DCAM classes

Dynamic Classes for Academic Mastery

3.TRIGONOMETRIC FUNCTIONS

Single Correct Answer Type

1. If $\cos x + \cos y - \cos(x + y) = \frac{3}{2}$, then

a) $x + y = 0$ b) $x = 2y$ c) $x = y$ d) $2x = y$

2. The number of values of y in $[-2\pi, 2\pi]$ satisfying the equation $|\sin 2x| + |\cos 2x| = |\sin y|$ is

a) 3 b) 4 c) 5 d) 6

3. In ΔABC, the median AD divides $\angle BAC$ such that $\angle BAD : \angle CAD = 2 : 1$. Then $\cos(A/3)$ is equal to

a) $\frac{\sin B}{2 \sin C}$ b) $\frac{\sin C}{2 \sin B}$ c) $\frac{2 \sin B}{\sin C}$ d) None of these

4. The equation $\sin^2 \theta - \frac{4}{\sin^3 \theta - 1} = 1 - \frac{4}{\sin^3 \theta - 1}$ has

a) No root b) One root c) Two roots d) Infinite roots

5. If $f(x) = \sin^6 x + \cos^6 x$, then range of $f(x)$ is

a) $\left[\frac{1}{4}, 1\right]$ b) $\left[\frac{1}{4}, \frac{3}{4}\right]$ c) $\left[\frac{3}{4}, 1\right]$ d) None of these

6. The number of solutions of $\sin x + \sin 2x + \sin 3x = \cos x + \cos 2x + \cos 3x, 0 \le x \le 2\pi$, is

a) 7 b) 5 c) 4 d) 6

7. If $y = (1 + \tan A)(1 - \tan B)$ where $A - B = \frac{\pi}{4}$, then $(y + 1)^{y+1}$ is equal to

a) 9 b) 4 c) 27 d) 81

8. In triangle ABC, if $\sin A \cos B = \frac{1}{4}$ and $3 \tan A = \tan B$, then$\cot^2 A$ is equal to

a) 2 b) 3 c) 4 d) 5

9. The range of y such that the equation in $x, y + \cos x = \sin x$ has a real solution is

a) $[-2, 2]$ b) $[-\sqrt{2}, \sqrt{2}]$ c) $[-1, 1]$ d) $[-1/2, 1/2]$

10. The value of $\cos 2(\theta + \phi) + 4 \cos(\theta + \phi) \sin \theta \sin \phi + 2 \sin^2 \phi$ is

a) Independent of θ only b) Independent of ϕ only

c) Independent of both θ and ϕ d) Dependent on θ and ϕ

11. If $x_1, x_2, x_3, \dots, x_n$ are in A.P. whose common difference is α, then the value of $\sin \alpha$ ($\sec x_1 \sec x_2 +$ $\sec x_2 \sec x_3 + \dots + \sec x_{n-1} \sec x_n$ is

a) $\frac{\sin(n-1)\alpha}{\cos x_1 \cos x_n}$ b) $\frac{\sin n\alpha}{\cos x_1 \cos x_n}$

c) $\sin(n-1)\alpha \cos x_1 \cos x_n$ d) $\sin n \alpha \cos x_1 \cos x_n$

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

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

13. In triangle $ABC, \angle A = 30°, BC = 2 + \sqrt{5}$, then the distance of the vertex A from the orthocenter of the triangle is

a) 1 b) $(2 + \sqrt{5})\sqrt{3}$ c) $\frac{\sqrt{3} + 1}{2\sqrt{2}}$ d) $\frac{1}{2}$

14. In triangle ABC, medians AD and CE are drawn. If $AD = 5, \angle DAC = \pi/8$ and $\angle ACE = \pi/4$, then the area of the triangle ABC is equal to

a) $\frac{25}{9}$ b) $\frac{25}{3}$ c) $\frac{25}{18}$ d) $\frac{10}{3}$

15. If $\theta = \pi/4n$, then the value of $\tan \theta \tan 2\theta \dots \tan(2n - 2)\theta \tan(2n - 1)\theta$ is

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

16. $e^{|\sin x|} + e^{-|\sin x|} + 4a = 0$ will have exactly four different solutions in $[0, 2\pi]$ if

a) $a \in R$ b) $a \in \left[-\frac{e}{4}, -\frac{1}{4}\right]$ c) $a \in \left[\frac{-1 - e^2}{4e}, \infty\right]$ d) None of these

17. The numerical value of $\tan 20° \tan 80° \cot 50°$ is equal to

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

18. In ΔABC, let $R =$ circumradius, $r =$ inradius, if r is the distance between the circumcentre and the incentre, then ratio R/r is equal to
a) $\sqrt{2}-1$ b) $\sqrt{3}-1$ c) $\sqrt{2}+1$ d) $\sqrt{3}+1$

19. If $A+B+C = 3\pi/2$, then $\cos 2A + \cos 2B + \cos 2C$ is equal to
a) $1 - 4\cos A \cos B \cos C$ b) $4 \sin A \sin B \sin C$
c) $1 + 2\cos A \cos B \cos C$ d) $1 - 4 \sin A \sin B \sin C$

20. In triangle ABC, line joining circumcentre and incentre is parallel to side AC, then $\cos A + \cos C$ is equal to
a) -1 b) 1 c) -2 d) 2

21. The roots of the equation $4x^2 - 2\sqrt{5}\,x + 1 = 0$ are
a) $\sin 36°, \sin 18°$ b) $\sin 18°, \cos 36°$ c) $\sin 36°, \cos 18°$ d) $\cos 18°, \cos 36°$

22. Let $0 < x < \pi/4$, then $(\sec 2x - \tan 2x)$ equals
a) $\tan\left(x - \frac{\pi}{4}\right)$ b) $\tan\left(\frac{\pi}{4} - x\right)$ c) $\tan\left(x + \frac{\pi}{4}\right)$ d) $\tan^2\left(x + \frac{\pi}{4}\right)$

23. A quadratic equation whose roots are $\text{cosec}^2\theta$ and $\sec^2\theta$ can be
a) $x^2 - 5x + 2 = 0$ b) $x^2 - 3x + 6 = 0$ c) $x^2 - 5x + 5 = 0$ d) None of these

24. The value of $\tan 6° \tan 42° \tan 66° \tan 78°$ is
a) 1 b) 1/2 c) 1/4 d) 1/8

25. If $f(x) = \log\left(\frac{1+x}{1-x}\right)$, then
a) $f(x_1) . f(x_2) = f(x_1 + x_2)$ b) $f(x+2) - 2f(x+1) + f(x) = 0$
c) $f(x) + f(x+1) = f(x^2 + x)$ d) $f(x_1) + f(x_2) = f\left(\frac{x_1 + x_2}{1 + x_1 x_2}\right)$

26. In triangle ABC, if $\cos A + \cos B + \cos C = \frac{7}{4}$, then $\frac{R}{r}$ is equal to
a) $\frac{3}{4}$ b) $\frac{4}{3}$ c) $\frac{2}{3}$ d) $\frac{3}{2}$

27. Let n be a positive integer such that $\sin\frac{\pi}{2n} + \cos\frac{\pi}{2n} = \frac{\sqrt{x}}{2}$. Then
a) $6 \le n \le 8$ b) $4 < n \le 8$ c) $4 \le n \le 8$ d) $4 < n < 8$

28. If $\tan(A - B) = 1$ and $\sec(A + B) = 2/\sqrt{3}$, then the smallest positive values of A and B, respectively, are
a) $\frac{25\pi}{24}, \frac{19\pi}{24}$ b) $\frac{19\pi}{24}, \frac{25\pi}{24}$ c) $\frac{31\pi}{24}, \frac{13\pi}{24}$ d) $\frac{13\pi}{24}, \frac{31\pi}{24}$

29. One root of the equation $\cos x - x + \frac{1}{2} = 0$ lies in the interval
a) $\left(0, \frac{\pi}{2}\right)$ b) $\left(-\frac{\pi}{2}, 0\right)$ c) $\left(\frac{\pi}{2}, \pi\right)$ d) $\left(\pi, \frac{3\pi}{2}\right)$

30. Let α and β be any two positive values of x for which $2\cos x$, $|\cos x|$ and $1 - 3\cos^2 x$ are in G.P. The minimum value of $|\alpha - \beta|$ is
a) $\frac{\pi}{3}$ b) $\frac{\pi}{4}$ c) $\frac{\pi}{2}$ d) None of these

31. In ΔABC, if $\frac{\sin A}{c \sin B} + \frac{\sin B}{c} + \frac{\sin C}{b} = \frac{c}{ab} + \frac{b}{ac} + \frac{a}{bc}$, then the value of angle A is
a) $120°$ b) $90°$ c) $60°$ d) $30°$

32. The most general value for which $\tan\theta = -1, \cos\theta = \frac{1}{\sqrt{2}}$ is $(n \in Z)$
a) $n\pi + \frac{7\pi}{4}$ b) $n\pi + (-1)^n \frac{7\pi}{4}$ c) $2n\pi + \frac{7\pi}{4}$ d) None of these

33. If $\tan\theta = \sqrt{n}$ where $n \in N, \ge 2$, then $\sec 2\theta$ is always
a) A rational number b) An irrational number c) A positive integer d) A negative integer

34. Let $x = \sin 1°$, then the value of the expression
$$\frac{1}{\cos 0° . \cos 1°} + \frac{1}{\cos 1° . \cos 2°} + \frac{1}{\cos 2° . \cos 3°} + \cdots + \frac{1}{\cos 44° . \cos 45°}$$ is equal to
a) x b) $1/x$ c) $\sqrt{2}/x$ d) $x/\sqrt{2}$

35. If $\sin(y+z-x)$, $\sin(z+x-y)$, $\sin(x+y-z)$ are in A.P., then $\tan x$, $\tan y$, $\tan z$ are in
a) A.P. b) G.P. c) H.P. d) None of these

36. $\dfrac{\sin^2 A - \sin^2 B}{\sin A\cos A - \sin B\cos B}$ is equal to
a) $\tan(A-B)$ b) $\tan(A+B)$ c) $\cot(A-B)$ d) $\cot(A+B)$

37. If $\tan^2\theta = 2\tan^2\phi + 1$, then $\cos 2\theta + \sin^2\phi$ equals
a) -1 b) 0 c) 1 d) None of these

38. Let AD be a median of the ΔABC. If AE and AF are medians of the triangle ABD and ADC, respectively, and $AD = m_1, AE = m_2, AF = m_3$, then $a^2/8$ is equal to
a) $m_2^2 + m_3^2 - 2m_1^2$ b) $m_1^2 + m_2^2 - 2m_3^2$ c) $m_1^2 + m_3^2 - 2m_2^2$ d) None of these

39. The number $N = 6\log_{10} 2 + \log_{10} 31$ lies between two successive integers whose sum is equal to
a) 5 b) 7 c) 9 d) 10

40. Let $A_0A_1A_2A_3A_4A_5$ be a regular hexagon inscribed in a circle of unit radius. Then the product of the lengths of the line segments A_0A_1, A_0A_2 and A_0A_4 is
a) $3/4$ b) $3\sqrt{3}$ c) 3 d) $3\sqrt{3}/2$

41. The general values of θ satisfying the equation $2\sin^2\theta - 3\sin\theta - 2 = 0$ is $(n \in Z)$
a) $n\pi + (-1)^n \pi/6$ b) $n\pi + (-1)^n \pi/2$ c) $n\pi + (-1)^n 5\pi/6$ d) $n\pi + (-1)^n 7\pi/6$

42. If the lengths of the sides of triangle are 3, 5 and 7, then the largest angle of the triangle is
a) $\dfrac{\pi}{2}$ b) $\dfrac{5\pi}{6}$ c) $\dfrac{2\pi}{3}$ d) $\dfrac{3\pi}{4}$

43. If $\sin\theta$ and $-\cos\theta$ are the roots of the equation $ax^2 - bx - c = 0$, where a, b and c are the sides of a triangle ABC, then $\cos B$ is equal to
a) $1 - \dfrac{c}{2a}$ b) $1 - \dfrac{c}{a}$ c) $1 + \dfrac{c}{2a}$ d) $1 + \dfrac{c}{3a}$

44. If $5\tan\theta = 4$, then $\frac{5\sin\theta - 3\cos\theta}{5\sin\theta + 2\cos\theta}$ is equal to
a) 0 b) 1 c) $1/6$ d) 6

45. If $\cot(\alpha+\beta) = 0$, then $\sin(\alpha + 2\beta)$ can be
a) $-\sin\alpha$ b) $\sin\beta$ c) $\cos\alpha$ d) $\cos\beta$

46. The general solution of $\cos x \cos 6x = -1$ is
a) $x = (2n+1)\pi, n \in Z$ b) $x = 2n\pi, n \in Z$
c) $x = n\pi, n \in Z$ d) None of these

47. If $a, b \in [0, 2\pi]$ and the equation $x^2 + 4 + 3\sin(ax+b) - 2x = 0$ has at least one solution, then the value of $(a+b)$ can be
a) $\dfrac{7\pi}{2}$ b) $\dfrac{5\pi}{2}$ c) $\dfrac{9\pi}{2}$ d) None of these

48. The total number of ordered pairs (x, y) satisfying $|x| + |y| = 4, \sin\left(\frac{\pi x^2}{3}\right) = 1$ is equal to
a) 2 b) 3 c) 4 d) 6

49. In triangle $ABC, \angle A = \pi/2$, then $\tan(C/2)$ is equal to
a) $\dfrac{a-c}{2b}$ b) $\dfrac{a-b}{2c}$ c) $\dfrac{a-c}{b}$ d) $\dfrac{a-b}{c}$

50. If $\sin\theta_1 \sin\theta_2 - \cos\theta_1\cos\theta_2 + 1 = 0$, then the value of $\tan(\theta_1/2)\cot(\theta_2/2)$ is always equal to
a) -1 b) 1 c) 2 d) -2

51. In triangle ABC, $\tan \mathrm{A} + \tan \mathrm{B} + \tan \mathrm{C} = 6$ and $\tan A \tan B = 2$, then the values of $\tan A, \tan B, \tan C$ are
a) $1, 2, 3$ b) $3, 2/3, 7/3$ c) $4, 1/2, 3/2$ d) None of these

52. If the median of ΔABC through A is perpendicular to AB, then
a) $\tan A + \tan B = 0$ b) $2\tan A + \tan B = 0$ c) $\tan A + 2\tan B = 0$ d) None of these

53. If $\sin\theta = \frac{1}{2}$ and $\cos\theta = -\frac{\sqrt{3}}{2}$, then the general value of θ is $(n \in Z)$ is
a) $2n\pi + \dfrac{5\pi}{6}$ b) $2n\pi + \dfrac{\pi}{6}$ c) $2n\pi + \dfrac{7\pi}{6}$ d) $2n\pi + \dfrac{\pi}{4}$

54. If $\log_2 x + \log_x 2 = \frac{10}{3} = \log_2 y + \log_y 2$ and $x \neq y$ then $x + y =$

a) 2 b) 65/8 c) 37/6 d) None of these

55. If $'O'$ is the circumcentre of ΔABC and R_1, R_2 and R_3 are the radii of the circumcircles of triangles OBC, OCA and OAB, respectively, then $\frac{a}{R_1} + \frac{b}{R_2} + \frac{c}{R_3}$ has the value equal to

a) $\frac{abc}{2R^3}$ b) $\frac{R^3}{abc}$ c) $\frac{4\Delta}{R^2}$ d) $\frac{\Delta}{4R^2}$

56. In an acute angled triangle $ABC, r + r_1 = r_2 + r_3$ and $\angle B > \frac{\pi}{3}$, then

a) $b + 2c < 2a < 2b + 2c$ b) $b + 4c < 4a < 2b + 4c$

c) $b + 4c < 4a < 4b + 4c$ d) $b + 3c < 3a < 3b + 3c$

57. The radii r_1, r_2, r_3 of the escribed circles of the triangle ABC are in H.P. If the area of the triangle is 24 cm^2 and its perimeter is 24 cm, then the length of its largest side is

a) 10 b) 9 c) 8 d) None of these

58. In triangle ABC, base BC and area of triangle Δ are fixed. Locus of the centroid of triangle ABC is a straight line that is

a) Parallel to side BC b) Right bisector of side BC

c) Right angle of BC d) Inclined at an angle $\sin^{-1}\left(\frac{\sqrt{\Delta}}{BC}\right)$ to side BC

59. Which of the following is not the general solution of $2^{\cos 2x} + 1 = 3.2^{-\sin^2 x}$?

a) $n\pi, n \in Z$ b) $\left(n + \frac{1}{2}\right)\pi, n \in Z$ c) $\left(n - \frac{1}{2}\right)\pi, n \in Z$ d) None of these

60. If $\frac{\sin(x+y)}{\sin(x-y)} = \frac{a+b}{a-b}$, then $\frac{\tan x}{\tan y}$ is equal to

a) $\frac{b}{a}$ b) $\frac{a}{b}$ c) ab d) None of these

61. If x_1 and x_2 are two distinct roots of the equation $a\cos x + b\sin x = c$, then $\tan\frac{x_1+x_2}{2}$ is equal to

a) $\frac{a}{b}$ b) $\frac{b}{a}$ c) $\frac{c}{a}$ d) $\frac{a}{c}$

62. If $\tan\theta + \sin\theta = m$ and $\tan\theta - \sin\theta = n$, then

a) $m^2 - n^2 = 4mn$ b) $m^2 + n^2 = 4mn$ c) $m^2 - n^2 = m^2 + n^2$ d) $m^2 - n^2 = 4\sqrt{mn}$

63. In triangle ABC, if P, Q, R divides sides BC, AC and AB, respectively, in the ratio k: 1 (in order). If the ratio $\left(\frac{\text{area } PQR}{\text{area } ABC}\right)$ is $\frac{1}{3}$, then k is equal to

a) 1/3 b) 2 c) 3 d) None of these

64. If $x \in \left(\pi, \frac{3\pi}{2}\right)$, then $4\cos^2\left(\frac{\pi}{4} - \frac{x}{2}\right) + \sqrt{4\sin^4 x + \sin^2 2x}$ is always equal to

a) 1 b) 2 c) -2 d) None of these

65. The area of the circle and the area of a regular polygon of n sides and of perimeter equal to that of the circle are in the ratio of

a) $\tan\left(\frac{\pi}{n}\right) : \frac{\pi}{n}$ b) $\cos\left(\frac{\pi}{n}\right) : \frac{\pi}{n}$ c) $\sin\frac{\pi}{n} : \frac{\pi}{n}$ d) $\cot\left(\frac{\pi}{n}\right) : \frac{\pi}{n}$

66. If $\sin 6\theta + \sin 4\theta + \sin 2\theta = 0$, then θ is equal to $(n \in Z)$

a) $\frac{n\pi}{4}$ or $n\pi \pm \frac{\pi}{3}$ b) $\frac{n\pi}{4}$ or $n\pi \pm \frac{\pi}{6}$ c) $\frac{n\pi}{4}$ or $2n\pi \pm \frac{\pi}{6}$ d) None of these

