CHAPTER 3

Trigonometric Functions

1. If $\sin\theta$ and $\cos\theta$ are the roots of the equation $ax^2 - bx + c = 0$, then a, b and c satisfy the relation.
   (a) $a^2 + b^2 + 2ac = 0$ (b) $a^2 - b^2 + 2ac = 0$
   (c) $a^2 + c^2 + 2ab = 0$ (d) $a^2 - b^2 - 2ac = 0$

2. If $\tan\theta = \frac{-4}{3}$, then $\sin\theta$ is
   (a) $\frac{-4}{5}$ but not $\frac{4}{5}$ (b) $\frac{-4}{5}$ or $\frac{4}{5}$
   (c) $\frac{4}{5}$ but not $-\frac{4}{5}$ (d) None of these

3. What is the value of radian measures corresponding to the 25° measures ?
   (a) $\frac{5\pi}{36}$ (b) $\frac{2\pi}{36}$
   (c) $\frac{3\pi}{36}$ (d) $\frac{4\pi}{36}$

4. The value of $\sin 20° \sin 40° \sin 60° \sin 80°$ is
   (a) $\frac{-3}{16}$ (b) $\frac{5}{16}$
   (c) $\frac{3}{16}$ (d) $\frac{1}{16}$

5. In a ΔABC, if $a = 2$, $b = 3$ and $\sin A = \frac{2}{3}$, then $\angle B$ is
   (a) 90° (b) 80°
   (c) 30° (d) 60°

6. The general solutions of the following equation : $\tan 2\theta = 0$ is
   (a) $\theta = \frac{n}{2} + \pi,\ n \in Z$ (b) $\theta = \frac{n\pi}{2},\ n \in Z$
   (c) $\theta = \frac{\pi}{2} + n,\ n \in Z$ (d) None

7. The value of $\cos 22\frac{1}{2}^\circ$ is
   (a) $\sqrt{\frac{\sqrt{2}+1}{2}}$ (b) $\sqrt{\frac{\sqrt{2}+1}{\sqrt{2}}}$
   (c) $\sqrt{\frac{\sqrt{2}+1}{2\sqrt{2}}}$ (d) $\frac{\sqrt{2}+1}{2\sqrt{2}}$

8. If $\cos A = \frac{4}{5}, \cos B = \frac{12}{13}, \frac{3\pi}{2} < A, B < 2\pi$, the values of the following : $\cos(A + B)$ is
   (a) $\frac{65}{33}$ (b) $\frac{33}{65}$
   (c) $\frac{30}{65}$ (d) $\frac{65}{30}$

9. If $\sin A = \frac{3}{5}, 0 < A < \frac{\pi}{2}$ and $\cos B = \frac{-12}{13}, \pi < B < \frac{3\pi}{2}$, then the value of $\cos(A + B)$ is
   (a) $\frac{65}{33}$ (b) $\frac{33}{65}$
   (c) $-\frac{65}{33}$ (d) $-\frac{33}{65}$

10. Which of the following is not correct ?
    (a) $\sin\theta = -\frac{1}{5}$ (b) $\cos\theta = 1$
    (c) $\sec\theta = \frac{1}{2}$ (d) $\tan\theta = 20$

