 (2) 1
(3) 1/2 (4) 2/3

11. If $\text{cosec}(20° + x) = \sec(50° + x)$, the value of x is
(1) 10° (2) 20°
(3) 30° (4) 40°

12. If $\sin\theta = 1/2$ and $0° < \theta < 90°$, then $\cos 2\theta$ = _____.
(1) 0 (2) 1
(3) $\frac{1}{2}$ (4) $\frac{\sqrt{3}}{2}$

13. ABC is a right isosceles triangle, right angled at B. Then $\sin^2 A + \cos^2 C$ = _____.

(1) 0 (2) $\frac{1}{2}$

(3) $\frac{1}{\sqrt{2}}$ (4) 1

14. The value of $\frac{\sin 20^\circ \cos 70^\circ + \cos 20^\circ \sin 70^\circ}{\sin 23^\circ \operatorname{cosec} 23^\circ + \cos 23^\circ \sec 23^\circ}$ is

(1) 0 (2) 1

(3) 2 (4) 1/2

15. The value of $4(\sin^4 30^\circ + \cos^4 30^\circ) - 3(\cos^2 45^\circ + \sin^2 90^\circ)$ is _____.

(1) −1/2 (2) −2

(3) 2 (4) 1/2

16. If $\sin^4\theta + \cos^4\theta = \frac{1}{2}$, then the value of $\sin\theta \cos\theta$ is

(1) $\pm\frac{1}{8}$ (2) $\pm\frac{1}{4}$

(3) ±1 (4) $\pm\frac{1}{2}$

17. If $\sin\theta = \frac{3}{5}$ and θ is acute, then find the value of $\frac{\tan\theta - 2\cos\theta}{3\sin\theta + \sec\theta}$.

(1) 15/61

(2) 17/61

(3) −15/61

(4) −17/61

18. If $\sin(A + B) = \frac{\sqrt{3}}{2}$ and $\cot(A - B) = 1$, then find A.

(1) $27\frac{1^\circ}{2}$ (2) $35\frac{1^\circ}{2}$

(3) $52\frac{1^\circ}{2}$ (4) $55\frac{1^\circ}{2}$

19. Find the value of $\cos 15^\circ$.

(1) $\frac{\sqrt{3}+1}{2\sqrt{2}}$ (2) $\frac{\sqrt{3}-1}{2\sqrt{2}}$

(3) $\frac{\sqrt{2}+1}{2\sqrt{3}}$ (4) $\frac{\sqrt{2}-1}{2\sqrt{3}}$

20. If $\tan\theta - \cot\theta = 7$, find the value of $\tan^3\theta - \cot^3\theta$.

(1) 284 (2) 296

(3) 345 (4) 364

21. If $\tan\theta + \cot\theta = 2$, find the value of $\tan^{1025}\theta + \cot^{1025}\theta$.

(1) 0 (2) 1

(3) 2 (4) 1/2

22. If $\sin\theta + \operatorname{cosec}\theta = 2$, find the value of $\cot\theta + \cos\theta$.

(1) 0 (2) 1/2

(3) 1 (4) 2

23. If $\sin(A + B) = \sqrt{3}/2$ and $\cot(A - B) = \sqrt{3}$, then find the value of

(1) 15° (2) 30°

(3) 10° (4) 20°

24. $\frac{\cot A + \operatorname{cosec} A - 1}{\cot A - \operatorname{cosec} A + 1}$ _____.

(1) $\frac{1 - \cos A}{\sin A}$ (2) $\frac{1 + \sin A}{\cos A}$

(3) $\frac{1 - \sin A}{\cos A}$ (4) $\frac{1 + \cos A}{\sin A}$

25. If $\sec\theta + \tan\theta = 2$, then find the value of $\sin\theta$, where $0^\circ < \theta < 90^\circ$

(1) 2/5 (2) 3/5

(3) 4/5 (4) 1

26. $\sin\theta - \sqrt{3}\cos\theta =$

(1) $\sin(\theta + 60^\circ)$ (2) $\sin(\theta - 60^\circ)$

(3) $2\sin(\theta + 60^\circ)$ (4) $2\sin(\theta - 60^\circ)$

27. Find the value of $\tan(22^1/_2{}^\circ)$.

(1) $\sqrt{2} - 1$ (2) $\sqrt{2} + 1$

(3) $\sqrt{3} - 1$ (4) $\sqrt{3} - 1$

28. $[\sin(x - \pi) + \cos(x - \frac{\pi}{2})]. \cos(x - 2\pi) =$ _____.

(1) 0 (2) 1

(3) $\frac{1}{\sqrt{2}}$ (4) $\frac{\sqrt{3}}{2}$

29. If ABCD is a cyclic quadrilateral, then $\tan A + \tan C$ is

(1) 0 (2) 1

(3) −1 (4) 2

30. $[\sin\alpha + \sin(180^\circ - \alpha) + \sin(180^\circ + \alpha)] \operatorname{cosec}\alpha =$ _____.