67. $\log_4 18$ is

a) A rational number b) An irrational number c) A prime number d) None of these

68. If $S = \{x \in N : 2 + \log_2\sqrt{x+1} > 1 - \log_{1/2}\sqrt{4 - x^2}\}$, then

a) $S = \{1\}$ b) $S = Z$ c) $S = N$ d) None of these

69. If $|2\sin\theta - \text{cosec}\,\theta| \geq 1$ and $\theta \neq \frac{n\pi}{2}, n \in I$, then

a) $\cos 2\theta \geq 1/2$ b) $\cos 2\theta \geq 1/4$ c) $\cos 2\theta \leq 1/2$ d) $\cos 2\theta \leq 1/4$

70. If $(1 - \tan\theta)(1 + \tan\theta)\sec^2\theta + 2^{\tan^2\theta} = 0$, then the number of values of θ in the interval $(-\pi/2, \pi/2)$ are

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

71. Sum of all the solutions in $[0, 4\pi]$ of the equation $\tan x + \cot x + 1 = \cos\left(x + \frac{\pi}{4}\right)$ is

a) 3π b) $\pi/2$ c) $7\pi/2$ d) 4π

72. If $\tan\frac{\pi}{9}, x$ and $\tan\frac{5\pi}{18}$ are in A.P. and $\tan\frac{\pi}{9}, y$ and $\tan\frac{7\pi}{18}$ are also in A.P., then

a) $2x = y$ b) $x > 2$ c) $x = y$ d) None of these

73. The general solution of the equation $\sin x - 3\sin 2x + \sin 3x = \cos x - 3\cos 2x + \cos 3x$ is $(n \in Z)$

a) $n\pi + \frac{\pi}{8}$ b) $\frac{n\pi}{2} + \frac{\pi}{8}$ c) $(-1)^n \frac{n\pi}{2} + \frac{\pi}{8}$ d) $2n\pi + \cos^{-1}\frac{2}{3}$

74. If $\cos 2B = \frac{\cos(A + C)}{\cos(A - C)}$, then $\tan A, \tan B, \tan C$ are in

a) A.P. b) G.P. c) H.P. d) None of these

75. The equation $\cos x + \sin x = 2$ has

a) Only one solution b) Two solutions

c) No solution d) Infinite number of solutions

76. The general solution of the trigonometric equation $\sin x + \cos x = 1$ is given by

a) $x = 2n\pi, n = 0, \pm 1, \pm 2, \ldots$

b) $x = 2n\pi + \pi/2; n = 0, \pm, \pm 2, \ldots$

c) $x = n\pi + (-1)^n \frac{\pi}{4} - \frac{\pi}{4}\ n = 0, \pm 1, \pm 2, \ldots$

d) None of these

77. The number of values of θ which satisfy the equation $\sin 3\theta - \sin\theta = 4\cos^2\theta - 2, \forall\, \theta \in [0, 2\pi]$, is

a) 4 b) 5 c) 7 d) 0

78. If $\cos B \cos C + \sin B \sin C \sin^2 A = 1$, then triangle ABC is

a) Isosceles and right angled

b) Equilateral

c) Isosceles whose equal angles are greater than $\pi/4$

d) None

79. If $\sin 2\theta = \cos 3\theta$ and θ is an acute angle, then $\sin\theta$ equals

a) $\frac{\sqrt{5} - 1}{4}$ b) $-\left(\frac{\sqrt{5} - 1}{4}\right)$ c) $\frac{\sqrt{5} + 1}{4}$ d) $\frac{-\sqrt{5} - 1}{4}$

80. The number of solutions of $\sec^2\theta + \text{cosec}^2\theta + 2\,\text{cosec}^2\theta = 8, 0 \le \theta \le \pi/2$ is

a) 4 b) 3 c) 0 d) 2

81. Which of the following is correct?

a) $\sin 1° > \sin 1$ b) $\sin 1° < \sin 1$ c) $\sin 1° = \sin 1$ d) $\sin 1° = \frac{\pi}{180}\sin 1$

82. One of the general solutions of $4\sin\theta \sin 2\theta \sin 4\theta = \sin 3\theta$ is

a) $(3n \pm 1)\pi/12, \forall\, n \in Z$ b) $(4n \pm 1)\pi/9, \forall\, n \in Z$

c) $(3n \pm 1)\pi/9, \forall\, n \in Z$ d) $(3n \pm 1)\pi/3, \forall\, n \in Z$

83. The side of triangle ABC are in A.P. (order being a, b, c) and satisfy $\frac{2!}{1!9!} + \frac{2!}{3!7!} + \frac{1}{5!5!} = \frac{8^a}{(2b)!}$, then the value of $\cos A + \cos B$ is

a) $\frac{12}{7}$ b) $\frac{13}{7}$ c) $\frac{11}{7}$ d) $\frac{10}{7}$

84. If $\sin^{-1} a + \sin^{-1} b + \sin^{-1} c = \pi$, then $a\sqrt{1 - a^2} + b\sqrt{1 - b^2} + c\sqrt{1 - c^2}$ is equal to

a) $a + b + c$ b) $a^2b^2c^2$ c) $2abc$ d) $4abc$

85. If in a triangle, $\left(1 - \frac{r_1}{r_2}\right)\left(1 - \frac{r_1}{r_3}\right) = 2$, then the triangle is

a) Right angled b) Isosceles c) Equilateral d) None of these

86. In triangle ABC if angle C is 90° and area of triangle is 30 sq. units, then the minimum possible value of the hypotenuse c is equal to

a) $30\sqrt{2}$ b) $60\sqrt{2}$ c) $120\sqrt{2}$ d) $\sqrt{30}$

87. In triangle ABC, angle A is greater than angle B. If the measures of angles A and B satisfy the equation

$3\sin x-4\sin^3 x-k=0, 0<k<1$, then the measure of angle C is

a) $\frac{\pi}{3}$ b) $\frac{\pi}{2}$ c) $\frac{2\pi}{3}$ d) $\frac{5\pi}{6}$

88. The range of k for which the inequality $k\cos^2 x-k\cos x+1\geq 0\ \forall x\in(-\infty,\infty)$, is

a) $k<\frac{-1}{2}$ b) $\frac{-1}{2}\leq k\leq 4$ c) $k>4$ d) $\frac{1}{2}\leq k\leq 5$

89. The number of solution of $\sin^4 x-\cos^2 x\sin x+2\sin^2 x+\sin x=0$ in $0\leq x\leq 3\pi$ is

a) 3 b) 4 c) 5 d) 6

90. In any triangle ABC, $\sin^2 A-\sin^2 B+\sin^2 C$ is always equal to

a) $2\sin A\sin B\cos C$ b) $2\sin A\cos B\sin C$ c) $2\sin A\cos B\cos C$ d) $2\sin A\sin B\sin C$

91. Let $f(n)=2\cos nx\ \forall n\in N$, then $f(1)\,f(n+1)-f(n)$ is equal to

a) $f(n+3)$ b) $f(n+2)$ c) $f(n+1)\,f(2)$ d) $f(n+2)f(2)$

92. If the equation $\cot^4 x-2\ \text{cosec}^2 x+a^2=0$ has at least one solution, then the sum of all possible integral values of $'a'$ is equal to

a) 4 b) 3 c) 2 d) 0

93. $$\cos^3 x\sin 2x=\sum_{x=0}^{n} a_r\sin(r\,x)\ \forall x\in R,\text{ then}$$

a) $n=5, a_1=1/2$ b) $n=5, a_1=1/4$ c) $n=5, a_2=1/8$ d) $n=5, a_2=1/4$

94. In triangle ABC, if $\tan(A/2)=5/6$ and $\tan(B/2)=20/37$, the sides a, b and c are in

a) A.P. b) GP. c) H.P. d) None of these

95. If $\sin x+\text{cosec}\,x=2$, then $\sin^n x+\ \text{cosec}^n x$ is equal to

a) 2 b) 2^n c) 2^{n-1} d) 2^{n-2}

96. The equation $2\cos^2\frac{x}{2}\sin^2 x=x^2=x^{-2}; 0<x\leq\frac{\pi}{2}$ has

a) No real solution
b) One real solution
c) More than one solution
d) None of these

97. If in ΔABC, $\sin A\cos B=\frac{\sqrt{2}-1}{\sqrt{2}}$ and $\sin B\cos A=\frac{1}{\sqrt{2}}$, then the triangle is

a) Equilateral
b) Isosceles
c) Right angled
d) Right-angled isosceles

98. In triangle ABC, $\angle A=60°$, $\angle B=40°$ and $\angle C=80°$. If P is the centre of the circumcircle of triangle ABC with radius unity, then the radius of the circumcircle of triangle BPC is

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

99. The number of solutions of the pair of equations $2\sin^2\theta-\cos 2\theta=0$ and $2\cos^2\theta-3\sin\theta=0$ in the interval $[0, 2\pi]$ is

a) Zero b) One c) Two d) Four

100. The value of $\frac{\log_2 24}{\log_{96} 2}-\frac{\log_2 192}{\log_{12} 2}$ is

a) 3 b) 0 c) 2 d) 1

101. Number of solutions the equation $\cos(\theta)\cdot\cos(\pi\theta)=1$ has

a) 0 b) 2 c) 1 d) Infinite

102. If $1+\sin x+\sin^2 x+\sin^3 x+\cdots\infty$ is equal to $4+2\sqrt{3}, 0<x<\pi$, then x is equal to

a) $\frac{\pi}{6}$ b) $\frac{\pi}{4}$ c) $\frac{\pi}{3}$ or $\frac{\pi}{6}$ d) $\frac{\pi}{3}$ or $\frac{2\pi}{3}$

103. If $\cos x=\tan y$, $\cos y=\tan z$, $\cos z=\tan x$, then the value of $\sin x$ is

a) $2\cos 18°$ b) $\cos 18°$ c) $\sin 18°$ d) $2\sin 18°$

104. 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

105. Let $\theta\in[0, 4\pi]$ satisfy the equation $(\sin\theta+2)(\sin\theta+3)(\sin\theta+4)=6$. If the sum of all the values of θ is of the form $k\pi$, then the value of k is

a) 6 b) 5 c) 4 d) 2

106. The sum of all the solutions of the equation $\cos\theta\cos\left(\frac{\pi}{3}+\theta\right)\cos\left(\frac{\pi}{3}-\theta\right)=\frac{1}{4},\theta\in[0,6\pi]$

a) 15π b) 30π c) $\frac{100\pi}{3}$ d) None of these

107. If $a\sin x+b\cos(x+\theta)+b\cos(x-\theta)=d$, then the minimum value of $|\cos\theta|$ is equal to

a) $\frac{1}{2|b|}\sqrt{d^2-a^2}$ b) $\frac{1}{2|a|}\sqrt{d^2-a^2}$ c) $\frac{1}{2|d|}\sqrt{d^2-a^2}$ d) None of these

108. If $a\le 3\cos x+5\sin(x-\pi/6)\le b$ for all x, then (a,b) is

a) $(-\sqrt{19},\sqrt{19})$ b) $(-17,17)$ c) $(-\sqrt{21},\sqrt{21})$ d) None of these

109. In triangle $ABC, a=5, b=3$ and $c=7$, the value of $3\cos C+7\cos B$ is equal to

a) 5 b) 10 c) 7 d) 3

110. The value of $\cot 70°+4\cos 70°$ is

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

111. The number of solution of the equation $\tan x\tan 4x=1$ for $0<x<\pi$ is

a) 1 b) 2 c) 5 d) 8

112. A piece of paper is in the shape of a square of side 1 m long. It is cut at the four corners to make a regular polygon of eight sides (octagon). The area of the polygon is

a) $2(\sqrt{2}-1)\text{m}^2$ b) $(\sqrt{2}-1)\text{m}^2$ c) $\frac{1}{\sqrt{2}}\text{m}^2$ d) None of these

113. If in triangle $ABC, \angle B=90°$, then $\tan^2(A/2)$ is

a) $\frac{b-c}{b+c}$ b) $\frac{b+c}{b-c}$ c) $\frac{2bc}{b-c}$ d) None of these

114. If $\frac{1}{6}\sin\theta, \cos\theta, \tan\theta$ are in G.P., then θ is equal to $(n\in Z)$

a) $2n\pi\pm\frac{\pi}{3}$ b) $2n\pi\pm\frac{\pi}{6}$ c) $n\pi+(-1)^n\frac{\pi}{3}$ d) $n\pi+\frac{\pi}{3}$

115. If $2^{x+y=6^y}$ and $3^{x-1}=2^{y+1}$, then the value of $(\log 3-\log 2)/(x-y)$ is

a) 1 b) $\log_2 3-\log_3 2$ c) $\log(3/2)$ d) None of these

116. $3(\sin x-\cos x)^4+6(\sin x+\cos x)^2+4(\sin^6 x+\cos^6 x)$ is equal to

a) 11 b) 12 c) 13 d) 14

117. If $\sec\alpha$ and $\operatorname{cosec}\alpha$ are the roots of $x^2-px+q+0$, then

a) $p^2=q(q-2)$ b) $p^2=q(q+2)$ c) $p^2+q^2=2q$ d) None of these

118. If $\cos 25°+\sin 25°=p$, then $\cos 50°$ is

a) $\sqrt{2-p^2}$ b) $-\sqrt{2-p^2}$ c) $p\sqrt{2-p^2}$ d) $-p\sqrt{2-p^2}$

119. If $\cot^2 x=\cot(x-y)\cot(x-z)$, thencot $2x$ is equal to (where $x\ne\pm\pi/4$)

a) $\frac{1}{2}(\tan y+\tan z)$ b) $\frac{1}{2}(\cot y+\cot z)$ c) $\frac{1}{2}(\sin y+\sin z)$ d) None of these

120. The total number of solutions of $\cos x=\sqrt{1-\sin 2x}$ in $[0,2\pi]$ is equal to

a) 2 b) 3 c) 5 d) None of these

121. If θ is eliminated from the equations $x=a\cos(\theta-\alpha)$ and $y=b\cos(\theta-\beta)$, then $\frac{x^2}{a^2}+\frac{y^2}{b^2}-\frac{2xy}{ab}\cos(\alpha-\beta)$ is equal to

a) $\sec^2(\alpha-\beta)$ b) $\operatorname{cosec}^2(\alpha-\beta)$ c) $\cos^2(-\beta)$ d) $\sin^2(\alpha-\beta)$

122. If $\cos\theta_1=2\cos\theta_2$, then $\tan\frac{\theta_1-\theta_2}{2}\tan\frac{\theta_1+\theta_2}{2}$ is equal to

a) $\frac{1}{3}$ b) $-\frac{1}{3}$ c) 1 d) -1

123. The value of $\frac{1+2\log_3 2}{(1+\log_3 2)^2}+(\log_6 2)^2$ is

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

124. Given that $(1+\sqrt{1+x})\tan y=1+\sqrt{1-x}$. Then $\sin 4y$ is equal to

a) $4x$ b) $2x$ c) x d) None of these

125. If $\left|\cos\theta\left\{\sin\theta+\sqrt{\sin^2\theta+\sin^2\alpha}\right\}\right|\le k$, then the value of k is

a) $\sqrt{1+\cos^2\alpha}$ b) $\sqrt{1+\sin^2\alpha}$ c) $\sqrt{2+\sin^2\alpha}$ d) $\sqrt{2+\cos^2\alpha}$

126. If $\ln\left(\frac{a+b}{3}\right)=\left(\frac{\ln a+\ln b}{2}\right)$, then $\frac{a}{b}+\frac{b}{a}$ is equal to

a) 1 b) 3 c) 5 d) 7

127. A variable triangle ABC is circumscribed about a fixed circle of unit radius. Side BC always touches the circle at D and has fixed direction. If B and C vary in such a way that $(BD)(CD)=2$, then locus of vertex A will be a straight line

a) Parallel to side BC b) Perpendicular to side BC

c) Making an angle $(\pi/6)$ with BC d) Making an angle $\sin^{-1}(2/3)$ with BC

128. Let $f(\theta)=\frac{\cot\theta}{1+\cot\theta}$ and $\alpha+\beta=\frac{5\pi}{4}$, then the value $f(\alpha)f(\beta)$ is

a) $\frac{1}{2}$ b) $-\frac{1}{2}$ c) 2 d) None of these

129. If in $\Delta ABC, b=3$ cm, $c=4$ cm and the length of the perpendicular from A to the side BC is 2 cm, then the number of solutions of the triangle is

a) 1 b) 0 c) 3 d) 2

130. If $\sin\theta_1-\sin\theta_2=a$ and $\cos\theta_1+\cos\theta_2=b$, then

a) $a^2+b^2\ge 4$ b) $a^2+b^2\le 4$ c) $a^2+b^2\ge 3$ d) $a^2+b^2\le 2$

131. In in triangle $ABC, \sum\sin\frac{A}{2}=\frac{6}{5}$ and $\sum II_1=9$ (where I_1, I_2 and I_3 are ex-centres and I is in-centre, then circumradius R is equal to

a) $\frac{15}{8}$ b) $\frac{15}{4}$ c) $\frac{15}{2}$ d) $\frac{4}{12}$

132. $x^{\log_5 x}>5$ imlies

a) $x\in(0,\infty)$ b) $x\in(0,1/5)\cup(5,\infty)$

c) $x\in(1,\infty)$ d) $x\in(1,2)$

133. The number of values of x for which $\sin 2x+\cos 4x=2$ is

a) 0 b) 1 c) 2 d) Infinite

134. $\tan^6\frac{\pi}{9}-33\tan^4\frac{\pi}{9}+27\tan^2\frac{\pi}{9}$ is equal to

a) 0 b) $\sqrt{3}$ c) 3 d) 9

135. The value of b for which the equation $2\log_{1/25}(bx+28)=-\log_5(12-4x-x^2)$ has coincident roots if

a) $b=-12$ b) $b=4$ c) $b=4$ or $b=-12$ d) $b=-4$ or $b=12$

136. The number of distinct real roots of $\begin{vmatrix}\sin x & \cos x & \cos x\\ \cos x & \sin x & \cos x\\ \cos x & \cos x & \sin x\end{vmatrix}=0$ in the interval $-\frac{\pi}{4}\le x\le\frac{\pi}{4}$ is

a) 0 b) 2 c) 1 d) 3

137. The value of $3^{\log_4 5}-5^{\log_4 3}$ is

a) 0 b) 1 c) 2 d) None of these

138. The number of real values of the parameter k for which $(\log_{16}x)^2-\log_{16}x+\log_{16}k=0$ with real coefficients will have exactly one solution is

a) 2 b) 1 c) 4 d) None of these

139. If the hypotenuse of a right-angled triangle is four times the length of the perpendicular drawn from the opposite vertex to it, then the difference of the two acute angles will be

a) 60° b) 15° c) 75° d) 30°

140. If a, b, c are distinct positive numbers different from 1 such that $(\log_b a\log_c a-\log_a a)+(\log_a b\log_c b-$ log*bb+*loga*c*log*bc*–logc*c=0,* then abc is

a) 0 b) E c) 1 d) None of these

141. The general solution of $\sin 3\alpha=4\sin\alpha\sin(x+\alpha)\sin(x-\alpha)$ is

a) $n\pi\pm\pi/4, \forall\, n\in Z$ b) $n\pi\pm\pi/3, \forall\, n\in Z$ c) $n\pi\pm\pi/9, \forall\, n\in Z$ d) $n\pi\pm\pi/12, \forall\, n\in Z$

142. If $\sec\theta-1=\left(\sqrt{2}-1\right)\tan\theta$, then θ is equal to $(n\ \in Z)$

a) $(2n-1)\pi$ b) $2n\pi+\frac{\pi}{4}$ c) $2n\pi-\frac{\pi}{4}$ d) $2n\pi+\frac{\pi}{3}$