11. If $3\tan(\theta-15°)=\tan(\theta-15°)$, $0°<\theta<90°$, then $\theta=$

(a) $\frac{\pi}{4}$ (b) $\frac{\pi}{2}$

(c) $-\frac{\pi}{4}$ (d) $-\frac{\pi}{2}$

12. The most general value of θ, satisfying the two equations, $\cos\theta=\frac{1}{\sqrt{2}}$, $\tan\theta=1$ is:

(a) $2n\pi\pm\frac{5\pi}{4}$ (b) $2n\pi+\frac{\pi}{4}$

(c) $n\pi+\frac{5\pi}{4}$ (d) $(2n+1)\pi+\frac{\pi}{4}$

13. If $\frac{\cos A}{\cos B}=n$, $\frac{\sin A}{\sin B}=m$, then the value of $(m^2-n^2)\sin^2 B$ is

(a) $1+n^2$ (b) $1-n^2$
(c) n^2 (d) $-n^2$

14. The value of $\tan 3A-\tan 2A-\tan A$ is:
(a) $\tan 3A\tan 2A\tan A$
(b) $\tan 3A+\tan 2A+\tan A$
(c) $\tan 3A-\tan 2A\tan A$
(d) $\tan 3A+\tan 2A\tan A$

15. Given $x>0$, in which interval the values of $f(x)=3\cos\sqrt{3+x+x^2}$ lie?

(a) $[-3,3)$ (b) $(-3,3]$
(c) $(-3,3)$ (d) $[-3,3]$

16. Value of $\sin 12°.\sin 48°.\sin 54°$ is:

(a) $\frac{-1}{8}$ (b) 8

(c) $\frac{1}{8}$ (d) -8

17. If $\operatorname{cosec}\theta-\cot\theta=q$, then the value of $\cot\theta$ is:

(a) $\frac{1-q^2}{2q}$ (b) $\frac{1+q^2}{q}$

(c) $\frac{q}{1-q^2}$ (d) $\frac{q}{1+q^2}$

18. If $\sin A=\sin B$, $\cos A=\cos B$, then the value of A in terms of B is:

(a) $n\pi+B$ (b) $n\pi+(-1)^n B$
(c) $2n\pi+B$ (d) $2n\pi-B$

19. $\cos\theta.\cos(90-\theta)-\sin\theta\sin(90-\theta)$ equals:

(a) 1 (b) 2
(c) -1 (d) 0

20. The value of the expression

$\frac{1}{2}(\sqrt{3}\sin 75°-\cos 75°)$ is:

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

21. If $\tan^2 A=2\tan^2 B+1$, then $\cos 2A+\sin^2 B$ equals:

(a) -1 (b) 1
(c) 0 (d) 2

22. The value of $\left(\frac{\cos\left(\frac{\pi}{2}+x\right)+\sin\left(\frac{\pi}{2}+x\right)}{\cos\left(\frac{\pi}{2}-x\right)-\sin\left(\frac{\pi}{2}-x\right)}\right)^2$ is

(a) $\frac{1-\sin 2x}{1+\sin 2x}$ (b) $\frac{1+\sin 2x}{1-\sin 2x}$

(c) 1 (d) None of these

23. To derive the tangent formula, the following steps are given:

1. $\tan(A+B)=\dfrac{\frac{\sin A\cos B}{\cos A\cos B}+\frac{\cos A\sin B}{\cos A\cos B}}{\frac{\cos A\cos B}{\sin A\sin B}+\frac{\sin A\sin B}{\cos A\cos B}}$

2. $\tan(A+B)=\dfrac{\sin(A+B)}{\cos(A+B)}$

3. $\tan(A+B)=\dfrac{\sin A\cos B+\cos A\sin B}{\cos A\cos B-\sin A\sin B}$

4. $\tan(A+B)=\dfrac{\tan A+\tan B}{1-\tan A\tan B}$

Their correct and proper sequential form to derive the formula is:

(a) 2, 4, 3, 1 (b) 1, 2, 3, 4
(c) 1, 4, 2, 3 (d) 2, 3, 1, 4

24. The value of $\cos^3\theta + \cos^3(120° + \theta) \cos^3(\theta - 120°)$ is :

(a) $\frac{\sqrt{3}}{2}\cos 3\theta$ (b) $\frac{3}{4}\sec^3\theta$

(c) $\frac{3}{2}\tan^3\theta$ (d) $\frac{3}{4}\cos 3\theta$

25. If $\cos T = \frac{3}{5}$ and if $\sin R = \frac{8}{17}$, where T is in the fourth quadrant and R is in the second quadrant, then $\cos(T - R)$ is equal to:

(a) $\frac{77}{85}$ (b) $\frac{13}{85}$

(c) $-\frac{13}{85}$ (d) $-\frac{77}{85}$

26. $\cos(A + B).\cos(A - B)$ is given by:

(a) $\cos^2 A - \cos^2 B$ (b) $\cos(A^2 - B^2)$

(c) $\cos^2 A - \sin^2 B$ (d) $\sin^2 A - \cos^2 B$

27. The value of $\sin 20°(\tan 10° + \cot 10°)$ is equal to:

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

(c) 1 (d) 2

28. If $x = \cos^2\theta + \sec^2\theta$, then which one of the following is correct?

(a) $x = 2$ (b) $x < 2$

(c) $x > 2$ (d) $x \geq 2$

29. If $\sin\theta = \frac{24}{25}$ and $0° < \theta < 90°$ then what is the value of $\sin\left(\frac{\theta}{2}\right)$?

(a) $\frac{12}{25}$ (b) $\frac{7}{25}$

(c) $\frac{3}{5}$ (d) $\frac{4}{5}$

30. If $\tan\theta + \sec\theta = 4$, then what is the value of $\sin\theta$?

(a) $\frac{15}{28}$ (b) $\frac{8}{15}$

(c) $\frac{15}{17}$ (d) $\frac{3}{5}$

31. What is the value of $\sin 1950° - \cos 1950°$?

(a) 0 (b) $(\sqrt{3}+1)/2$

(c) $(1-\sqrt{3})/2$ (d) $(\sqrt{3}-1)/2$

32. Consider the following:

1. $\frac{1+\sin\theta}{1-\sin\theta} = (\sec\theta + \tan\theta)^2$

2. $\sqrt{\sec^2\theta + \operatorname{cosec}^2\theta} = \tan\theta + \cot\theta$

Which of the above is/are correct?

(a) 1 only (b) 2 only

(c) both 1 and 2 (d) neither 1 nor 2

33. If $\tan A = 1/2$, $\tan B = 1/3$; then what is the value of $\tan(2A + B)$?

(a) 1 (b) 2

(c) 3 (d) 4

34. If $\tan\theta + \sec\theta = p$, then what is the value of $\sec\theta$?

(a) $\frac{p^2+1}{p^2}$ (b) $\frac{p^2+1}{\sqrt{p}}$

(c) $\frac{p^2+1}{2p}$ (d) $\frac{p+1}{2p}$

35. What is the value of $\sin 10° + \sin 50° - \sin 70°$?

(a) 1 (b) 0

(c) $\frac{1}{2}$ (d) 2

36. If $\tan A = \frac{1}{3}$ and $\tan B = \frac{1}{7}$, then what is the value of $2A + B$?

(a) 30° (b) 45°

(c) 60° (d) 135°

37. Given that $p = \tan\alpha + \tan\beta$, and $q = \cot\alpha + \cot\beta$; then what is $\left(\frac{1}{p} - \frac{1}{q}\right)$ equal to ?

(a) $\cot(\alpha - \beta)$ (b) $\tan(\alpha - \beta)$

(c) $\tan(\alpha + \beta)$ (d) $\cot(\alpha + \beta)$

38. Given that $\tan\theta = m \neq 0$, $\tan 2\theta = n \neq 0$ and $\tan\theta + \tan 2\theta = \tan 3\theta$, then which one of the following is correct ?