(1) 0 (2) 1

(3) 2 (4) 3

31. Which of the following functions is never negative?

(1) $\sin x^2 + \cos y^2$

(2) $\sin x^4 + \cos y^4$

(3) $\sin|x| - \cos|x|$

(4) $(\sin x + \cos x)^2$

32. If $\operatorname{cosec}\theta = -\sqrt{2}$ and $\tan\theta = -1$, $\cos\theta$ is

(1) $\frac{1}{\sqrt{2}}$ (2) $\frac{\sqrt{3}}{2}$

(3) 1 (4) $\frac{1}{2}$

33. If sin A = 3/5 and A is not in the first quadrant, then find $\frac{\cos A + \sin 2A}{\tan A + \sec A}$.

(1) 16/25 (2) 17/25

(3) 22/25 (4) 19/25

34. If $\cos\theta_1 + \cos\theta_2 + \cos\theta_3 = 3$, find $\sin\theta_1 + \sin\theta_2 + \sin\theta_3$.

(1) 0 (2) 1

(3) 2 (4) 3

35. $\sin^2 5° + \sin^2 10° + \sin^2 15° \ldots\ldots + \sin^2 90° =$

(1) 17/2 (2) 19/2

(3) 21/2 (4) 23/2

36. $\sin^2(43° 24') + \sin^2(46° 36') =$ _____.

(1) 0.3 (2) 0.5

(3) 1.2 (4) 1

37. From a point at a height h m above a lake, the angle of elevation of a cloud is α and the angle of depression of its reflection in the lake is β. The height of the cloud above the surface of the lake is

(1) $\frac{h\cos(\alpha+\beta)}{\cos(\alpha-\beta)}$m (2) $\frac{h\sin(\alpha+\beta)}{\cos(\alpha-\beta)}$m

(3) $\frac{h\sin(\alpha-\beta)}{\cos(\alpha+\beta)}$m (4) $\frac{h\sin(\alpha+\beta)}{\sin(\beta-\alpha)}$m

38. A man on the top of a rock observed a boat coming towards the rock with a uniform speed. It takes 15 minutes for the angle of depression to change from 30° to 60°, then what time will the boat take to reach the shore?

(1) 5 minutes (2) 10 minutes

(3) $7\frac{1}{2}$ minutes (4) $2\frac{1}{2}$ minutes

39. If the sun ray's inclination increases from 45° to 60°, the length of the shadow of a tower decreases by 50 m. Find the height of the tower.

(1) $25\left(\sqrt{3}+1\right)$

(2) $25\left(3+\sqrt{3}\right)$

(3) $50\left(\sqrt{3}+1\right)$

(4) $30\left(3+\sqrt{3}\right)$

40. AB is a vertical pole. The end A is on the level ground. C is the mid point of AB. P is a point on the level ground such that the portion BC subtends an angle θ at P. If AP = nAB, then the value of cotθ is

(1) $\frac{2n^2+1}{n}$

(2) $\frac{n}{2n^2+1}$

(3) $\frac{2n^2+1}{2n}$

(4) $\frac{2n}{2n^2+1}$

ANSWER KEYS

PRACTICE EXERCISE 5 (A)

1. 3	**2.** 2	**3.** 2	**4.** 1	**5.** 3	**6.** 2	**7.** 3	**8.** 2	**9.** 2	**10.** 2
11. 3	**12.** 4	**13.** 2	**14.** 3	**15.** 3	**16.** 2	**17.** 1	**18.** 1	**19.** 3	**20.** 4
21. 1	**22.** 1	**23.** 4	**24.** 3	**25.** 4	**26.** 1	**27.** 2	**28.** 4	**29.** 3	**30.** 2
31. 4	**32.** 2	**33.** 4	**34.** 4	**35.** 1	**36.** 4	**37.** 3	**38.** 1	**39.** 3	**40.** 3

PRACTICE EXERCISE 5 (B)

1. 2	**2.** 2	**3.** 3	**4.** 2	**5.** 2	**6.** 1	**7.** 2	**8.** 1	**9.** 3	**10.** 2
11. 1	**12.** 3	**13.** 4	**14.** 4	**15.** 2	**16.** 4	**17.** 4	**18.** 3	**19.** 1	**20.** 4
21. 3	**22.** 1	**23.** 1	**24.** 4	**25.** 2	**26.** 4	**27.** 1	**28.** 1	**29.** 1	**30.** 2
31. 4	**32.** 1	**33.** 3	**34.** 1	**35.** 2	**36.** 4	**37.** 4	**38.** 3	**39.** 2	**40.** 1