143. Which of the following is not the solution of $\log_x\left(\frac{5}{2}-\frac{1}{x}\right)>\left(\frac{5}{2}-\frac{1}{x}\right)$?

a) $\left(\frac{2}{5},\frac{1}{2}\right)$ b) $(1,2)$ c) $\left(\frac{2}{5},\frac{3}{4}\right)$ d) None of these

144. If $\cos 3x+\sin\left(2x-\frac{7\pi}{6}\right)=-2$, then x is equal to $(k\in Z)$

a) $\frac{\pi}{3}(6k+1)$ b) $\frac{\pi}{3}(6k-1)$ c) $\frac{\pi}{3}(2k+1)$ d) None of these

145. The minimum value of the expression $2\log_{10}x-\log_x 0.01$, where $x>1$, is

a) 2 b) 0.1 c) 4 d) 1

146. In any ΔABC, if $\cot\frac{A}{2},\cot\frac{B}{2},\cot\frac{C}{2}$ are in A.P., then a,b,c are in

a) A.P. b) G.P. c) H.P. d) None of these

147. In $\Delta ABC, \angle B=\pi/3$. The range of values of x, where $x=\sin A\sin C$, is the interval

a) $\left[-\frac{1}{4},\frac{3}{4}\right]$ b) $\left(0,\frac{3}{4}\right)$ c) $\left(0,\frac{3}{4}\right]$ d) $\left[\frac{1}{4},\frac{3}{4}\right]$

148. If point P lies on sides of a right-angled triangle ABC, then $PA+PB+PC$ is minimum when P is the

a) Orthocenter
b) Circumcentre
c) Mid-point of the smallest side
d) None of these

149. In triangle $ABC, \tan\frac{A}{2},\tan\frac{B}{2},\tan\frac{C}{2}$ are in H.P., then the value of $\cot\frac{A}{2}\times\cot\frac{C}{2}$ is equal to

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

150. If one side of a triangle is double the other, and the angles on opposite sides differ by 60°, then the triangle is

a) Equilateral b) Obtuse angled c) Right angled d) Acute angled

151. If $(\sin x+\cos x)^2+k\sin x\cos x=1$ holds $\forall x\in R$, then the value of k equals

a) 2 b) 2 c) -2 d) 3

152. The total number of solutions of $\sin\{x\}=\cos\{x\}$ (where $\{.\}$ denotes the fractional part) in $[0,2\pi]$ is equal to

a) 5 b) 6 c) 8 d) None of these

153. The value of $\cos y\cos\left(\frac{\pi}{2}-x\right)-\cos\left(\frac{\pi}{2}-y\right)\cos x+\sin y\cos\left(\frac{\pi}{2}-x\right)+\cos x\sin\left(\frac{\pi}{2}-y\right)$ is zero if

a) $x=0$ b) $y=0$ c) $x=y$ d) $n\pi+y-\frac{\pi}{4}$ $(n\in Z)$

154. If $\theta=3\alpha$ and $\sin\theta=\frac{a}{\sqrt{a^2+b^2}}$ The value of the expression $a\,\mathrm{cosec}\,\alpha-b\sec\alpha$ is

a) $\frac{a}{\sqrt{a^2+b^2}}$ b) $2\sqrt{a^2+b^2}$ c) $a+b$ d) None of these

155. If $f(\theta)=5\cos\theta+3\cos\left(\theta+\frac{\pi}{3}\right)+3$, then range of $f(\theta)$ is

a) $[-5,11]$ b) $[-3,9]$ c) $[-2,10]$ d) $[-4,10]$

156. Consider the system of linear equations in x,y and z:

$(\sin 3\theta)x-y+z=0$
$(\cos 2\theta)x+4y+3z=0$
$2x+7y+7z=0$

Then which of the following can be the values of θ for which the system has a non-trivial solution

a) $n\pi+(-1)^n\pi/6, \forall n\in Z$ b) $n\pi+(-1)^n\pi/3, \forall n\in Z$
c) $n\pi+(-1)^n\pi/9, \forall n\in Z$ d) None of these

157. If in $\Delta ABC, AC$ is double of AB, then the value of $\cot\frac{A}{2}\cot\frac{B-C}{2}$ is equal to

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

158. The least value of $6\tan^2\phi+54\cot^2\phi+18$ is

I: 54 when A.M. ≥ G.M. is applicable for $6\tan^2\phi, 54\cot^2\phi, 18$
II: 54 when A.M. ≥ G.M. is applicable for $6\tan^2\phi, 54\cot^2\phi$ and 18 added further
III: 78 when $\tan^2\phi = \cot^2\phi$

a) I is correct
b) I and II are correct
c) III is correct
d) None of the above is correct

159. If $u = \sqrt{a^2\cos^2\theta + b^2\sin^2\theta} + \sqrt{a^2\sin^2\theta + b^2\cos^2\theta}$, then the difference between the maximum and minimum values of u^2 is given by

a) $2(a^2 + b^2)$ b) $2\sqrt{a^2 + b^2}$ c) $(a + b)^2$ d) $(a - b)^2$

160. With usual notations, in triangle ABC, $a\cos(B - C) + b\cos(C - A) + c\cos(A - B)$ is equal to

a) $\frac{abc}{R^2}$ b) $\frac{abc}{4R^2}$ c) $\frac{4\,abc}{R^2}$ d) $\frac{abc}{2R^2}$

161. If $3\tan^2\theta - 2\sin\theta = 0$, then θ is equal to $(n \in Z)$

a) $2n\pi \pm \frac{\pi}{4}$ b) $n\pi + (-1)^n\frac{\pi}{6}$ c) $n\pi - (-1)^n\frac{\pi}{6}$ d) $n\pi + \frac{\pi}{3}$

162. If $S = \{x \in R : (\log_{0.6} 0.216)\log_5(5 - 2x) \le 0\}$, then S is equal to

a) $[2.5, \infty)$ b) $[2, 2.5)$ c) $(2, 2.5)$ d) $(0, 2.5)$

163. In triangle ABC, $\angle A = \pi/3$ and its incircle is of unit radius. If the radius of the circle touching the sides AB, AC internally and incircle externally is x, then the value of x is

a) 1/2 b) 1/4 c) 1/3 d) None of these

164. The equation $\tan^4 x - 2\sec^2 x + a = 0$ will have at least one solution if

a) $1 < a \le 4$ b) $a \ge 2$ c) $a \le 3$ d) None of these

165. In ΔABC, $(a + b + c)(b + c - a) = kbc$ if

a) $k < 0$ b) $k > 0$ c) $0 < k < 4$ d) $k > 4$

166. The distance between the two parallel lines is 1 unit. A point $'A'$ is chosen to lie between the lines at a distance $'d'$ from one of them. Triangle ABC is equilateral with B on one line and C on the other parallel line. The length of the side of the equilateral triangle is

a) $\frac{2}{3}\sqrt{d^2 + d + 1}$ b) $2\sqrt{\frac{d^2 - d + 1}{3}}$ c) $2\sqrt{d^2 - d + 1}$ d) $\sqrt{d^2 - d + 1}$

167. If $\sin\theta, 1, \cos 2\theta$ are in G.P., then θ is equal to $(n \in Z)$

a) $n\pi + (-1)^n\frac{\pi}{2}$ b) $n\pi + (-1)^{n-1}\frac{\pi}{2}$ c) $2n\pi$ d) None of these

168. Number of solutions of $\sin 5x + \sin 3x + \sin x = 0$ for $0 \le x \le \pi$ is

a) 1 b) 2 c) 3 d) None of these

169. If H is the orthocenter of a acute-angled triangle ABC whose circumcircle is $x^2 + y^2 = 16$, then circumdiameter of the trangle HBC is

a) 1 b) 2 c) 4 d) 8

170. The solution set of the inequality $\log_{10}(x^2 - 16) \le \log_{10}(4x - 11)$ is

a) $(4, \infty)$ b) $(4, 5]$ c) $(11/4, \infty)$ d) $(11/4, 5)$

171. Solution set of the inequality $\log_3(x + 2)(x + 4) + \log_{1/3}(x + 2) < (1/2)\log_{\sqrt{3}} 7$ is

a) $(-2, -1)$ b) $(-2, 3)$ c) $(-1, 3)$ d) $(3, \infty)$

172. If $2x^{\log_4 3} + 3^{\log_4 x} = 27$, then x is equal to

a) 2 b) 4 c) 8 d) 16

173. The number of solutions of $[\sin x + \cos x] = 3 + [-\sin x] + [-\cos x]$ (where [.] denotes the greatest integer function), $x \in [0, 2\pi]$, is

a) 0 b) 4 c) Infinite d) 1

174. If $\cos\theta + \cos 7\theta + \cos 3\theta + \cos 5\theta = 0$, then θ is equal to $(n \in Z)$

a) $n\pi$ b) $n\pi/2$ c) $n\pi/4$ d) $n\pi/8$

175. If $x \in (\pi, 2\pi)$ and $\frac{\sqrt{1 + \cos x} + \sqrt{1 - \cos x}}{\sqrt{1 + \cos x} - \sqrt{1 - \cos x}} = \cot\left(a + \frac{x}{2}\right)$, then a is equal to

a) $\frac{\pi}{4}$ b) $\frac{\pi}{2}$ c) $\frac{\pi}{3}$ d) None of these

176. If $\frac{r}{r_1}=\frac{r_2}{r_3}$, then

a) $A=90°$ b) $B=90°$ c) $C=90°$ d) None of these

177. In an equilateral triangle, the inradius, circumradius and one of the ex-radii are in the ratio

a) $2:3:5$ b) $1:2:3$ c) $1:3:7$ d) $3:7:9$

178. The value of $\cos^2 10° - \cos 10° \cos 50° + \cos^2 50°$ is equal to

a) $\frac{4}{3}$ b) $\frac{1}{3}$ c) $\frac{3}{4}$ d) 3

179. In ΔABC, $\cot\frac{A}{2}+\cot\frac{B}{2}+\cot\frac{C}{2}$ is equal to

a) $\frac{\Delta}{r^2}$ b) $\frac{(a+b+c)^2}{abc}\ 2R$ c) $\frac{\Delta}{r}$ d) $\frac{\Delta}{Rr}$

180. In triangle ABC, $2ac\sin\left(\frac{1}{2}(A-B+C)\right)$ is equal to

a) $a^2+b^2+c^2$ b) $c^2+a^2-b^2$ c) $b^2-c^2-a^2$ d) $c^2-a^2-b^2$

181. If $a+b=3-\cos 4\theta$ and $a-b=4\sin 2\theta$, then ab is always less than or equal to

a) $\frac{1}{2}$ b) 1 c) $\frac{2}{3}$ d) $\frac{3}{4}$

182. The set of all values of x satisfying $x^{\log_x(1-x)^2}=9$ is

a) A subset of R containing N

b) A subset of R containing Z (set of all integers)

c) Is a finite set containing at least two elements

d) A finite set

183. If in triangle ABC, $\sin A\cos B=1/4$ and $3\tan A=\tan B$, then the triangle is

a) Right angled b) Equilateral c) Isosceles d) None of these

184. If $f(x)=\cos^2\theta+\sec^2\theta$, then

a) $f(x)<1$ b) $f(x)=1$ c) $2>f(x)>1$ d) $f(x)\geq 2$

185. If P is a point on the altitude AD of the triangle ABC such that $\angle CBP=B/3$, then AP is equal to

a) $2a\sin\frac{C}{3}$ b) $2b\sin\frac{C}{3}$ c) $2c\sin\frac{B}{3}$ d) $2c\sin\frac{C}{3}$

186. The value of $\sin^2\frac{\pi}{8}+\sin^2\frac{3\pi}{8}+\sin^2\frac{5\pi}{8}+\sin^2\frac{7\pi}{8}$ is

a) 1 b) 2 c) $1\frac{1}{8}$ d) $2\frac{1}{8}$

187. If $0<\alpha<\frac{\pi}{6}$, then $\alpha(\operatorname{cosec}\alpha)$ is

a) Less than $\pi/6$ b) Greater than $\pi/6$ c) Less than $\pi/3$ d) Greater than $\pi/3$

188. If $x=\frac{2\sin\theta}{1+\cos\theta+\sin\theta}$, then $\frac{1-\cos\theta+\sin\theta}{1+\sin\theta}$ is equal to

a) $1+x$ b) $1-x$ c) x d) $1/x$

189. In triangle ABC, if $a:b:c=7:8:9$, then $\cos A:\cos B$ is equal to

a) $\frac{11}{63}$ b) $\frac{22}{63}$ c) $\frac{2}{9}$ d) None of these

190. The general solution of the equation $\sin^{100}x-\cos^{100}x=1$ is

a) $2n\pi+\frac{\pi}{3}, n\in I$ b) $n\pi+\frac{\pi}{2}, n\in I$ c) $n\pi+\frac{\pi}{4}, n\in I$ d) $2n\pi-\frac{\pi}{3}, n\in I$

191. If A, B, C are acute positive angles such that $A+B+C=\pi$ and $\cot A\cot B\cot C=k$, then

a) $K\leq\frac{1}{3\sqrt{3}}$ b) $K\geq\frac{1}{3\sqrt{3}}$ c) $K<\frac{1}{9}$ d) $K>\frac{1}{3}$

192. If a, b, c are consecutive positive integers and $\log(1+ac)=2K$, then the value of K is

a) $\log b$ b) $\log a$ c) 2 d) 1

193. General solution of $\sin^2 x-5\sin x\cos x-6\cos^2 x=0$ is

a) $x=n\pi-\pi/4, n\in Z$ only b) $n\pi+\tan^{-1}6, n\in Z$ only

c) Both (a) and (b) d) None of these

194. The set of all x satisfying the equation $x^{\log_3 x^2 + (\log_3 x)^2 - 10} = 1/x^2$ is

a) $\{1, 9\}$ b) $\{1, 9, 1/81\}$ c) $\{1, 4, 1/81\}$ d) $\{9, 1/81\}$

195. Given both θ and $\emptyset$ are the acute angles $\sin\theta = \frac{1}{2}$, $\cos\emptyset = \frac{1}{3}$, then the value of $\theta + \emptyset$ belongs to

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

196. If $\frac{\cos(x-y)}{\cos(x+y)} + \frac{\cos(z+t)}{\cos(z-t)} = 0$, then the value of $\tan x \tan y \tan z \tan t$ is equal to

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

197. Given that a, b, c are the sides of a triangle ABC which is right angled at C, then the minimum value of $\left(\frac{c}{a} + \frac{c}{b}\right)^2$ is

a) 0 b) 4 c) 6 d) 8

198. The number of solutions of $12\cos^3 x - 7\cos^2 x + 4\cos x = 9$ is

a) 0 b) 2 c) Infinite d) None of these

199. If $3\tan(\theta - 15°) = \tan(\theta + 15°)$, then θ is equal to $(n \in Z)$

a) $n\pi + \frac{\pi}{4}$ b) $n\pi + \frac{\pi}{8}$ c) $n\pi + \frac{\pi}{3}$ d) None of these

200. If $\frac{3\pi}{4} < \alpha < \pi$, then $\sqrt{2\cot\alpha + \frac{1}{\sin^2\alpha}}$ is equal to

a) $1 + \cot\alpha$ b) $-1 - \cot\alpha$ c) $1 - \cot\alpha$ d) $-1 + \cot\alpha$

201. If $\sin x + \cos x = \frac{\sqrt{7}}{2}$ where $x \in A$, then $\tan\frac{x}{2}$ is equal to

a) $\frac{3 - \sqrt{7}}{3}$ b) $\frac{\sqrt{7} - 2}{3}$ c) $\frac{4 - \sqrt{7}}{4}$ d) None of these

202. The value of $\tan 9° - \tan 27° - \tan 63° + \tan 81°$ is

a) 2 b) 3 c) 4 d) None of these

203. $\tan\left(\frac{p\pi}{4}\right) = \cot\left(\frac{q\pi}{4}\right)$ if $(n \in Z)$

a) $p + q = 0$ b) $p + q = 2n + 1$ c) $p + q = 2n$ d) $p + q = 2(2n + 1)$

204. Let $f(\theta) = \sin\theta(\sin\theta + \sin 3\theta)$. Then $f(\theta)$ is

a) ≥ 0 only when $\theta \geq 0$ b) ≤ 0 for all real θ c) ≥ 0 for all real θ d) ≤ 0 only when $\theta \leq 0$

205. The complete solution of $7\cos^2 x + \sin x \cos x - 3 = 0$ is given by

a) $n\pi + \frac{\pi}{2} (n \in Z)$ b) $n\pi - \frac{\pi}{2} (n \in Z)$

c) $n\pi + \tan^{-1}\left(\frac{3}{4}\right) (n \in Z)$ d) $n\pi + \frac{3\pi}{4}, k\pi + \tan^{-1}\left(\frac{4}{3}\right) (k, n \in Z)$

206. If $\log_{10}\left[\frac{1}{2^x + x - 1}\right] = x[\log_{10} 5 - 1]$, then $x =$

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

207. In ΔABC, if $b^2 + c^2 = 2a^2$, then value of $\frac{\cot A}{\cot B + \cot C}$ is

a) $\frac{1}{2}$ b) $\frac{3}{2}$ c) $\frac{5}{2}$ d) $\frac{5}{3}$

208. The value of x satisfying $\sqrt{3}^{-4 + 2\log_{\sqrt{5}} x} = 1/9$ is

a) 2 b) 3 c) 4 d) None of these

209. If $\alpha, \beta, \gamma, \delta$ are the smallest positive angles in ascending order of magnitude which have their sines equal to the positive quantity k, then the value of $4\sin\frac{\alpha}{2} + 3\sin\frac{\beta}{2} + 2\sin\frac{\gamma}{2} + \sin\frac{\delta}{2}$ is equal to

a) $2\sqrt{1 - k}$ b) $2\sqrt{1 + k}$ c) $\frac{\sqrt{1 + k}}{2}$ d) None of these

210. The value of $\log ab - \log|b| =$

a) $\log a$ b) $\log|a|$ c) $-\log a$ d) None of these

211. If $(4)^{\log_9 3} + (9)^{\log_2 4} = (10)^{\log_x 83}$, then x is equal to

a) 2 b) 3 c) 10 d) 30

212. In triangle ABC, internal angle bisector $\angle A$ makes an angle θ with side BC. The value of $\sin\theta$ is equal to

a) $\left|\sin\left(\frac{B-C}{2}\right)\right|$ b) $\left|\sin\left(\frac{B}{2}-C\right)\right|$ c) $\cos\left(\frac{B-C}{2}\right)$ d) $\cos\left(\frac{B}{2}-C\right)$