(a) $m = n$ (b) $m + n = 1$

(c) $m + n = 0$ (d) $mn = -1$

39. Given that $\tan\alpha = m/(m+1)$, $\tan\beta = 1/(2m+1)$, then what is the value of $\alpha + \beta$?

(a) 0 (b) $\frac{\pi}{4}$

(c) $\frac{\pi}{6}$ (d) $\frac{\pi}{3}$

40. What is the value of $(\sec\theta - \cos\theta)(\cot\theta + \tan\theta)$?

(a) 1 (b) 2

(c) $\sin\theta$ (d) $\cos\theta$

41. What is the value of $\cot(-870°)$?

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

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

42. What is the value of $\left(\sin 22\frac{1°}{2} + \cos 22\frac{1°}{2}\right)^4$?

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

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

43. If $\sin 2A = \frac{4}{5}$, then what is the value of $\tan A\left(0 \le A \le \frac{\pi}{4}\right)$?

(a) 1 (b) -1

(c) $\frac{1}{2}$ (d) 2

44. What is the value of $\sin\left(\frac{5\pi}{12}\right)$?

(a) $\frac{\sqrt{3}+1}{2}$ (b) $\frac{\sqrt{6}+\sqrt{2}}{4}$

(c) $\frac{\sqrt{3}+\sqrt{2}}{4}$ (d) $\frac{\sqrt{6}+1}{2}$

45. What is the correct sequence of the following values?

1. $\sin\left(\frac{\pi}{12}\right)$ 2. $\cos\left(\frac{\pi}{12}\right)$

3. $\cot\left(\frac{\pi}{12}\right)$

Select the correct answer using the code given below

(a) $3>2>1$ (b) $1>2>3$

(c) $1>3>2$ (d) $3>1>2$

46. The value of $\sin\left[n\pi + (-1)^n \frac{\pi}{4}\right]$, $n \in I$ is

(a) 0 (b) $\frac{1}{\sqrt{2}}$

(c) $-\frac{1}{\sqrt{2}}$ (d) None of these

47. The value of $\frac{\tan x}{\tan 3x}$ wherever defined never lies between

(a) $\frac{1}{2}$ and 2 (b) $\frac{1}{3}$ and 3

(c) $\frac{1}{4}$ and 4 (d) $\frac{1}{3}$ and 2

48. In a ΔABC, if angle C is obtuse, then

(a) $\tan A \tan B < 1$ (b) $\tan A \tan B \le 1$

(c) $\tan A \tan B > 1$ (d) None of these

49. The number of solution of $\tan x + \sec x = 2\cos x$ in $[0, 2\pi)$ is

(a) 2 (b) 3

(c) 0 (d) 1

50. Let α, β be such that $\pi < \alpha - \beta < 3\pi$.

If $\sin\alpha + \sin\beta = -\frac{21}{65}$ and $\cos\alpha + \cos\beta = -\frac{27}{65}$, then the value of $\cos\frac{\alpha-\beta}{2}$

(a) $\frac{-6}{65}$ (b) $\frac{3}{\sqrt{130}}$

(c) $\frac{6}{65}$ (d) $-\frac{3}{\sqrt{130}}$

51. The number of values of x in the interval $[0, 3\pi]$ satisfying the equation $2\sin^2 x + 5\sin x - 3 = 0$ is

(a) 4 (b) 6

(c) 1 (d) 2

52. If $0 < x < \pi$ and $\cos x + \sin x = \frac{1}{2}$, then $\tan x$ is

(a) $\frac{(1-\sqrt{7})}{4}$ (b) $\frac{(4-\sqrt{7})}{3}$

(c) $-\frac{(4+\sqrt{7})}{3}$ (d) $\frac{(1+\sqrt{7})}{4}$

53. Let **A** and **B** denote the statements
A : $\cos\alpha + \cos\beta + \cos\gamma = 0$
B : $\sin\alpha + \sin\beta + \sin\gamma = 0$

If $\cos(\beta-\gamma) + \cos(\gamma-\alpha) + \cos(\alpha-\beta) = -\frac{3}{2}$, then :
(a) **A** is false and **B** is true.
(b) both **A** and **B** are true.
(c) both **A** and **B** are false.
(d) **A** is true and **B** is false.

54. Let $\cos(\alpha+\beta) = \frac{4}{5}$ and $\sin(\alpha-\beta) = \frac{5}{13}$, where $0 \le \alpha, \beta \le \frac{\pi}{4}$.

Then $\tan 2\alpha$ =

(a) $\frac{56}{33}$ (b) $\frac{19}{12}$

(c) $\frac{20}{7}$ (d) $\frac{25}{16}$

55. If $A = \sin^2 x + \cos^4 x$, then for all real x :

(a) $\frac{13}{16} \le A \le 1$ (b) $1 \le A \le 2$

(c) $\frac{3}{4} \le A \le \frac{13}{16}$ (d) $\frac{3}{4} \le A \le 1$

56. The possible values of $\theta \in (0, \pi)$ such that $\sin(\theta) + \sin(4\theta) + \sin(7\theta) = 0$ are :

(a) $\frac{\pi}{4}, \frac{5\pi}{12}, \frac{\pi}{2}, \frac{2\pi}{3}, \frac{3\pi}{4}, \frac{8\pi}{9}$

(b) $\frac{2\pi}{9}, \frac{\pi}{4}, \frac{\pi}{2}, \frac{2\pi}{3}, \frac{3\pi}{4}, \frac{35\pi}{36}$

(c) $\frac{2\pi}{9}, \frac{\pi}{4}, \frac{\pi}{2}, \frac{2\pi}{3}, \frac{3\pi}{4}, \frac{8\pi}{9}$

(d) $\frac{2\pi}{9}, \frac{\pi}{4}, \frac{4\pi}{9}, \frac{\pi}{2}, \frac{3\pi}{4}, \frac{8\pi}{9}$

57. If $\alpha + \beta + \gamma = 2\pi$, then :

(a) $\tan\frac{\alpha}{2} + \tan\frac{\beta}{2} + \tan\frac{\gamma}{2} = \tan\frac{\alpha}{2}\tan\frac{\beta}{2}\tan\frac{\gamma}{2}$

(b) $\tan\frac{\alpha}{2}\tan\frac{\beta}{2} + \tan\frac{\beta}{2}\tan\frac{\gamma}{2} + \tan\frac{\gamma}{2}\tan\frac{\alpha}{2} = 1$

(c) $\tan\frac{\alpha}{2} + \tan\frac{\beta}{2} + \tan\frac{\gamma}{2} = -\tan\frac{\alpha}{2}\tan\frac{\beta}{2}\tan\frac{\gamma}{2}$

(d) None of these

58. Given both θ and ϕ are acute angle $\sin\theta = \frac{1}{2}, \cos\phi = \frac{1}{3}$, then the value of $\theta+\phi$ belongs to :

(a) $\left(\frac{\pi}{3}, \frac{\pi}{6}\right)$ (b) $\left(\frac{\pi}{2}, \frac{2\pi}{3}\right)$

(c) $\left(\frac{2\pi}{3}, \frac{5\pi}{6}\right)$ (d) $\left(\frac{5\pi}{6}, \pi\right)$

59. The smallest positive root of the equation, $\tan x - x = 0$ lies in :

(a) $\left(0, \frac{\pi}{2}\right)$ (b) $\left(\frac{\pi}{2}, \pi\right)$

(c) $\left(\pi, \frac{3\pi}{2}\right)$ (d) $\left(\frac{3\pi}{2}, 2\pi\right)$

60. If $\sin\theta + \text{cosec}\,\theta = 2$, then $\sin^2\theta + \text{cosec}^2\theta$ is equal to
(a) 1 (b) 4
(c) 2 (d) None of these