213. If both the distinct roots of the equation $|\sin x|^2+|\sin x|+b=0$ in $[0,\pi]$ are real, then the values of b are

a) $[-2,0]$ b) $(-2,0)$ c) $[-2,0)$ d) None of these

214. The maximum value of $(\cos\alpha_1)(\cos\alpha_2)\dots(\cos\alpha_n)$,unser the restrictions $0\le\alpha_1,\alpha_2,\dots\alpha_n\le\pi/2$ and $(\cot\alpha_1)(\cot\alpha_2)\dots(\cot\alpha_n)=1$is

a) $1/2^{n/2}$ b) $1/2^n$ c) $1/2n$ d) 1

215. If $\sqrt{\log_2 x}-0.5=\log_2\sqrt{x}$, then x equals

a) Odd integer b) Prime number c) Composite number d) Irrational

216. The value of $49^{(1-\log_7 2)}+5^{-\log_5 4}$ is

a) 27/2 b) 25/2 c) 625/16 d) None of these

217. If A and B are acute positive angles satisfying the equations $3\sin^2 A+2\sin^2 B=1$ and $3\sin 2A-2\sin 2B=0$, then A+2 B is equal to

a) π b) $\frac{\pi}{2}$ c) $\frac{\pi}{4}$ d) $\frac{\pi}{6}$

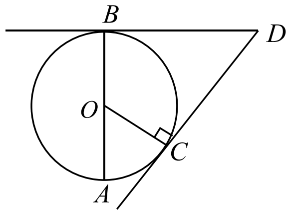
218. If the equation $2^x+4^y=2^y+4^x$ is solved for y in terms of x, where $x<0$, then the sum of the solutions is

a) $x\log_2(1-2^x)$ b) $x+\log_2(1-2^x)$ c) $\log_2(1-2^x)$ d) $x\log_2(2^x+1)$

219. If $\tan x=n\tan y, n\in R^+$, then the maximum value of $sec^2(x-y)$ is equal to

a) $\frac{(n+1)^2}{2n}$ b) $\frac{(n+1)^2}{n}$ c) $\frac{(n+1)^2}{2}$ d) $\frac{(n+1)^2}{4n}$

220. In the given figure, AB is the diameter of the circle, centered at $'O'$. If $\angle COA=60°, AB=2r, AC=d$ and $CD=l$, then l is equal to



a) $d\sqrt{3}$ b) $d/\sqrt{3}$ c) $3d$ d) $\sqrt{3}d/2$

221. In triangle ABC, if $A-B=120°$ and $R=8r$ where R and r have their usual meaning, then $\cos C$ equals

a) 3/4 b) 2/3 c) 5/6 d) 7/8

222. The solution of $4\sin^2 x+\tan^2 x+\text{cosec}^2 x+\cot^2 x-6=0$ is

a) $n\pi\pm\frac{\pi}{4}$ b) $2n\pi\pm\frac{\pi}{4}$ c) $n\pi+\frac{\pi}{3}$ d) $n\pi-\frac{\pi}{6}$

223. If in a ΔABC, $\cos 3A+\cos 3B+\cos 3C=1$, then one angle must be exactly equal to

a) 90° b) 45° c) 120° d) None of these

224. The greatest value of $\sin^4\theta+\cos^4\theta$ is

a) 1/2 b) 1 c) 2 d) 3

225. In triangle ABC, $\frac{a}{b}=\frac{2}{3}$ and $\sec^2 A=\frac{8}{5}$. Then the number of triangles satisfying these conditions is

a) 0 b) 1 c) 2 d) 3

226. If $(21.4)^a=(0.00214)^b=100$, then the value of $\frac{1}{b}-\frac{1}{b}$ is

a) 0 b) 1 c) 2 d) 4

227. Complete the set of values of x in $(0,\pi)$ satisfying the equation $1+\log_2\sin x+\log_2\sin 3x\ge 0$ is

a) $\left(\frac{2\pi}{3},\frac{3\pi}{4}\right]$ b) $\left(\frac{\pi}{3},\frac{2\pi}{3}\right)$ c) $\left(0,\frac{\pi}{2}\right)\cup\left(\frac{2\pi}{3},\pi\right)$ d) $\left(\frac{\pi}{2},\frac{2\pi}{3}\right)$

228. The numerical value of $\tan\frac{\pi}{3}+2\tan\frac{2\pi}{3}+4\tan\frac{4\pi}{3}+8\tan\frac{8\pi}{3}$ is equal to

a) $-5\sqrt{3}$ b) $-5/\sqrt{3}$ c) $5\sqrt{3}$ d) $5/\sqrt{3}$

229. If $0 \leq x \leq 2\pi$, then the number of solutions of $3(\sin x + \cos x) - 2(\sin^3 x + \cos^3 x) = 8$ is

a) 0 b) 1 c) 2 d) 4

230. In triangle $ABC, a^2 + c^2 = 2002b^2$, then $\frac{\cot A + \cot C}{\cot B}$ is equal to

a) $\frac{1}{2001}$ b) $\frac{2}{2001}$ c) $\frac{3}{2001}$ d) $\frac{4}{2001}$

231. If $2 \sec 2\theta = \tan \phi + \cot \phi$, then one of the values of $\theta + \phi$ is

a) $\pi/2$ b) $\pi/4$ c) $\pi/3$ d) None of these

232. $\frac{\sqrt{2} - \sin \alpha - \cos \alpha}{\sin \alpha - \cos \alpha}$ is equal to

a) $\sec\left(\frac{\alpha}{2} - \frac{\pi}{8}\right)$ b) $\cos\left(\frac{\pi}{8} - \frac{\alpha}{2}\right)$ c) $\tan\left(\frac{\alpha}{2} - \frac{\pi}{8}\right)$ d) $\cot\left(\frac{\alpha}{2} - \frac{\pi}{2}\right)$

233. If $A = \sin 45° + \cos 45°$ and $B = \sin 44° + \cos 44°$, then

a) $A > B$ b) $A < B$ c) $A = B$ d) None of these

234. If the inequality $\sin^2 x + a \cos x + a^2 > 1 + \cos x$ holds for any $x \in R$ then the largest negative integral value of $'a'$ is

a) -4 b) -3 c) -2 d) -1

235. If $\frac{1 + \sin 2x}{1 - \sin 2x} = \cot^2(a + x) \, \forall x \in R \sim \left(n\pi + \frac{\pi}{4}\right), n \in N$, then a can be

a) $\frac{\pi}{4}$ b) $\frac{\pi}{2}$ c) $\frac{3\pi}{4}$ d) None of these

236. If A, B, C are angles of a triangle, then $2 \sin \frac{A}{2} \operatorname{cosec} \frac{B}{2} \sin \frac{C}{2} - \sin A \cot \frac{B}{2} - \cos A$ is

a) Independent of A, B, C b) Function of A, B

c) Function of C d) None of these

237. If $\tan^2 \alpha \tan^2 \beta + \tan^2 \beta \tan^2 \gamma + \tan^2 \gamma \tan^2 \alpha + 2 \tan^2 \alpha \tan^2 \beta \tan^2 \gamma = 1$, then the value of $\sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma$ is

a) 3 b) 2 c) 1 d) None of these

238. The ratio of the area of a regular polygon of n sides inscribed in a circle to that of the polygon of same number of sides circumscribing the same circle is 3: 4. Then the value of n is

a) 6 b) 4 c) 8 d) 12

239. Which of the following is true for $z = (3 + 2i \sin \theta)/(1 - 2\,i \sin \theta)$, where $i = \sqrt{-1}$

a) z is purely real for $\theta = n\pi \pm \pi/3, n \in Z$

b) z is purely imaginary for $\theta = n\pi \pm \pi/2, n \in Z$

c) z is purely real for $\theta = n\pi, n \in Z$

d) None of these

240. In any triangle, the minimum value of $r_1 r_2 r_3 / r^3$ is equal to

a) 1 b) 9 c) 27 d) None of these

241. The equation $\sin^4 x + \cos^4 x + \sin 2x + \alpha = 0$ is solvable for

a) $-5/2 \leq \alpha \leq 1/2$ b) $-3 \leq \alpha \leq 1$ c) $-3/2 \leq \alpha \leq 1/2$ d) $-1 \leq \alpha \leq 1$

242. If $\frac{\sin x}{a} = \frac{\cos x}{b} = \frac{\tan x}{c} = k$, then $bc + \frac{1}{ck} + \frac{ak}{1 + bk}$ is equal to

a) $k\left(a + \frac{1}{a}\right)$ b) $\frac{1}{k}\left(a + \frac{1}{a}\right)$ c) $\frac{1}{k^2}$ d) $\frac{a}{k}$

243. If $\tan A = \dfrac{1 - \cos B}{\sin B}$, then $\tan 2A$ is

a) $\tan 2A = \tan B$ b) $\tan 2A = \tan^2 B$

c) $\tan 2A = \tan^2 B + 2 \tan B$ d) None of these

244. The number of roots of the equation $\log_{3\sqrt{x}} x + \log_{3x} \sqrt{x} = 0$ is

a) 1 b) 2 c) 3 d) 0

245. If $\frac{x}{\cos \theta} = \frac{y}{\cos\left(\theta - \frac{2\pi}{3}\right)} = \frac{z}{\cos\left(\theta + \frac{2\pi}{3}\right)}$, then $x + y + z$ is equal to

a) 1 b) 0 c) -1 d) None of these

246. The general value of x satisfying the equation $2 \cot^2 x + 2\sqrt{3} \cot x + 4 \operatorname{cosec} x + 8 = 0$ is

a) $n\pi - \dfrac{\pi}{6}, n \in Z$ b) $n\pi + \dfrac{\pi}{6}, n \in Z$ c) $2n\pi - \dfrac{\pi}{6}, n \in Z$ d) $2n\pi + \dfrac{\pi}{6}, n \in Z$

247. If x, y, z are in A. P, then $\dfrac{\sin x - \sin z}{\cos z - \cos x}$ is equal to

a) $\tan y$ b) $\cot y$ c) $\sin y$ d) $\cos y$

248. In ΔABC, if $A = 30°, b = 2, c = \sqrt{3} + 1$, then $\frac{C-B}{2}$ is equal to

a) $15°$ b) $30°$ c) $45°$ d) None of these

249. In triangle ABC, $\sin A$, $\sin B$ and $\sin C$ are in A.P, then

a) The altitudes are in H.P.

b) The altitudes are in A.P.

c) The altitudes are in G.P.

d) None of these

250. The value of the expression $\frac{2(\sin 1° + \sin 2° + \sin 3° + \cdots + \sin 89°)}{2(\cos 1° + \cos 2° + \cdots + \cos 44°) + 1}$ equals

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

251. Product of roots of the equation $\frac{\log_8(8/x^2)}{(\log_8 x)^2} = 3$ is

a) 1 b) 1/2 c) 1/3 d) 1/4

252. $\sec^2 \theta = \frac{4xy}{(x+y)^2}$ is true if and only if

a) $x + y \neq 0$ b) $x = y, x \neq 0$ c) $x = y$ d) $x \neq 0, y \neq 0$

253. If x_1 and x_2 are the roots of the equation $e^2 . x^{\ln x} = x^3$ with $x_1 > x_2$, then

a) $x_1 = 2x_2$ b) $x_1 = x_2^2$ c) $2x_1 = x_2^2$ d) $x_1^2 = x_2^3$

254. If $\cos p\theta + \cos q\theta = 0$, then the different values of θ are in A.P. where the common difference is

a) $\dfrac{\pi}{p+q}$ b) $\dfrac{\pi}{p-q}$ c) $\dfrac{2\pi}{p+q}$ d) $\dfrac{3\pi}{p \pm q}$

255. If $\cos^2 A + \cos^2 B + \cos^2 C = 1$, then ΔABC is

a) Equilateral b) Isosceles c) Right angled d) None of these

256. The total number of solution of $\sin^4 x + \cos^4 x = \sin x \cos x$ in $[0, 2\pi]$ is equal to

a) 2 b) 4 c) 6 d) None of these

257. If $\tan x = b/a$, then $\sqrt{(a+b)/(a-b)} + \sqrt{(a-b)/(a+b)}$ is equal to

a) $2 \sin x / \sqrt{\sin 2x}$ b) $2 \cos x / \sqrt{\cos 2x}$ c) $2 \cos x / \sqrt{\sin 2x}$ d) $2 \sin x / \sqrt{\cos 2x}$

258. Number of ordered pair(s)(a, b) for each of which the equality $a(\cos x - 1) + b^2 = \cos(ax + b^2) - 1$ holds true for all $x \in R$ are

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

259. We are given b, c and $\sin B$ such that B is acute and $b < c \sin B$. Then

a) No triangle is possible b) One triangle is possible

c) Two triangles are possible d) A right-angled triangle is possible

260. In triangle ABC, $a = 5, b = 4$ and $c = 3$. G is the centroid of the triangle. Circumradius of triangle GAB is equal to

a) $2\sqrt{13}$ b) $\dfrac{5}{12}\sqrt{13}$ c) $\dfrac{5}{3}\sqrt{13}$ d) $\dfrac{3}{2}\sqrt{13}$

261. In any triangle ABC, $\frac{a^2+b^2+c^2}{R^2}$ has the maximum value of

a) 3 b) 6 c) 9 d) None of these

262. The set of values of θ satisfying the inequation $2\sin^2 \theta - 5 \sin \theta + 2 > 0$, where $0 < \theta < 2\pi$, is

a) $\left(0, \dfrac{\pi}{6}\right) \cup \left(\dfrac{5\pi}{6}, 2\pi\right)$ b) $\left[0, \dfrac{\pi}{6}\right] \cup \left[\dfrac{5\pi}{6}, 2\pi\right]$ c) $\left[0, \dfrac{\pi}{3}\right] \cup \left[\dfrac{2\pi}{3}, 2\pi\right]$ d) None of these

263. If $\sin \theta_1 + \sin \theta_2 + \sin \theta_3 = 3$, thencos $\theta_1 + \cos \theta_2 + \cos \theta_3$ is equal to

a) 3 b) 2 c) 1 d) 0

264. The sum of all roots of $\sin\left(\pi \log_3 \left(\frac{1}{x}\right)\right) = 0$ in $(0, 2\pi)$ is

a) 3/2 b) 4 c) 9/2 d) 13/3

265. Which of the following is not the value of $\sin 27° - \cos 27°$?

a) $-\frac{\sqrt{3-\sqrt{5}}}{2}$ b) $-\frac{\sqrt{5-\sqrt{5}}}{2}$ c) $-\frac{\sqrt{5}-1}{2\sqrt{2}}$ d) None of these

266. One of the general solutions of $4\sin^4 x + \cos^4 x = 1$ is

a) $n\pi \pm \alpha/2, \alpha = \cos^{-1}(1/5), \forall\, n \in Z$

b) $n\pi \pm \alpha/2, \alpha = \cos^{-1}(3/5), \forall\, n \in Z$

c) $2n\pi \pm \alpha/2, \alpha = \cos^{-1}(1/3), \forall\, n \in Z$

d) None of these

267. Let α and β be such that $\pi < \alpha - \beta < 3\pi$. If $\sin\alpha + \sin\beta = -\frac{21}{65}$ and $\cos\alpha + \cos\beta = -\frac{17}{65}$, then the value of $\cos\frac{\alpha-\beta}{2}$ is

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

268. If a, b and c are the sides of a triangle, then the minimum value of $\frac{2a}{b+c-a} + \frac{2b}{c+a-b} + \frac{2c}{a+b-c}$ is

a) 3 b) 9 c) 6 d) 1

269. The number of solutions of the equation $\sin^3 x \cos x + \sin^2 x \cos^2 x + \sin x \cos^3 x = 1$, in the interval $[0, 2\pi]$, is

a) 4 b) 2 c) 1 d) 0

270. The sum of all the solution of $\cot\theta = \sin 2\theta$, ($\theta \neq n\pi, n$ integer), $0 \le \theta \le \pi$ is

a) $3\pi/2$ b) π c) $3\pi/4$ d) 2π

271. If $(x+1)^{\log_{10}(x+1)} = 100(x+1)$, then

a) All the roots are positive real numbers.

b) All the roots lie in the interval $(0, 100)$

c) All the roots lie in the interval $[-1, 99]$

d) None of these

272. If $a^4 . b^5 = 1$, then the value of $\log_a(a^5 b^4)$ equals

a) $9/5$ b) 4 c) 5 d) $8/5$

273. $\frac{\sin 3\theta + \sin 5\theta + \sin 7\theta + \sin 9\theta}{\cos 3\theta + \cos 5\theta + \cos 7\theta + \cos 9\theta}$ is equal to

a) $\tan 3\theta$ b) $\cot 3\theta$ c) $\tan 6\theta$ d) $\cot 6\theta$

274. If the inequality $\sin^2 x + a\cos x + a^2 > 1 + \cos x$ holds for any $x \in R$, then the largest negative integral value of a is

a) -4 b) -3 c) -2 d) -1

275. The total number of solutions of $|\cot x| = \cot x + \frac{1}{\sin x}, x \in [0, 3\pi]$ is equal to

a) 1 b) 2 c) 3 d) 0

276. If in $\Delta ABC, 8R^2 = a^2 + b^2 + c^2$, then the triangle ABC is

a) Right angled b) Isosceles c) Equilateral d) None of these

277. $\sin x + \cos x = y^2 - y + a$ has no value of x for any value of y if a belongs to

a) $(0, \sqrt{3})$ b) $(-\sqrt{3}, 0)$ c) $(-\infty, -\sqrt{3})$ d) $(\sqrt{3}, \infty)$

278. If $\log_4 5 = a$ and $\log_5 6 = b$, then $\log_3 2$ is equal to

a) $\frac{1}{2a+1}$ b) $\frac{1}{2b+1}$ c) $2ab+1$ d) $\frac{1}{2ab-1}$

279. The smallest +ve x satisfying the equation $\log_{\cos x}\sin x + \log_{\sin x}\cos x = 2$ is

a) $\pi/2$ b) $\pi/3$ c) $\pi/4$ d) $\pi/6$

280. If $\alpha + \beta = \pi/2$ and $\beta + \gamma = \alpha$, then $\tan\alpha$ equals

a) $2(\tan\beta + \tan\gamma)$ b) $\tan\beta + \tan\gamma$ c) $\tan\beta + 2\tan\gamma$ d) $2\tan\beta + \tan\gamma$

281. The value of $\cos\frac{\pi}{7} + \cos\frac{2\pi}{7} + \cos\frac{3\pi}{7} + \cos\frac{4\pi}{7} + \cos\frac{5\pi}{7} + \cos\frac{6\pi}{7} + \cos\frac{7\pi}{7}$ is

a) 1 b) -1 c) 0 d) None of these

282. If $\cos x = \dfrac{2\cos y - 1}{2 - \cos y}$, where $x, y \in (0, \pi)$, then $\tan\dfrac{x}{2}\cot\dfrac{y}{2}$ is equal to

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

283. The value of expression $\sqrt{3}\text{cosec } 20° - \sec 20°$is equal to

a) 2 b) $2\sin 20°/\sin 40°$ c) 4 d) $4\sin 20°/\sin 40°$

284. In triangle $ABC, \angle ABC = 120°, AB = 3$ and $BC = 4$. If perpendicular constructed to the side AB at A and to the side BC at C meets at D, then CD is equal to

a) 3 b) $\dfrac{8\sqrt{3}}{3}$ c) 5 d) $\dfrac{10\sqrt{3}}{3}$

285. The equation $(\cos p - 1)x^2 + (\cos p)x + \sin p = 0$ in the variable x has real roots. Then p can take any value in the interval

a) $(0, 2\pi)$ b) $(-\pi, 0)$ c) $\left(-\dfrac{\pi}{2}, \dfrac{\pi}{2}\right)$ d) $(0, \pi)$