61. If $\tan\theta = \frac{1}{2}$ and $\tan\phi = \frac{1}{3}$, then the value of $\theta+\phi$ is

(a) $\frac{\pi}{6}$ (b) π

(c) 0 (d) $\frac{\pi}{4}$

62. The value of $\cos 1° \cos 2° \cos 3° \ldots \cos 179°$ is

(a) $\frac{1}{\sqrt{2}}$ (b) 0

(c) 1 (d) -1

63. The value of $\cos 12° + \cos 84° + \cos 156° + \cos 132°$ is

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

(c) $-\frac{1}{2}$ (d) $\frac{1}{8}$

64. The value of $\sin\frac{\pi}{10}\sin\frac{13\pi}{10}$ is

(a) $\frac{1}{2}$ (b) $-\frac{1}{2}$

(c) $-\frac{1}{4}$ (d) 0

[**Hint :** Use $\sin 18° = \frac{\sqrt{5}-1}{4}$

and $\cos 36° = \frac{\sqrt{5}+1}{4}$]

65. The value of $\cos^2 48° - \sin^2 12°$ is

(a) $\frac{\sqrt{5}+1}{8}$ (b) $\frac{\sqrt{5}-1}{8}$

(c) $\frac{\sqrt{5}+1}{5}$ (d) $\frac{\sqrt{5}+1}{2\sqrt{2}}$

[**Hint :** Use $\cos^2 A - \sin^2 B$
$= \cos(A+B)\cos(A-B)$]

66. The solution of the equation $\cos^2\theta + \sin\theta + 1 = 0$, lies in the interval:

(a) $\left(-\frac{\pi}{4}, \frac{\pi}{4}\right)$ (b) $\left(\frac{\pi}{4}, \frac{3\pi}{4}\right)$

(c) $\left(\frac{3\pi}{4}, \frac{5\pi}{4}\right)$ (d) $\left(\frac{5\pi}{4}, \frac{7\pi}{4}\right)$

67. Solution of the equation $\tan x + \tan 2x + \tan x . \tan 2x = 1$ will be :

(a) $x = \frac{n\pi}{3} + \frac{\pi}{12}$ (b) $x = n\pi - \frac{\pi}{4}$

(c) $x = n\pi + \frac{\pi}{3}$ (d) $x = n\pi \pm \frac{\pi}{4}$

68. If $x + \frac{1}{x} = 2\cos\theta$, then $x^3 + \frac{1}{x^3}$ is:

(a) $\frac{1}{2}\cos 3\theta$ (b) $2\cos 3\theta$

(c) $\cos 3\theta$ (d) $\frac{1}{3}\cos 3\theta$

69. The value of $\cos\frac{\pi}{3}.\cos\frac{\pi}{7}.\cos\frac{2\pi}{7}\cos\frac{4\pi}{7}$:

(a) 16 (b) $\frac{-1}{16}$

(c) $\frac{11}{16}$ (d) $\frac{16}{11}$

70. The general value of x satisfying $\cos x = \sqrt{3}(1 - \sin x)$ is given by :

(a) $x = n\pi \pm \frac{\pi}{2}$

(b) $x = n\pi \pm x$

(c) $x = n\pi + (-1)^n \frac{\pi}{3} - \frac{\pi}{6}$

(d) $x = n\pi \pm \frac{\pi}{3}$

71. If $\tan x = \frac{b}{a}$, then the value of $a\cos 2x + b\sin 2x$ is:

(a) a (b) a – b

(c) a + b (d) b

72. The value of $\tan 20° + 2\tan 50° - \tan 70°$ is :

(a) 1 (b) 0

(c) $\tan 50°$ (d) none of these

73. The general solution of the equation $\sin 2x + 2\sin x + 2\cos x + 1 = 0$ is

(a) $3n\pi - \frac{\pi}{4}$

(b) $2n\pi + \frac{\pi}{4}$

(c) $2n\pi + (-1)^n \sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$

(d) $n\pi - \frac{\pi}{4}$

74. If $\sin x + \sin^2 x = 1$, then the value of $\cos^{12} x + 3\cos^{10} x + 3\cos^8 x + \cos^6 x - 1$ is equal to

(a) 0 (b) 1

(c) –1 (d) 2