286. The equation $\sin x(\sin x + \cos x) = k$ has real solutions if and only if k is a real number such that

a) $0 \le k \le \dfrac{1+\sqrt{2}}{2}$ b) $2-\sqrt{3} \le k \le 2+\sqrt{3}$ c) $0 \le k \le 2-\sqrt{3}$ d) $\dfrac{1-\sqrt{2}}{2} \le k \le \dfrac{1+\sqrt{2}}{2}$

287. If a, b and A are given in a triangle and c_1, c_2 are the possible values of the third side, then $c_1^2 + c_2^2 - 2c_1c_2\cos A =$ is equal to

a) $4a^2\sin 2A$ b) $4a^2\sin^2 A$ c) $4a^2\cos 2A$ d) $4a^2\cos^2 A$

288. In triangle ABC, if $r_1 = 2r_2 = 3r_3$, then $a : b$ is equal to

a) $\dfrac{5}{4}$ b) $\dfrac{4}{5}$ c) $\dfrac{7}{4}$ d) $\dfrac{4}{7}$

289. If $\text{cosec }\theta - \cot\theta = q$, then the value of $\text{cosec }\theta$ is

a) $q + \dfrac{1}{q}$ b) $q - \dfrac{1}{q}$ c) $\dfrac{1}{2}\left(q + \dfrac{1}{q}\right)$ d) None of these

290. $\tan 20° + \tan 40° + \sqrt{3}\tan 20°\tan 40°$ is equal to

a) $\dfrac{1}{\sqrt{3}}$ b) $\sqrt{3}$ c) $-\dfrac{1}{\sqrt{3}}$ d) $-\sqrt{3}$

291. If $(1 + \tan\alpha)(1 + \tan 4\alpha) = 2, \alpha \in (0, \pi/16)$ then α is equal to

a) $\dfrac{\pi}{20}$ b) $\dfrac{\pi}{30}$ c) $\dfrac{\pi}{40}$ d) $\dfrac{\pi}{60}$

292. Given $A = \sin^2\theta + \cos^2\theta$, then for all real θ,

a) $1 \le A \le 2$ b) $3/4 \le A \le 1$ c) $13/16 \le A \le 1$ d) $3/4 \le A \le 13/16$

293. In $\Delta ABC, \sin A + \sin B + \sin C = 1 + \sqrt{2}$ and $\cos A + \cos + \cos C = \sqrt{2}$ if the triangle is

a) Equilateral b) Isosceles
c) Right angled d) Right-angled isosceles

294. The equation $\sin^2\theta = \frac{x^2+y^2}{2xy}$ is possible if

a) $x = y$ b) $x = -y$ c) $2x = y$ d) None of these

295. If $\tan\beta = 2\sin\alpha\sin\gamma\ \text{cosec}(\alpha + \gamma)$, then $\cot\alpha, \cot\beta, \cot\gamma$ are in

a) A.P. b) G.P. c) H.P. d) None of these

296. Let area of triangle ABC is $(\sqrt{3} - 1)/2, b = 2$ and $c = (\sqrt{3} - 1)$ and $\angle A$ is acute. The measure of the angle C is

a) 15° b) 30° c) 60° d) 75°

297. $\dfrac{\sin 2A + \sin 2B + \sin 2C}{\sin A + \sin B + \sin C}$ is equal to

a) $8\sin\dfrac{A}{2}\sin\dfrac{B}{2}\sin\dfrac{C}{2}$ b) $8\cos\dfrac{A}{2}\cos\dfrac{B}{2}\cos\dfrac{C}{2}$ c) $8\tan\dfrac{A}{2}\tan\dfrac{B}{2}\tan\dfrac{C}{2}$ d) $8\cot\dfrac{A}{2}\cot\dfrac{B}{2}\cot\dfrac{C}{2}$

298. 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

299. If $\sin(\alpha+\beta)=1, \sin(\alpha-\beta)=\frac{1}{2}$, then $\tan(\alpha+2\beta)\tan(2\alpha+\beta)$ is equal to, $\alpha,\beta\in(0,\pi/2)$

a) 1 b) -1 c) 0 d) None of these

300. The general solution of $\tan\theta+\tan 2\theta+\tan 3\theta=0$ is

a) $\theta=n\pi/6, n\in Z$ b) $\theta=n\pi\pm\alpha, n\in Z$, where $\tan\alpha=1/\sqrt{2}$

c) Both a and b d) None of these

301. The number of solutions of $2\sin^2 x+\sin^2 2x=2, x\in[0,2\pi]$ is

a) 4 b) 5 c) 7 d) 6

302. The minimum vertical distance between the graphs of $y=2+\sin x$ and $y=\cos x$ is

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

303. The equation $\cos^8 x+b\cos^4 x+1=0$ will have a solution if b belongs to

a) $(-\infty,2]$ b) $[2,\infty)$ c) $(-\infty,-2]$ d) None of these

304. If $\sin^2\theta=\frac{x^2+y^2+1}{2x}$, then x must be

a) -3 b) -2 c) 1 d) None of these

305. $\frac{1}{4}\left[\sqrt{3}\cos 23°-\sin 23°\right]$ is equal to

a) $\cos 43°$ b) $\cos 7°$ c) $\cos 53°$ d) None of these

306. Number of solutions of $\tan\left(\frac{\pi}{2}\sin\theta\right)=\cot\left(\frac{\pi}{2}\cos\theta\right), \theta\in[0,6\pi]$, is

a) 5 b) 7 c) 4 d) 5

307. In ΔABC, if $\sin^2\frac{A}{2}, \sin^2\frac{B}{2}$ and $\sin^2\frac{C}{2}$ are in H.P., then a, b and c will be in

a) A.P. b) G.P. c) H.P. d) None of these

308. Number of ordered pairs which satisfy the equation $x^2+2x\sin(xy)+1=0$ are (where $y\in[0,2\pi]$)

a) 1 b) 2 c) 3 d) 0

309. Let $a>1$ be a real number. Then the number of roots equation $a^{2\log_2 x}=5+4x^{\log_2 a}$ has

a) 2 b) Infinite c) 0 d) 1

310. If $\log_2 x+\log_2 y\geq 6$, then the least value of $x+y$ is

a) 4 b) 8 c) 16 d) 32

311. In $\Delta ABC, a, b, A$ are given and c_1, c_2 are two values of the third side c. The sum of the areas of the two triangles with sides a, b, c_1 and a, b, c_2 is

a) $(1/2)b^2\sin 2A$ b) $(1/2)a^2\sin 2A$ c) $b^2\sin 2A$ d) None of these

312. In triangle ABC, line joining the circumcentre and orthocenter is parallel to side AC, then the value of $\tan A\tan C$ is equal to

a) $\sqrt{3}$ b) 3 c) $3\sqrt{3}$ d) None of these

313. In a convex quadrilateral $ABCD, AB=a, BC=b, CD=c$ and $DA=d$. This quadrilateral is such that a circle can be inscribed in it and a circle can be also circumscribed about it, then $\tan^2(A/2)$ is equal to

a) $\frac{ad}{bc}$ b) $\frac{ab}{cd}$ c) $\frac{cd}{ab}$ d) $\frac{bc}{ad}$

314. The number of solutions of the equation $\tan x+\sec x-2\cos x$ lying in the interval $[0,2\pi]$ is

a) 0 b) 1 c) 2 d) 3

315. If $\log_y x+\log_x y=1, x^2+y=12$, then the value of xy is

a) 9 b) 12 c) 15 d) 21

316. If $\log_3\{5+4\log_3(x-1)\}=2$, then x is equal to

a) 2 b) 4 c) 8 d) $\log_2 16$

317. If $\log_a 3=2$ and $\log_b 8=3$, then $\log_a b$ is

a) $\log_3 2$ b) $\log_2 3$ c) $\log_3 4$ d) $\log_4 3$

318. General solution of $\tan\theta+\tan 4\theta+\tan 7\theta=\tan\theta\tan 4\theta\tan 7\theta$ is

a) $\theta = n\pi/12$, where $n \in Z$
b) $\theta = n\pi/9$, where $n \in Z$
c) $\theta = n\pi + \pi/12$, where $n \in Z$
d) None of these

319. If I is the incentre of a triangle ABC, then the ratio $IA:IB:IC$ is equal to
a) $\text{cosec}\frac{A}{2}:\text{cosec}\frac{B}{2}:\text{cosec}\frac{C}{2}$
b) $\sin\frac{A}{2}:\sin\frac{B}{2}:\sin\frac{C}{2}$
c) $\sec\frac{A}{2}:\sec\frac{B}{2}:\sec\frac{C}{2}$
d) None of these

320. If $xy^2 = 4$ and $\log_3(\log_2 x) + \log_{1/3}(\log_{1/2} y) = 1$, then x equals
a) 4
b) 8
c) 16
d) 64

321. If α is a root of $25\cos^2\theta + 5\cos\theta - 12 = 0, \frac{\pi}{2} < \alpha < \pi$, then $\sin 2\alpha$ is equal to
a) $\frac{24}{25}$
b) $-\frac{24}{25}$
c) $\frac{13}{18}$
d) $-\frac{13}{18}$

322. The general solution of the equation $8\cos x\cos 2x\cos 4x = \sin 6x / \sin x$ is
a) $x = (n\pi/7) + (\pi/21), \forall n \in Z$
b) $x = (2\pi/7) + (\pi/14), \forall n \in Z$
c) $x = (n\pi/7) + (\pi/14), \forall n \in Z$
d) $x = (n\pi) + (\pi/14), \forall n \in Z$

323. The total number of solutions of $\ln|\sin x| = -x^2 + 2x$ in $\left[-\frac{\pi}{2}, \frac{3\pi}{2}\right]$ is equal to
a) 1
b) 2
c) 4
d) None of these

324. In triangle $ABC, \frac{\sin A + \sin B + \sin C}{\sin A + \sin B - \sin C}$ is equal to
a) $\tan\frac{A}{2}\cot\frac{B}{2}$
b) $\cot\frac{A}{2}\tan\frac{B}{2}$
c) $\cot\frac{A}{2}\cot\frac{B}{2}$
d) $\tan\frac{A}{2}\tan\frac{B}{2}$

325. The value of $\left(1+\cos\frac{\pi}{8}\right)\left(1+\cos\frac{3\pi}{8}\right)\left(1+\cos\frac{5\pi}{8}\right)\left(1+\cos\frac{7\pi}{8}\right)$ is
a) 1/4
b) 3/4
c) 1/8
d) 3/8

326. If $x, y \in [0, 2\pi]$ and $\sin x + \sin y = 2$, then the value of $x + y$ is
a) π
b) $\pi/2$
c) 3π
d) None of these

327. The set of all x in $\left(\frac{-\pi}{2}, \frac{\pi}{2}\right)$ satisfying $|4\sin x - 1| < \sqrt{5}$ is given by
a) $\left(-\frac{\pi}{10}, \frac{3\pi}{10}\right)$
b) $\left(\frac{\pi}{10}, \frac{3\pi}{10}\right)$
c) $\left(\frac{\pi}{10}, \frac{3\pi}{10}\right)$
d) None of these

328. For $n \in Z$, the general solution of $(\sqrt{3}-1)\sin\theta + (\sqrt{3}+1)\cos\theta = 2$ is $(n \in Z)$
a) $\theta = 2n\pi \pm \frac{\pi}{4} + \frac{\pi}{12}$
b) $\theta = n\pi + (-1)^n\frac{\pi}{4} + \frac{\pi}{12}$
c) $\theta = 2n\pi \pm \frac{\pi}{4}$
d) $\theta = n\pi + (-1)^n\frac{\pi}{4} - \frac{\pi}{12}$

329. $\sin^{2n} x + \cos^{2n} x$ lies between
a) -1 and 1
b) 0 and 1
c) 1 and 2
d) None of these

330. Number of roots of $(1-\tan\theta)(1+\sin 2\theta) = 1 + \tan\theta$ for $\theta \in [0, 2\pi]$ is
a) 3
b) 4
c) 5
d) None of these

331. The number of solutions of $\sum_{r=1}^{5}\cos r\,x = 5$ in the interval $[0, 2\pi]$ is
a) 0
b) 2
c) 5
d) 10

332. If $\tan 3\theta + \tan\theta = 2\tan 2\theta$, then θ is equal to $(n \in Z)$
a) $n\pi$
b) $\frac{n\pi}{4}$
c) $2n\pi$
d) None of these

333. If $\frac{\sin x}{\sin y} = \frac{1}{2}, \frac{\cos x}{\cos y} = \frac{3}{2}$ where $x, y \in \left(0, \frac{\pi}{2}\right)$, then the value of $(x+y)$ is equal to
a) $\sqrt{13}$
b) $\sqrt{14}$
c) $\sqrt{17}$
d) $\sqrt{15}$

334. In any ΔABC, the value of
$a(b^2+c^2)\cos A + b(c^2+a^2)\cos B + c(a^2+b^2)\cos C =$
a) $3abc^2$
b) $3a^2bc$
c) $3abc$
d) $3\,ab^2c$

335. For triangle $ABC, R = 5/2$ and $r = 1$. Let I be the incentre of the triangle and D, E and F be the feet of the

perpendiculars from I to BC, CA and AB, respectively. The value of $\frac{ID\times IE\times IF}{IA\times IB\times IC}$ is equal to

a) $\frac{5}{2}$ b) $\frac{5}{4}$ c) $\frac{1}{10}$ d) $\frac{1}{5}$

336. Given $b = 2, c = \sqrt{3}, \angle A = 30°$, then inradius of ΔABC is

a) $\frac{\sqrt{3}-1}{2}$ b) $\frac{\sqrt{3}+1}{2}$ c) $\frac{\sqrt{3}-1}{4}$ d) None of these

337. If θ_1 and θ_2 are two values lying in $[0, 2\pi]$ for which $\tan\theta = \lambda$, then $\tan\frac{\theta_1}{2}\tan\frac{\theta_2}{2}$ is equal to

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

338. Number of roots of $\cos^2 x + \frac{\sqrt{3}+1}{2}\sin x - \frac{\sqrt{3}}{4} - 1 = 0$ which lie in the interval $[-\pi, \pi]$ is

a) 2 b) 4 c) 6 d) 8

339. If $\tan\alpha$ is equal to the integral solution of the inequality $4x^2 - 16x + 15 < 0$ and $\cos\beta$ is equal to the slope of the bisector of the first quadrant, then $\sin(\alpha+\beta)\sin(\alpha-\beta)$ is equal to

a) $\frac{3}{5}$ b) $\frac{3}{5}$ c) $\frac{2}{\sqrt{5}}$ d) $\frac{4}{5}$

340. $\tan 100° + \tan 125° + \tan 100° \tan 125°$ is equal to

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

341. If $\pi < \alpha < \frac{3\pi}{2}$, then $\sqrt{\frac{1-\cos\alpha}{1+\cos\alpha}} + \sqrt{\frac{1+\cos\alpha}{1-\cos\alpha}}$ is equal to

a) $\frac{2}{\sin\alpha}$ b) $-\frac{2}{\sin\alpha}$ c) $\frac{1}{\sin\alpha}$ d) $-\frac{1}{\sin\alpha}$

342. Equation $\log_4(3-x) + \log_{0.25}(3+x) = \log_4(1-x) + \log_{0.25}(2x+1)$ has

a) Only one prime solution b) Two real solutions
c) No real solution d) None of these

343. Given that $\log(2) = 0.3010$ …, the number of digits in the number 2000^{2000} is

a) 6601 b) 6602 c) 6603 d) 6604

344. If $\sin\theta + \cos\theta = \frac{1}{5}$ and $0 \le \theta < \pi$, then $\tan\theta$ is

a) $-4/3$ b) $-3/4$ c) $3/4$ d) $4/3$

345. If $\cos(A-B) = 3/5$ and $\tan A \tan B = 2$, then

a) $\cos A\cos B = 1/5$ b) $\sin A\sin B = -2/5$ c) $\cos A\cos B = -1/5$ d) $\sin A\sin B = -1/5$

346. If $\cos\alpha + \cos\beta = 0$ $\sin\alpha + \sin\beta$, thencos $2\alpha + \cos 2\beta$ is equal to

a) $-2\sin(\alpha+\beta)$ b) $-2\cos(\alpha+\beta)$ c) $2\sin(\alpha+\beta)$ d) $2\cos(\alpha+\beta)$

347. In triangle $ABC, \angle C = 2\pi/3$ and CD is the internal angle bisector of $\angle C$, meeting the side AB at D. Length CD is equal to

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

348. In triangle $ABC, \angle B = \pi/3$ and $\angle C = \pi/4$. Let D divide BC internally in the ratio 1:3. Then $\frac{\sin\angle BAD}{\sin\angle CAD}$ equals

a) $\frac{1}{\sqrt{5}}$ b) $\frac{1}{3}$ c) $\frac{1}{\sqrt{3}}$ d) $\sqrt{\frac{2}{3}}$

349. Let $\theta \in \left(0, \frac{\pi}{4}\right)$ and $t_1 = (\tan\theta)^{\tan\theta}, t_2 = (\tan\theta)^{\cot\theta}, t_3 = (\cot\theta)^{\tan\theta}$ and $t_4 = (\cot\theta)^{\tan\theta}$, then

a) $t_1 > t_2 > t_3 > t_4$ b) $t_4 > t_3 > t_1 > t_2$ c) $t_3 > t_1 > t_2 > t_4$ d) $t_2 > t_3 > t_1 > t_4$

350. If D is the mid-point of the side BC of triangle ABC and AD is perpendicular to AC, then

a) $3b^2 = a^2 - c^2$ b) $3a^2 = b^2 - 3c^2$ c) $b^2 = a^2 - c^2$ d) $a^2 + b^2 = 5c^2$

351. If A, B and C are angles of a triangle such that angle A is obtuse, then $\tan B\tan C$ will be less than

a) $\frac{1}{\sqrt{3}}$ b) $\frac{\sqrt{3}}{2}$ c) 1 d) None of these

352. ABC is an equilateral triangle of side 4 cm. If R, r and h are the circumradius, inradius and altitude, respectively, then $\frac{R+r}{h}$ is equal to

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

353. One of the general solutions of $\sqrt{3}\cos\theta - 3\sin\theta = 4\sin 2\theta \cos 3\theta$ is

a) $m\pi + \pi/18, m \in Z$ b) $m\pi/2 + \pi/6, \forall\, m \in Z$ c) $m\pi/3 + \pi/18, m \in Z$ d) None of these

354. In $\Delta ABC, a^2 + b^2 + c^2 = ac + ab\sqrt{3}$, then the triangle is

a) Equilateral b) Isosceles c) Right angled d) None of these

355. The least value of $2\sin^2\theta + 3\cos^2\theta$ is

a) 1 b) 2 c) 3 d) 5

356. In triangle ABC, let $\angle C = \pi/2$. If r is the inradius and R is circumradius of the triangle, then $2(r + R)$ is equal to

a) $a + b$ b) $b + c$ c) $c + a$ d) $a + b + c$

357. The number of pairs of integer (x, y) that satisfy the following two equations $\begin{cases}\cos(xy) = x \\ \tan(xy) = y\end{cases}$ is

a) 1 b) 2 c) 4 d) 6

358. In ΔABC, the bisector of the angle A meets the side BC at D and the circumscribed circle at E, then DE equals

a) $\frac{a^2 \sec\frac{A}{2}}{2(b+c)}$ b) $\frac{a^2 \sin\frac{A}{2}}{2(b+c)}$ c) $\frac{a^2 \cos\frac{A}{2}}{2(b+c)}$ d) $\frac{a^2 \operatorname{cosec}\frac{A}{2}}{2(b+c)}$

359. The total number of solutions of $\tan x + \cot x = 2\operatorname{cosec} x$ in $[-2\pi, 2\pi]$ is

a) 2 b) 4 c) 6 d) 8

360. In a right-angled isosceles triangle, the ratio of the circumradius and inradius is

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

361. Let $y = (\sin x + \operatorname{cosec} x)^2 + (\cos x + \sec x)^2 + (\cos x + \sec x)^2$, then the minimum value of $y, \forall x \in R$, is

a) 7 b) 3 c) 9 d) 0

362. In triangle $ABC, R(b + c) = a\sqrt{bc}$ where R is the circumradius of the triangle. Then the triangle is

a) Isosceles but not right b) Right but not isosceles

c) Right isosceles d) Equilateral

363. Assume that θ is a rational multiple of π such that $\cos\theta$ is a distinct rational. Number of values of $\cos\theta$ is

a) 3 b) 4 c) 5 d) 6

364. Value of $\frac{3+\cot 80° \cot 20°}{\cot 80° + \cot 20°}$ is equal to

a) $\cos 20°$ b) $\tan 50°$ c) $\cot 50°$ d) $\cot\sqrt{20°}$

365. Two medians drawn from the acute angles of a right-angled triangle intersect at an angle $\pi/6$. If the length of the hypotenuse of the triangle is 3 units, then the area of the triangle (in sq. units) is

a) $\sqrt{3}$ b) 3 c) $\sqrt{2}$ d) 9

Multiple Correct Answers Type

366. If in triangle ABC, a, b, c and angle A are given and $c\sin A < a < c$, then

a) $b_1 + b_2 = 2c\cos A$ b) $b_1 + b_2 = c\cos A$ c) $b_1 b_2 = c^2 - a^2$ d) $b_1 b_2 = c^2 + a^2$

367. The values of θ lying between $\theta = 0$ and $\theta = \theta/2$ and satisfying the equation

$$\begin{vmatrix} 1+\sin^2\theta & \cos^2\theta & 4\sin 4\theta \\ \sin^2\theta & 1+\cos^2\theta & 4\sin 4\theta \\ \sin^2\theta & \cos^2\theta & 1+4\sin 4\theta \end{vmatrix} = 0 \text{ are}$$

a) $7\pi/24$ b) $5\pi/24$ c) $11\pi/24$ d) $\pi/24$

368. If $(\operatorname{cosec}^2\theta - 4)x^2 + (\cot\theta + \sqrt{3})x + \cos^2\frac{3\pi}{2} = 0$ holds true for all real x, then the most general values of θ can be given by $(n \in Z)$

a) $2n\pi + \frac{11\pi}{6}$ b) $2n\pi + \frac{5\pi}{6}$ c) $2n\pi \pm \frac{7\pi}{6}$ d) $n\pi \pm \frac{11\pi}{6}$

369. Which of the following statements are always correct (where Q denotes the set of rationals)?

a) $\cos 2\theta \in Q$ and $\sin 2\theta \in Q \Rightarrow \tan\theta \in Q$ (if defined)

b) $\tan\theta \in Q \Rightarrow \sin 2\theta$, $\cos 2\theta$ and $\tan 2\theta \in Q$ (if defined)
c) if $\sin\theta \in Q$ and $\cos\theta \in Q \Rightarrow \tan 3\theta \in Q$(if defined)
d) if $\sin\theta \in Q \Rightarrow \cos 3\theta \in Q$

370. If $\sin^2 x - 2\sin x - 1 = 0$ has exactly four different solutions in $x \in [0, n\pi]$, then value/values of n is/are $(n \in N)$
a) 5 b) 3 c) 4 d) 6

371. For the equation $1 - 2x - x^2 = \tan^2(x+y) + \cot^2(x+y)$
a) Exactly one value of x exists
b) Exactly two values of x exists
c) $y = -1 + n\pi + \pi/4, n \in Z$
d) $y = 1 + n\pi + \pi/4, n \in Z$

372. If the angles of a triangle are 30° and 45°, and the included side is $(\sqrt{3}+1)$ cm, then
a) Area of the triangle is $\frac{1}{2}(\sqrt{3}+1)$ sq. units
b) Area of the triangle is $\frac{1}{2}(\sqrt{3}-1)$ sq. units
c) Ratio of greater side to smaller side is $\frac{\sqrt{3}+1}{\sqrt{2}}$
d) Ratio of greater side to smaller side is $\frac{1}{4\sqrt{3}}$

373. If $\log_k x \, . \log_5 k = \log_x 5$, $k \neq 1, k > 0$, then x is equal to
a) k b) $1/5$ c) 5 d) None of these

374. For $0 \le x \le 2\pi$, then $2^{\mathrm{cosec}^2 x}\sqrt{\frac{1}{2}y^2 - y + 1} \le \sqrt{2}$
a) Is satisfied by exactly one value of y
b) Is satisfied by exactly two value of x
c) Is satisfied by x for which $\cos x = 0$
d) Is satisfied by x for which $\sin x = 0$

375. Let $\tan x - \tan^2 x > 0$ and $|2\sin x| < 1$. Then the intersection of which of the following two sets satisfies both the inequalities?
a) $x > n\pi, n \in Z$ b) $x > n\pi - \pi/6, n \in Z$ c) $x < n\pi - \pi/4, n \in Z$ d) $x < n\pi + \pi/6, n \in Z$

376. A solution of the equation $(1-\tan\theta)(1+\tan\theta)\sec^2\theta + 2^{\tan^2\theta} = 0$, where θ lies in the interval $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ is given by
a) $\theta = 0$ b) $\theta = \frac{\pi}{3}$ c) $\theta = -\frac{\pi}{3}$ d) $\theta = \frac{\pi}{6}$

377. The equation $x^3 - \frac{3}{4}x = -\frac{\sqrt{3}}{8}$ is satisfied by
a) $x = \cos\left(\frac{5\pi}{18}\right)$ b) $x = \cos\left(\frac{7\pi}{18}\right)$ c) $x = \cos\left(\frac{23\pi}{18}\right)$ d) $x = \cos\left(\frac{17\pi}{18}\right)$

378. If the equation $x^{\log_a x^2} = \frac{x^{k-2}}{a^k}$, $a \neq 0$, has exactly one solution for x, then the value of k is/are
a) $6 + 4\sqrt{2}$ b) $2 + 6\sqrt{3}$ c) $6 - 4\sqrt{2}$ d) $2 - 6\sqrt{3}$

379. For a positive integer n, let $f_n(\theta) = \left(\tan\frac{\theta}{2}\right)(1+\sec\theta)(1+\sec 2\theta)(1+\sec 4\theta)\dots(1+\sec 2^n\theta)$. Then
a) $f_2(\pi/16) = 1$ b) $f_3(\pi/32) = 1$ c) $f_4(\pi/64) = 1$ d) $f_5(\pi/128) = 1$

380. In triangle ABC if $2a^2b^2 + 2b^2c^2 = a^4 + b^4 + c^4$, then angle B is equal to
a) 45° b) 135° c) 120° d) 60°

381. CF is the internal bisector of angle C of ΔABC, then CF is equal to
a) $\frac{2ab}{a+b}\cos\frac{C}{2}$ b) $\frac{a+b}{2ab}\cos\frac{C}{2}$ c) $\frac{b\sin A}{\sin\left(B+\frac{C}{2}\right)}$ d) None of these

382. If $\tan\theta = \frac{\sin\alpha - \cos\alpha}{\sin\alpha + \cos\alpha}$, then
a) $\sin\alpha - \cos\alpha = \pm\sqrt{2}\sin\theta$
b) $\sin\alpha + \cos\alpha = \pm\sqrt{2}\cos\theta$
c) $\cos 2\theta = \sin 2\alpha$
d) $\sin 2\theta + \cos 2\alpha = 0$

383. Which of the following number(s)is/are rational?
a) $\sin 15^\circ$ b) $\cos 15^\circ$ c) $\sin 15^\circ \cos 15^\circ$ d) $\sin 15^\circ \cos 75^\circ$

384. Which of the following quantities are rational?

a) $\sin\left(\frac{11\pi}{12}\right)\sin\left(\frac{5\pi}{12}\right)$
b) $\text{cosec}\left(\frac{9\pi}{10}\right)\sec\left(\frac{4\pi}{5}\right)$
c) $\sin^4\left(\frac{\pi}{8}\right)+\cos^4\left(\frac{\pi}{8}\right)$
d) $\left(1+\cos\frac{2\pi}{9}\right)\left(1+\cos\frac{4\pi}{9}\right)\left(1+\cos\frac{8\pi}{9}\right)$

385. The minimum value of the expression $\sin\alpha+\sin\beta+\sin\gamma$, where α,β,γ are real numbers satisfying $\alpha+\beta+\gamma=\pi$ is
a) Positive b) Zero c) Negative d) -3

386. The equation $\log_{x+1}(x-0.5)=\log_{x-0.5}(x+1)$ has
a) Two real solutions b) No prime solution c) One integral solution d) No irrational solution

387. $(a+2)\sin\alpha+(2a-1)\cos\alpha=(2a+1)$ if $\tan\alpha$ is
a) $3/4$ b) $4/3$ c) $2a/(a^2+1)$ d) $2a/(a^2-1)$

388. There exists triangle ABC satisfying
a) $\tan A+\tan B+\tan C=0$
b) $\frac{\sin A}{2}=\frac{\sin B}{3}=\frac{\sin C}{7}$
c) $(a+b)^2=c^2+ab$ and $\sqrt{2}\,(\sin A+\cos A)=\sqrt{3}$
d) $\sin A+\sin B=\frac{\sqrt{3}+1}{2}, \cos A\cos B=\frac{\sqrt{3}}{4}=\sin A\sin B$

389. If $\log a\ x=b$ for permissible values of a and x, then identify the statement (s) which can be correct.
a) If a and b are two irrational numbers, then x can be rational.
b) If a is rational and b is irrational, then x can be rational.
c) If a is irrational and =b is rational, then x can be rational.
d) If a is rational and b is rational, then x can be rational.

390. Let $A_0A_1A_2A_3A_4A_5$ be a regular hexagon inscribed in a circle of unit radius. Then the product of the lengths of the line segments A_0A_1, A_0A_2 and A_0A_4 is
a) $\frac{3}{4}$ b) $3\sqrt{3}$ c) 3 d) $\frac{3\sqrt{3}}{2}$

391. If $(\sin\alpha)x^2-2x+b\geq 2$ for all the real values of $x\leq 1$ and $\alpha\in(0,\pi/2)\cup(\pi/2,\pi)$, then the possible real values of b is/are
a) 2 b) 3 c) 4 d) 5

392. If $\sin^2 x-a\sin x+b=0$ has only one solution in $(0,\pi)$, then which of the following statements are correct?
a) $a\in(-\infty,1]\cup[2,\infty)$ b) $b\in(-\infty,0]\cup[1,\infty)$ c) $a=1+b$ d) None of these

393. Which of the following, when simplified, reduces to unity?
a) $\log_{10}5\ .\log_{10}20+(\log_{10}2)^2$
b) $\frac{2\log 2+\log 3}{\log 48-\log 4}$
c) $-\log_5\log_3\sqrt{5\sqrt{9}}$
d) $\frac{1}{6}\log_{\frac{\sqrt{3}}{2}}\left(\frac{64}{27}\right)$

394. In a triangle, the lengths of the two larger sides are 10 and 9, respectively. If the angles are in A.P., then the length of the third side can be
a) $5-\sqrt{6}$ b) $3\sqrt{3}$ c) 5 d) $5+\sqrt{6}$

395. For $\alpha=\pi/7$ which of the following hold(s) good?
a) $\tan\alpha\tan 2\alpha\tan 3\alpha=\tan 3\alpha-\tan 2\alpha-\tan\alpha$
b) $\text{cosec}\,\alpha=\text{cosec}\,2\alpha+\text{cosec}\,4\alpha$
c) $\cos\alpha-\cos 2\alpha+\cos 3\alpha=1/2$
d) $8\cos\alpha\cos 2\alpha\cos 4\alpha=1$

396. The equation $\sqrt{1+\log_x \sqrt{27}} \log_3 x + 1 = 0$ has

a) No integral solution
b) One irrational solution
c) Two real solutions
d) No prime solution

397. There exists a triangle ABC satisfying the conditions

a) $b \sin A = a,\ A < \pi/2$
b) $b \sin A > a,\ A > \pi/2$
c) $b \sin A < a,\ A < \pi/2$
d) $b \sin A < a,\ A < \pi/2, b > a$

398. If $\cos\beta$ is the geometric mean between $\sin\alpha$ and $\cos\alpha$, where $0 < \alpha, \beta < \pi 2$, then $\cos 2\beta$ is equal to

a) $-2\sin^2\left(\frac{\pi}{4}-\alpha\right)$
b) $-2\cos^2\left(\frac{\pi}{4}+\alpha\right)$
c) $2\sin^2\left(\frac{\pi}{4}+\alpha\right)$
d) $2\cos^2\left(\frac{\pi}{4}-\alpha\right)$

399. If in a triangle PQR, $\sin P, \sin Q, \sin R$ are in A.P., then

a) The altitudes are in A.P.
b) The altitudes are in H.P.
c) The medians are in G.P.
d) The medians are in A.P.

400. If $\log_{1/2}(4-x) \geq \log_{1/2} 2 - \log_{1/2}(x-1)$, then x belongs to

a) $(1, 2]$
b) $[3, 4)$
c) $(1, 3]$
d) $[1, 4)$

401. Which of the following do/does not reduce to unity?

a) $\dfrac{\dfrac{\sin(180°+A)}{\tan(180°+A)}\ \dfrac{\cot(90°+A)}{\tan(90°+A)}}{\dfrac{\cos(360°-A)\ \operatorname{cosec} A}{\sin(-A)}}$

b) $\dfrac{\sin(-A)}{\sin(180°+A)} - \dfrac{\tan(90°+A)}{\cot A} + \dfrac{\cos A}{\sin(90°+A)}$

c) $\dfrac{\sin 24° \cos 6° - \sin 6° \cos 24°}{\sin 21° \cos 39° - \cos 51° \sin 69°}$

d) $\dfrac{\cos(90°+A)\sec(-A)\tan(180°-A)}{\sec(360°+A)\sin(180°+A)\cot(90°-A)}$

402. Sides of ΔABC are in A.P. If $a < \min\{b, c\}$, then $\cos A$ may be equal to

a) $\frac{4b-3c}{2b}$
b) $\frac{3c-4b}{2c}$
c) $\frac{4c-3b}{2b}$
d) $\frac{4c-3b}{2c}$

403. The sides of ΔABC satisfy the equation $2a^2 + 4b^2 + c^2 = 4ab + 2ac$. Then

a) The triangle is isosceles
b) The triangle is obtuse
c) $B = \cos^{-1}(7/8)$
d) $A = \cos^{-1}(1/4)$

404. Which of the following identities, wherever defined, hold(s) good?

a) $\cot\alpha - \tan\alpha = 2\cot 2\alpha$
b) $\tan(45° + \alpha) - \tan(45° - \alpha) = 2 \operatorname{cosec} 2\alpha$
c) $\tan(45° + \alpha) + \tan(45° - \alpha) = 2 \sec 2\alpha$
d) $\tan\alpha + \cot\alpha = 2\tan 2\alpha$

405. If the sides of a right-angled triangle are in G.P., then the cosines of the acute angle of the triangle are

a) $\frac{\sqrt{5}-1}{2}$
b) $\frac{\sqrt{5}+1}{2}$
c) $\sqrt{\frac{\sqrt{5}-1}{2}}$
d) $\frac{\sqrt{\sqrt{5}+1}}{2}$

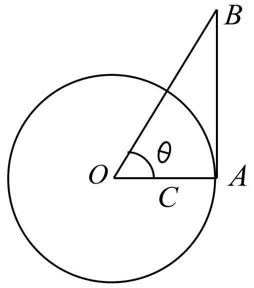
406. In which of the following sets the inequality $\sin^6 x + \cos^6 x > 5/8$ holds good?

a) $(-\pi/8, \pi/8)$
b) $(3\pi/8, 5\pi/8)$
c) $(\pi/4, 3\pi/4)$
d) $(7\pi/8, 9\pi/8)$

407. The number of all the possible triplets (a_1, a_2, a_3) such that $a_1 + a_2\cos(2x) + a_3\sin^2(x) = 0$ for all x is

a) 0
b) 1
c) 3
d) Infinite

408. A circle centred at O has radius 1 and contains the point A. Segment AB is tangent to the circle at A and $\angle AOB = \theta$. If point C lies on OA and BC bisects the angle ABO, then OC equals



a) $\sec\theta\ (\sec\theta-\tan\theta)$ b) $\frac{\cos^2\theta}{1+\sin\theta}$ c) $\frac{1}{1+\sin\theta}$ d) $\frac{1-\sin\theta}{\cos^2\theta}$

409. If A is the area and $2s$ is the sum of the sides of a triangle, then

a) $A\le\frac{s^2}{4}$ b) $A\le\frac{s^2}{3\sqrt{3}}$ c) $A<\frac{s^2}{\sqrt{3}}$ d) None of these

410. Let α,β and γ be some angles in the first quadrant satisfying $\tan(\alpha+\beta)=15/8$ and $\operatorname{cosec}\gamma=17/8$, then which of the following hold(s) good?

a) $\alpha+\beta+\gamma=\pi$

b) $\cot\alpha\cot\beta\cot\gamma=\cot\alpha+\cot\beta+\cot\gamma$

c) $\tan\alpha+\tan\beta+\tan\gamma=\tan\alpha\tan\beta\tan\gamma$

d) $\tan\alpha\tan\beta+\tan\beta\tan\gamma+\tan\gamma\tan\alpha=1$

411. The expression $3\left[\sin^4\left(\frac{3}{2}\pi-\alpha\right)+\sin^4(3\pi+\alpha)\right]-2\left[\sin^6\left(\frac{1}{2}\pi+\alpha\right)+\sin^6(5\pi-\alpha)\right]$ is equal to

a) 0 b) 1 c) 3 d) None of these

412. Let $2\sin^2x+3\sin x-2>0$ and $x^2-x-2<0$ (x is measured in radians). Then x lies in the interval

a) $\left(\frac{\pi}{6},\frac{5\pi}{6}\right)$ b) $\left(-1,\frac{5\pi}{6}\right)$ c) $(-1,2)$ d) $\left(\frac{\pi}{6},2\right)$

413. If in $\Delta ABC,\angle A=90°$ and $c,\sin B,\cos B$ are rational numbers, then

a) a is rational b) a is irrational c) b is rational d) b is irrational

414. A general solution of $\tan^2\theta+\cos2\theta=1$ is $(n\in Z)$

a) $n\pi-\frac{\pi}{4}$ b) $2n\pi+\frac{\pi}{4}$ c) $n\pi+\frac{\pi}{4}$ d) $n\pi$

415. If $\cos(x+\pi/3)+\cos x=a$ has real solutions, then

a) Number of integral values of a are 3

b) Sum of number of integral values of a is 0

c) When $a=1$, number of solutions for $x\in[0,2\pi]$ are 3

d) When $a=1$, number of solutions for $x\in[0,2\pi]$ are 2

416. Lengths of the tangents from A,B and C to the incircle are in A.P., then

a) r_1,r_2,r_3 are in H.P. b) r_1,r_2,r_3 are in A.P. c) a,b,c are in A.P. d) $\cos A=\frac{4c-3b}{2b}$

417. The solution of the equation $9\cos^{12}x+\cos^2 2x+1=6\cos^6x\cos2x+6\cos^6x-2\cos2x$ is/are

a) $x=n\pi+\frac{\pi}{2},n\in I$ b) $x=n\pi+\cos^{-1}\left(\sqrt[4]{\frac{2}{3}}\right),\ n\in I$

c) $x=n\pi-\cos^{-1}\left(\sqrt[4]{\frac{2}{3}}\right),\ n\in I$ d) None of the above

418. Suppose $ABCD$ (in order) is a quadrilateral inscribed in a circle. Which of the following is/are always true?

a) $\sec B=\sec D$ b) $\cot A+\cot C=0$ c) $\operatorname{cosec}A=\operatorname{cosec}C$ d) $\tan B+\tan D=0$

419. If $\cos3\theta=\cos3\alpha$, then the value of $\sin\theta$ can be given by

a) $\pm\sin\alpha$ b) $\sin\left(\frac{\pi}{3}\pm\alpha\right)$ c) $\sin\left(\frac{2\pi}{3}+\alpha\right)$ d) $\sin\left(\frac{2\pi}{3}-\alpha\right)$

420. For $a>0,\neq1$, the roots of the equation $\log_{ax}a+\log_x a^2+\log_{a^2x}a^3=0$ are given by

a) $a^{-4/3}$ b) $a^{-3/4}$ c) a d) $a^{-1/2}$

421. In ΔABC, if $\cos\frac{A}{2} = \sqrt{\frac{b+c}{2c}}$, then

a) Area of triangle is $\frac{1}{2}ab$
b) Circumradius is equal to $\frac{1}{2}c$
c) Area of triangle is $\frac{1}{2}bc$
d) Circumradius is equal to $\frac{1}{2}a$

422. The real solutions of the equation $2^{x+2}\ .\ 5^{6-x} = 10^{x^2}$ is/are

a) 1
b) 2
c) $-\log_{10}(250)$
d) $\log_{10} 4 - 3$

423. If $x + y = 2\pi/3$ and $\sin x / \sin y = 2$, then

a) The number of values of $x \in [0, 4\pi]$ are 4
b) Number of values of $x \in [0, 4\pi]$ are 2
c) Number of values of $y \in [0, 4\pi]$ are 4
d) Number of values of $y \in [0, 4\pi]$ are 8

424. If the tangents of the angles A and B of triangle ABC satisfy the equation $abx^2 - c^2x + ab = 0$, then

a) $\tan A = a/b$
b) $\tan B = b/a$
c) $\cos C = 0$
d) $\sin^2 A + \sin^2 B + \sin^2 C = 2$

425. Which of the following is/are correct?

a) $(\tan x)^{\ln(\sin x)} > (\cot x)^{\ln(\sin x)}, \forall x \in (0, \pi/4)$
b) $4^{\ln \operatorname{cosec} x} < 5^{\ln \operatorname{cosec} x}, \forall x \in (0, \pi/2)$
c) $(1/2)^{\ln(\cos x)} < (1/3)^{\ln(\cos x)}, \forall x \in (0, \pi/2)$
d) $2^{\ln(\tan x)} > 2^{\ln(\sin x)}, \forall x \in (0, \pi/2)$

426. If in a ΔABC,
$\sin^4 A + \sin^4 B + \sin^4 C$
$= \sin^2 B \sin^2 C + 2\sin^2 C \sin^2 A + 2\sin^2 A \sin^2 B$, then $A =$

a) $\frac{\pi}{6}, \frac{5\pi}{6}$
b) $\frac{\pi}{3}, \frac{5\pi}{6}$
c) $\frac{5\pi}{6}, \frac{2\pi}{3}$
d) None of these

427. $\cos(\sin x) = \frac{1}{\sqrt{2}}$, then x must be lie in the interval

a) $\left(\frac{\pi}{4}, \frac{\pi}{2}\right)$
b) $\left(-\frac{\pi}{4}, 0\right)$
c) $\left(\pi, \frac{3\pi}{2}\right)$
d) $\left(\frac{\pi}{2}, \pi\right)$

428. If $\sin^3\theta + \sin\theta\cos\theta + \cos^3\theta = 1$, then θ is equal to $(n \in Z)$

a) $2n\pi$
b) $2n\pi + \frac{\pi}{2}$
c) $2n\pi - \frac{\pi}{2}$
d) $n\pi$

429. The area of a regular polygon of n sides is (where r is inradius, R is circumradius and a is side of the triangle)

a) $\frac{nR^2}{2}\sin\left(\frac{2\pi}{n}\right)$
b) $nr^2\tan\left(\frac{\pi}{n}\right)$
c) $\frac{na^2}{4}\cot\frac{\pi}{n}$
d) $nR^2\tan\left(\frac{\pi}{n}\right)$

430. Let $0 \le \theta \le \pi/2$ and $x = X\cos\theta + Y\sin\theta$, $y = X\sin\theta - Y\cos\theta$ such that $x^2 + 4xy + y^2 = aX^2 + bY^2$, where a, b are constants. Then,

a) $a = -1, b = 3$
b) $\theta = \frac{\pi}{4}$
c) $a = 3, b = -1$
d) $\theta = \frac{\pi}{3}$

431. If $x + y = \pi/4$ and $\tan x + \tan y = 1$, then $(n \in Z)$

a) $\sin x = 0$ always
b) when $x = n\pi + \pi/4$ then $y = -n\pi$
c) when $x = n\pi$ then $y = n\pi + (\pi/4)$
d) when $x = n\pi + \pi/4$ then $y = n\pi - (\pi/4)$

432. If $\frac{\log x}{b-c} = \frac{\log y}{c-a} = \frac{\log z}{a-b}$, then which of the following is/are true?

a) $xyz = 1$
b) $x^a y^b z^c = 1$
c) $x^{b+c} y^{c+a} z^{a+b} = 1$
d) $xyz = x^a y^b z^c$

433. If $\cos x + \cos y - \cos(x + y) = \frac{3}{2}$, then

a) $x + y = 0$
b) $x = 2y$
c) $x = y$
d) $\cos^2\left(\frac{x-y}{2}\right) \ge 1$

434. The value of x in $(0, \pi/2)$ satisfying $\frac{\sqrt{3}-1}{\sin x} + \frac{\sqrt{3}+1}{\cos x} = 4\sqrt{2}$ is

a) $\frac{\pi}{12}$
b) $\frac{5\pi}{12}$
c) $\frac{7\pi}{24}$
d) $\frac{11\pi}{36}$

435. If $\frac{x}{y} = \frac{\cos A}{\cos B}$, where $A \ne B$, then

a) $\tan\left(\frac{A+B}{2}\right)=\frac{x\tan A+y\tan B}{x+y}$
b) $\tan\left(\frac{A-B}{2}\right)=\frac{x\tan A-y\tan B}{x+y}$
c) $\frac{\sin(A+B)}{\sin(A-B)}=\frac{y\sin A+x\sin B}{y\sin A-x\sin B}$
d) $x\cos A+y\cos B=0$

436. The expression $(\tan^4 x+2\tan^2 x+1)\cos^2 x$ when $x=\pi/12$ can be equal to
a) $4(2-\sqrt{3})$ b) $4(\sqrt{2}+1)$ c) $16\cos^2\pi/12$ d) $16\sin^2\pi/12$

437. The number of values of x in the interval $[0,5\pi]$ satisfying the equation $3\sin^2 x-7\sin x+2=0$ is
a) 0 b) 5 c) 6 d) 10

438. For the smallest positive values of x and y, the equation $2(\sin x+\sin y)-2\cos(x-y)=3$ has a solution, then which of the following is/are true?
a) $\sin\frac{x+y}{2}=1$
b) $\cos\left(\frac{x-y}{2}\right)=\frac{1}{2}$
c) Number of ordered pairs (x,y) is 2
d) Number of ordered pairs (x,y) is 3

439. If $\sin x+\cos x=\sqrt{y+\frac{1}{y}}$ for $x\in[0,\pi]$, then
a) $x=\pi/4$ b) $y=0$ c) $y=1$ d) $x=3\pi/4$

440. If $b>1, \sin t>0, \cos t>0$ and $\log_b(\sin t)=x$, then $\log_b(\cos t)$ is equal to
a) $\frac{1}{2}\log_b(1-b^{2x})$
b) $2\log(1-b^{x/2})$
c) $\log_b\sqrt{1-b^{2x}}\log_b(1-b^{2x})$
d) $\sqrt{1-x^2}$

441. In a right-angled triangle, the hypotenuse is $2\sqrt{2}$ times the perpendicular drawn from the opposite vertex. Then the other acute angles of the triangle are
a) $\frac{\pi}{3}$ b) $\frac{\pi}{8}$ c) $\frac{3\pi}{8}$ d) $\frac{\pi}{6}$

442. For $0<\emptyset\leq\pi/2$, if $x=\sum_{n=0}^{\infty}\cos^{2n}\emptyset$, $y=\sum_{n=0}^{\infty}\sin^{2n}\emptyset$, $z=\sum_{n=0}^{\infty}\cos^{2n}\emptyset\sin^{2n}\emptyset$, then
a) $xyz=xz+y$ b) $xyz=xy+z$ c) $xyz=x+y+z$ d) $xyz=yz+x$

443. Which of the following inequalities hold true in any triangle ABC?
a) $\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2}\leq\frac{1}{8}$
b) $\cos\frac{A}{2}\cos\frac{B}{2}\cos\frac{C}{2}\leq\frac{3\sqrt{3}}{8}$
c) $\sin^2\frac{A}{2}+\sin^2\frac{B}{2}+\sin^2\frac{C}{2}<\frac{3}{4}$
d) $\cos^2\frac{A}{2}+\cos^2\frac{B}{2}\cos^2\frac{C}{2}\leq\frac{9}{4}$

444. In a triangle, the angles are in A.P. and the lengths of the two larger sides are 10 and 9, respectively, then the length of the third side can be
a) $5+\sqrt{6}$ b) 0.7 c) $5-\sqrt{6}$ d) None of these

445. Which of the following sets can be the subset of the general solution of $1+\cos 3x=2\cos 2x$ $(n\in Z)$?
a) $n\pi+\frac{\pi}{3}$ b) $n\pi+\frac{\pi}{6}$ c) $n\pi-\frac{\pi}{6}$ d) $2n\pi$

446. If in a triangle, $\sin^4 A+\sin^4 B+\sin^4 C=\sin^2 B\sin^2 C+2\sin^2 C\sin^2 A+2\sin^2 A\sin^2 B$, then its angle A is equal to
a) 30° b) 120° c) 150° d) 60°

447. Let ABC be an isosceles triangle with base BC. If $'r'$ is the radius of the circle inscribed in ΔABC and r_1 is the radius of the circle escribed opposite to the angle A, then the product $r_1 r$ can be equal to
Where R is the radius of the circumcircle of the ΔABC
a) $R^2\sin^2 A$ b) $R^2\sin^2 2B$ c) $\frac{1}{2}a^2$ d) $\frac{a^2}{4}$

448. $\tan|x|=|\tan x|$, if
a) $x\in(-\pi(2k+1)/2,-\pi k), k\in I$
b) $x\in[\pi k,\pi(2k+1)/2], k\in I$
c) $x\in\{-\pi k,-\pi(2k-1)/2\}, k\in I$
d) $x\in\{\pi(2k-1)/2,\pi k\}, k\in I$

449. $\sin\theta+\sqrt{3}\cos\theta=6x-x^2-11, 0\leq\theta\leq 4\pi, x\in R$, holds for
a) No values of x and θ
b) One value of x and two values of θ
c) Two values of x and two values of θ
d) Two point of values of (x,θ)

450. In acute-angled triangle ABC, AD is the altitude. Circle drawn with AD as its diameter cuts the AB and AC at P and Q, respectively. Length PQ is equal to

a) $\frac{\Delta}{2R}$

b) $\frac{abc}{4R^2}$

c) $2R \sin A \sin B \sin C$

d) $\frac{\Delta}{R}$

451. If $\sin(x + 20°) = 2 \sin x \cos 40°$ where $x \in (0, \pi/2)$ then which of the following hold(s) good?

a) $\cos 2x = 1/2$ b) $\text{cosec } 4x = 2$ c) $\sec\frac{x}{2} = \sqrt{6} - \sqrt{2}$ d) $\tan\frac{x}{2} = (2 - \sqrt{3})$

452. If $4 \sin^4 x + \cos^4 x = 1$, then x is equal to $(n \in Z)$

a) $n\pi$ b) $n\pi \pm \sin^{-1}\sqrt{\frac{2}{5}}$ c) $\frac{2n\pi}{3}$ d) $2n\pi \pm \frac{\pi}{4}$

453. If sides of triangle ABC are a, b and c such that $2b = a + c$, then

a) $\frac{b}{c} > \frac{2}{3}$ b) $\frac{b}{c} > \frac{1}{3}$ c) $\frac{b}{c} < 2$ d) $\frac{b}{c} < \frac{3}{2}$

454. If $0 \leq \theta \leq \pi$ and $81^{\sin^2 \theta} + 81^{\cos^2 \theta} = 30$, then θ is

a) 30° b) 60° c) 120° d) 150°

455. If $p, q \in N$ satisfy the equation $x^{\sqrt{x}} = (\sqrt{x})^x$, then p and q are

a) Relatively prime

b) Twin prime

c) Coprime

d) If $\log_q p$ is defined, then $\log_p q$ is not and vice versa

456. If $\cos p\theta = \sin q\theta$, then the general values of θ are

a) $\frac{(2n+1)\pi}{2(p+q)}, n \in I$ b) $\frac{(2n+1)\pi}{2(p-q)}, n \in I$ c) $\frac{(4n-1)\pi}{2(p-q)}, n \in I$ d) $\frac{(4n+1)\pi}{2(p+q)}, n \in I$

457. Let $f(x) = \log(\log_{1/3}(\log_7(\sin x + a)))$ be defined for every real value of x, then the possible value of a is

a) 3 b) 4 c) 5 d) 6

Assertion - Reasoning Type

This section contain(s) 0 questions numbered 458 to 457. Each question contains STATEMENT 1(Assertion) and STATEMENT 2(Reason). Each question has the 4 choices (a), (b), (c) and (d) out of which **ONLY ONE** is correct.

a) Statement 1 is True, Statement 2 is True; Statement 2 **is** correct explanation for Statement 1

b) Statement 1 is True, Statement 2 is True; Statement 2 **is not** correct explanation for Statement 1

c) Statement 1 is True, Statement 2 is False

d) Statement 1 is False, Statement 2 is True

458

Statement 1: The incentre of the triangle formed by the feet of altitudes from the vertices of triangle ABC to the opposite sides is the orthocenter of the triangle ABC

Statement 2: The incentre of triangle ABC is orthocenter of the triangle $I_1I_2I_3$, where I_1, I_2, I_3 are excentres of triangle ABC

459

Statement 1: Equation $\sqrt{1-\sin 2x} = \sin x$ has 1 solution for $x \in [0, \pi/4]$

Statement 2: $\cos x > \sin x$ when $x \in [0, \pi/4]$

460 Let α, β, and γ satisfy $0 < \alpha < \beta < \gamma < 2\pi$ and $\cos(x+\alpha) + \cos(x+\beta) + \cos(x+\gamma) = 0 \forall x \in R$

Statement 1: $\gamma - \alpha = \frac{2\pi}{3}$

Statement 2: $\cos\alpha + \cos\beta + \cos\gamma = 0$ and $\sin\alpha + \sin\beta + \sin\gamma = 0$

461

Statement 1: General solution of $\frac{\tan 4x - \tan 2x}{1 + \tan 4x \tan 2x} = 1$ is $x = \frac{n\pi}{2} + \frac{\pi}{8}, n \in I$

Statement 2: General solution of $\tan\alpha = 1$ is $\alpha = n\pi + \frac{\pi}{4}, n \in I$

462

Statement 1: $\sin x = a$, where $-1 < a < 0$, then for $x \in [0, n\pi]$ has $2(n-1)$ solutions $\forall\, n \in N$

Statement 2: $\sin x$ takes value a exactly two times when we take one complete rotation covering all the quadrant starting from $x = 0$

463

Statement 1: The equation $\sin^2 x + \cos^2 y = 2\sec^2 z$ is solvable when only $\sin x = 1$; $\cos y = 1$ and $\sec z = 1$, where $x, y, z \in R$

Statement 2: The maximum value of $\sin x$ and $\cos y$ is 1 and minimum value of $\sec z$ is 1

464

Statement 1: $\sin \pi/18$ is a root of $8x^3 - 6x + 1 = 0$

Statement 2: For any $\theta \in R, \sin 3\theta = 3\sin\theta - 4\sin^3\theta$

465

Statement 1: In $(0, \pi)$, the number of solutions of the equation $\tan\theta + \tan 2\theta + \tan 3\theta = \tan\theta \tan 2\theta \tan 3\theta$ is two

Statement 2: $\tan 6\theta$ is not defined at $\theta = (2n+1)\frac{\pi}{12}, n \in I$

466

Statement 1: If the incircle of the triangle ABC passes through its circumcentre, then $\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2} = \sqrt{2}$

Statement 2: Distance between the circumcentre and incentre is $\sqrt{R^2 - 2rR}$

467

Statement 1: Number of solution of $n|\sin x| = m\,|\cos x|$ (where $m, n \in Z$) in $[0, 2\pi]$ is independent of m and n

Statement 2: Multiplying trigonometric functions by constant changes only range of the function but period remains same

468

Statement 1: $\sin\left(\frac{2\pi}{7}\right) + \sin\left(\frac{4\pi}{7}\right) + \sin\left(\frac{8\pi}{7}\right) = -\frac{1}{2}$

Statement 2: $\cos\left(\frac{2\pi}{7}\right) + i\sin\left(\frac{2\pi}{7}\right)$ is complex 7th root of unity

469

Statement 1: The minimum value of $27^{\cos 2x}81^{\sin 2x}$ is $\frac{1}{243}$.

Statement 2: The minimum value of $a\cos\theta + b\sin\theta$ is $-\sqrt{a^2+b^2}$.

470

Statement 1: $\cos 36° > \sin 36°$

Statement 2: $\cos 36° > \tan 36°$

471

Statement 1: If $f(\theta) = (\sin\theta + \operatorname{cosec}\theta)^2 + (\cos\theta + \sec\theta)^2$, then the minimum value of $f(\theta)$ is 9.

Statement 2: Maximum value of $\sin 2\theta$ is 1

472

Statement 1: If the quadrilateral Q_1 formed by joining mid-points of sides of another quadrilateral Q_2 is cyclic, then Q_1 is necessarily a rectangle

Statement 2: The quadrilateral Q_1 formed by joining mid-points of sides of another quadrilateral Q_2 is always a parallelogram

473

Statement 1: If $a = 3, b = 7, c = 8$, and internal angle bisector AI meets BC at D (where I is incentre), then $AI/ID = 11/2$

Statement 2: Internal angle bisector of angle A divides the side BC in ratio AB/AC

474

Statement 1: In a triangle, the least value of the sum of cosines of its angles is unity

Statement 2: $\cos A + \cos B + \cos C = 1 + 4\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2}$, if A, B, C are the angles of a triangle

475

Statement 1: $\cos^3\alpha + \cos^3\left(\alpha + \frac{2\pi}{3}\right) + \cos^3\left(\alpha + \frac{4\pi}{3}\right) = 3\cos\alpha\cos\left(\alpha + \frac{2\pi}{3}\right)\cos\left(\alpha + \frac{4\pi}{3}\right)$

Statement 2: If $a + b + c = 0 \Leftrightarrow a^3 + b^3 + c^3 = 3abc$

476

Statement 1: If I is incentre of ΔABC and I_1 excentre opposite to A and P is the intersection of II_1 and BC, then $IP \cdot I_1P = BP \cdot PC$

Statement 2: In ΔABC, I is incentre and I_1 is excentre opposite to A then IBI_1C must be square

477

Statement 1: The equation $\sin(\cos x) = \cos(\sin x)$ has no real solution

Statement 2: $\sin x \pm \cos x \in [-\sqrt{2}, \sqrt{2}]$

478

Statement 1: Circumradius of $\Delta I_1I_2I_3$ is $2R$

Statement 2: Circumradius of the triangle formed by feet of altitudes of ΔABC is $R/2$

479

Statement 1: If $x+y+z=xyz$, then at most one of the numbers can be negative.

Statement 2: In a triangle ABC, $\tan A+\tan B+\tan C=\tan A\tan B\tan C$ and there can be at most one obtuse angle in a triangle.

480 In acute-angled $\Delta ABC, a>b>c$

Statement 1: $r_1>r_2>r_3$

Statement 2: $\cos A<\cos B<\cos C$

481

Statement 1: $\cos 1<\cos 7$

Statement 2: $1<7$

482

Statement 1: The value of x for which $(\sin x+\cos x)^{1+\sin 2x}=2$, when $0\le x\le\pi$ is $\pi/4$ only

Statement 2: The maximum value of $\sin x+\cos x$ occurs when $x=\pi/4$

483

Statement 1: In any ΔABC, the maximum value of $r_1+r_2+r_3=9R/2$

Statement 2: In any $\Delta ABC, R\ge 2r$

484

Statement 1: $\tan 5°$ is an irrational number

Statement 2: $\tan 15°$ is an irrational number

485

Statement 1: $\tan\alpha+2\tan 2\alpha+4\tan 4\alpha+8\tan 8\alpha+16\cot 16\alpha=\cot\alpha$

Statement 2: $\cot\alpha-\tan\alpha=2\cot 2\alpha$

486

Statement 1: If side BC and ratio of r_2 and r_3 of an acute-angled triangle is given, then the locus of A is a hyperbola

Statement 2: If base of a triangle is given and difference of two variable sides is constant (less than the base), then locus of variable vertex is a hyperbola

487 Let l_1, l_2, l_3 be the lengths of the internal bisectors of angles A, B, C of ΔABC, respectively

Statement 1: $\frac{\cos\frac{A}{2}}{l_1}+\frac{\cos\frac{B}{2}}{l_2}+\frac{\cos\frac{C}{2}}{l_3}=2\left(\frac{l_1}{a}+\frac{l_2}{b}+\frac{l_3}{c}\right)$

Statement 2: $l_1^2=bc\left[1-\left(\frac{a}{a+c}\right)^2\right], l_2^2=ca\left[1-\left(\frac{b}{c+a}\right)^2\right], l_3^2=ab\left[1-\left(\frac{c}{a+b}\right)^2\right]$

488

Statement 1: $\cos 1 < \sin 1$

Statement 2: In the first quadrant, cosine decreases but sine increases

489 Let f be any one of the six trigonometric functions. Let $A, B \in R$ satisfying $f(2A) = f(2B)$

Statement 1: $A = n\pi + B$, for some $n \in Z$

Statement 2: 2π is one of the period of f

490

Statement 1: If $xy + yz + zx = 1$, then $\Sigma \frac{x}{(1+x^2)} = \frac{2}{\sqrt{\prod(1+x^2)}}$

Statement 2: In a ΔABC
$\sin 2A + \sin 2B - \sin 2C = 4 \cos A \cos B \sin C$

491

Statement 1: If $xy + yz + zx = 1$ where $x, y, z \in R^+$,
then $\frac{x}{1+x^2} + \frac{y}{1+y^2} + \frac{z}{1+z^2} = \frac{2}{\sqrt{(1+x^2)(1+y^2)(1+z^2)}}$

Statement 2: In a triangle ABC, $\sin 2A + \sin 2B + \sin 2C = 4 \sin A \sin B \sin C$.

492

Statement 1: If $C = 45°, B = 60°$, then the line joining A and circumcentre (O) divides BC in ratio $2 : \sqrt{3}$

Statement 2: Line joining A and circumcenter (O) divides BC in ratio $\frac{\sin 2C}{\sin 2B}$

493

Statement 1: Equation $x \sin x = 1$ has four roots for $x \in (-\pi, \pi)$

Statement 2: The graph of $y = \sin x$ and $y = 1/x$ cuts exactly two times for $x \in (0, \pi)$

494

Statement 1: The minimum value of the expression $\sin \alpha + \sin \beta + \sin \gamma$ is negative, where α, β, γ are real numbers such that $\alpha + \beta + \gamma = \pi$

Statement 2: If α, β, γ are the angles of a triangle, then $\sin \alpha + \sin \beta + \sin \gamma = 4 \cos \alpha/2 \cos \beta/2 \cos \gamma/2$

495

Statement 1: If in a triangle, $\sin^2 A + \sin^2 B + \sin^2 C = 2$ then one of the angles must be $90°$

Statement 2: In any triangle $\sin^2 A + \sin^2 B + \sin^2 C = 2 + 2 \cos A \cos B \cos C$

496

Statement 1: $\tan 4 < \tan 7.5$

Statement 2: $\tan x$ is always an increasing function

497

Statement 1: The equation $\sin(\cos x) = \cos(\sin x)$ does not possess real roots.

Statement 2: If $\sin x > 0$, then $2n\pi < x < (2n+1), n \in I$

498

Statement 1: The maximum and minimum values of the function $f(x) = \frac{1}{3\sin x + 4\cos x - 2}$ do not exist.

Statement 2: The given function is an unbounded function.

499

Statement 1: If $\tan\left(\frac{\pi}{2}\sin\theta\right) = \cot\left(\frac{\pi}{2}\cos\theta\right)$, then $\sin\theta + \cos\theta = \pm\sqrt{2}$

Statement 2: $-\sqrt{2} \leq \sin\theta + \cos\theta \leq \sqrt{2}$

500

Statement 1: Equation $\sin x = e^x$ has infinite solutions

Statement 2: $y = e^x$ is an unbounded function

501 If $A + B + C = \pi$, then

Statement 1: $\cos^2 A + \cos^2 B + \cos^2 C$ has its minimum value $\frac{3}{4}$

Statement 2: Maximum value of $\cos A \cos B \cos C$ is $\frac{1}{8}$

502

Statement 1: In triangle ABC, D is a point on the side AB such that $CD^2 = AD.DB$, then the greatest value of $\sin A \sin B$ is $\sin^2(C/2)$

Statement 2: Greatest value of $\sin A \sin B$ occurs when CD is the angle bisector of angle C

503

Statement 1: $\sin 3 < \sin 1 < \sin 2$.

Statement 2: $\sin x$ is positive in first and second quadrants.

504

Statement 1: In any triangle ABC,
$\ln\left(\cot\frac{A}{2} + \cot\frac{B}{2} + \cot\frac{C}{2}\right) \ln\cot\frac{A}{2} + \ln\cot\frac{B}{2} + \ln\cot\frac{C}{2}$

Statement 2: $\ln\left(1 + \sqrt{3} + (2 + \sqrt{3})\right) = \ln 1 + \ln\sqrt{3} + \ln(2 + \sqrt{3})$

505

Statement 1: If $\sin^2\theta_1 + \sin^2\theta_2 + \cdots + \sin^2\theta_n = 0$, then the different sets of values of $(\theta_1, \theta_2, \dots, \theta_n)$ for which $\cos\theta_1 + \cos\theta_2 + \cdots 9\cos\theta_n = n - 4$ is $n(n-1)$.

Statement 2: If $\sin^2\theta_1 + \sin^2\theta_2 + \cdots + \sin^2\theta_n = 0$, then $\cos\theta_1, \cos\theta_2, \dots, \cos\theta_n = \pm 1$.

506

Statement 1: If $\sin^2 A = \sin^2 B$ and $\cos^2 A = \cos^2 B$, then $A = n\pi + B, n \in I$

Statement 2: If $\sin A = \sin B$ and $\cos A = \cos B$, then $A = n\pi + B, n \in I$

507

Statement 1: If α and β are two distinct solutions of the equation $a\cos x + b\sin x = c$, then $\tan\left(\frac{\alpha+\beta}{2}\right)$ is independent of c

Statement 2: Solution of $a\cos x + b\sin x = c$ is possible, if $-\sqrt{(a^2+b^2)} \le c \le \sqrt{(a^2+b^2)}$

508

Statement 1: The equation $\sin x = x^2 + x + 1$ has no solution

Statement 2: The curve $y = \sin x$ and $y = x^2 + x + 1$ do not intersect each other when graph is observed

509

Statement 1: The number of solution of the equation $|\sin x| = |x|$ is only one

Statement 2: $|\sin x| \ge 0\ \forall x \in R$

510

Statement 1: If a, b, c are the sides of a triangle, then the minimum value of $\frac{2a}{b+c-a} + \frac{2b}{c+a-b} + \frac{2c}{a+b-c}$ is 9

Statement 2: $\text{A. M.} \ge \text{G. M.} \ge \text{H. M.}$

511

Statement 1: In ΔABC, the centroid (G) divides line joining orthocenter (H) and circumcenter in ratio $2:1$

Statement 2: The centroid (G) divides the median AD in ratio $2:1$

512

Statement 1: $\prod_{r=1}^{n}(1+\sec 2^r\theta) = \tan 2^n\theta \cot\theta$

Statement 2: $\prod_{r=1}^{n}\cos(2^{r-1}\theta) = \frac{\sin(2^n\,\theta)}{2^n \sin\theta}$

513

Statement 1: If $\sin x + \cos x = \sqrt{\left(y+\frac{1}{y}\right)}, x \in [0,\pi]$, then $x = \frac{\pi}{4}, y = 1$

Statement 2: $\text{AM} \ge \text{GM}$

514

Statement 1: The number of real solutions of the equation $\cos(x) = 7^x + 7^{-x}$ is zero

Statement 2: Since, $|\cos x| \le 1$

515

Statement 1: If A, B, C are the angles of a triangle such that angle A is obtuse, then $\tan B \tan C > 1$.

Statement 2: In any triangle, $\tan A = \frac{\tan B + \tan C}{\tan B \tan C - 1}$.

Matrix-Match Type

This section contain(s) 0 question(s). Each question contains Statements given in 2 columns which have to be matched. Statements (A, B, C, D) in **columns I** have to be matched with Statements (p, q, r, s) in **columns II**.

516.

	Column-I		Column- II
(A)	The smallest integer greater than $\frac{1}{\log_3 \pi}+\frac{1}{\log_4 \pi}$ is	(p)	10
(B)	Let $3^a=4, 4^b=5, 5^c=6, 6^d=7, 7^c=8$ and $8^f=9$. Then the value of the product $(abcdef)$ is	(q)	3
(C)	Characteristic of the logarithm of 2008 to the base 2 is	(r)	1
(D)	If $\log_2(\log_2(\log_3 x))=\log_2(\log_3(\log_2 y))=0$, then the value of $(x-y)$ is	(s)	2

CODES :

	A	**B**	**C**	**D**
a)	q	s	p	r
b)	p	r	q	s
c)	q	s	r	p
d)	r	p	q	s

517.

	Column-I		Column- II
(A)	If the sines of the angles A and B of a triangle ABC satisfy the equation $c^2x^2-c(a+b)x+ab=0$, the triangle can be	(p)	Right angled
(B)	If one angle of a triangle is 30° and the lengths of the sides adjacent to it are 40 and $40\sqrt{3}$, the triangle can be	(q)	Isosceles
(C)	If two angle of a triangle ABC satisfy the equation $81^{\sin^2 x}+81^{\cos^2 x}=30$, then the triangle can be $\left(x\in(0,\pi/2)\right)$	(r)	Equilateral
(D)	In triangle $ABC, \cos A\cos B+\sin A\sin B\sin C=1$, then the triangle can be	(s)	Obtuse angled

CODES :

	A	**B**	**C**	**D**
a)	Q,s	p	p,q	p
b)	p,q	p	q,s	q

c)	p	q,s	p	p,q
d)	q	p,q	p	q,s

518.

	Column-I		**Column- II**
(A)	$\max\limits_{\theta \in R}\{5\sin\theta + 3\sin(\theta - \alpha)\} = 7$ then the set of possible values of α is	(p)	$2n\pi + 3\pi/4, n \in Z$
(B)	$x \neq \frac{n\pi}{2}$ and $(\cos x)^{\sin^2 x - 3\sin x + 2} = 1$	(q)	$2n\pi \pm \frac{\pi}{3}; n \in Z$
(C)	$\sqrt{(\sin x)} + 2^{1/4}\cos x = 0$	(r)	$2n\pi + \cos^{-1}(1/3), n \in Z$
(D)	$\log_5 \tan x = (\log_5 4)(\log_4(3\sin x)$	(s)	No solution

CODES :

	A	**B**	**C**	**D**
a)	s	r	q	p
b)	p	q	r	s
c)	q	s	p	r
d)	r	p	q	s

519. If $\cos\theta - \sin\theta = \frac{1}{5}$ where $0 < \theta < \frac{\pi}{2}$

	Column-I		**Column- II**
(A)	$(\cos\theta + \sin\theta)/2$	(p)	$\frac{4}{5}$
(B)	$\sin 2\theta$	(q)	$\frac{7}{10}$
(C)	$\cos 2\theta$	(r)	$\frac{24}{25}$
(D)	$\cos\theta$	(s)	$\frac{7}{25}$

CODES :

	A	**B**	**C**	**D**
a)	q	r	s	p
b)	s	p	q	r
c)	p	q	s	r
d)	q	s	p	r

520.

	Column-I		**Column- II**
(A)	Suppose ABC is a triangle with three acute angles A, B and C. The point whose	(p)	1st quadrant

coordinates are $(\cos B - \sin A, \sin B - \cos A)$ can be in the

(B)	If $2^{\sin\theta} > 1$ and $3^{\cos\theta} < 1$, then $\theta \in$	(q)	2nd quadrant
(C)	$\lvert\cos x + \sin x\rvert = \lvert\sin x\rvert + \lvert\cos x\rvert$	(r)	3rd quadrant
(D)	If $\sqrt{\frac{1-\sin A}{1+\sin A}} + \frac{\sin A}{\cos A} = \frac{1}{\cos A}$, for all permissible values of A, then A can belong to	(s)	4th quadrant

CODES :

	A	B	C	D
a)	p	q	r,s	p,r
b)	q	p	q	s
c)	q	q	p,r	p,s
d)	p	s	q	q

521. Let O be the circumcentre, H be the orthocenter, I be the incentre and I_1, I_2, I_3 be the excentres of acute-angled ΔABC

	Column-I		Column- II
(A)	Angle subtended by OI at vertex A	(p)	$\lvert B - C\rvert$
(B)	Angle subtended by HI at vertex A	(q)	$\frac{\lvert B - C\rvert}{2}$
(C)	Angle subtended by OH at vertex A	(r)	$\frac{B + C}{2}$
(D)	Angle subtended by I_2I_3 at I_1	(s)	$\frac{B}{2} - C$

CODES :

	A	B	C	D
a)	q	q	p	r
b)	p	r	s	q
c)	s	p	r	q
d)	r	s	q	p

522.

	Column-I		Column- II
(A)	$\cos\frac{A}{2} = \frac{b + c}{a}$	(p)	Always right angled
(B)	$a\tan A + b\tan B = (a + b)\tan\left(\frac{A + B}{2}\right)$	(q)	Always isosceles
(C)	$a\cos A = b\cos B$	(r)	May be right angled
(D)	$\cos A = \frac{\sin B}{2\sin C}$	(s)	May be right-angled isosceles

CODES :

	A	B	C	D
a)	Q,r,s	r,s	p,r	q,r
b)	r,s	p,r	q,r,s	p,q
c)	q,r,s	r,s	p,q	p,r
d)	p,r	q,r,s	r,s	q,r,s

523.

Column-I	**Column- II**
(A) $\cos^2 2x + \cos^2 x = 1$	(p) $x = \left\{n\pi + \frac{\pi}{4}\right\} \cup \left\{n\pi + \frac{\pi}{6}\right\} n \in Z$
(B) $\cos x + \sqrt{3}\sin x = \sqrt{3}$	(q) $x = \frac{n\pi}{3}, n \in Z$
(C) $1 + \sqrt{3}\tan^2 x = \left(1 + \sqrt{3}\right)\tan x$	(r) $x = (2n-1)\frac{\pi}{6}, n \in Z$
(D) $\tan 3x - \tan 2x - \tan x = 0$	(s) $x = \left\{2n\pi + \frac{\pi}{2}\right\} \cup \left\{2n\pi + \frac{\pi}{6}\right\}, n \in Z$

CODES :

	A	B	C	D
a)	r	s	p	q
b)	p	q	r	s
c)	s	p	q	r
d)	q	r	s	p

524. In acute-angled triangle ABC

Column-I	**Column- II**
(A) $\cos A$, $\cos B$, $\cos C$ are in A.P.	(p) Distances of orthocenter from vertices of triangle are in A.P.
(B) $\sin(A/2)$, $\sin(B/2)$, $\sin(C/2)$ are in A.P.	(q) Distances of orthocenter from sides of triangle are in H.P.
(C) Distances of circumcentre from the vertices of the triangle ABC are in A.P.	(r) Distances of incentre from vertices of triangle are in H.P.
(D) Circumradii of triangles OBC, OAC and OAB are in H.P. (where O is cicumcentre of triangle ABC)	(s) Distances of incentre from excentres of triangle are in A.P.

CODES :

	A	B	C	D
a)	R,s	p,q	q,r	q
b)	p,q	r,s	p,q	p,q
c)	q,r	q	r,s	p,q

d)	p	p,q	q,r	r,s

525.

	Column-I		Column- II
(A)	The maximum value of $\{\cos(2A+\theta)+\cos 2B+\theta$, where A, B are constants, is	(p)	$2\sin(A+B)$
(B)	The maximum value of $\{\cos 2A+\cos 2B\}$, where $(A+B)$ is constant and $A, B \in (0, \pi/2)$, is	(q)	$2\sec(A+B)$
(C)	The minimum value of $\{\sec 2A+\sec 2B\}$, where (A+B) is constant and $A, B \in (0, \pi/4)$, is	(r)	$2\cos(A+B)$
(D)	The minimum value of $\sqrt{\{\tan\theta+\cot\theta-2\cos 2(A+B)\}}$ where A, B are constants and $\theta \in (0, \pi/2)$, is	(s)	$2\cos(A-B)$

CODES :

	A	**B**	**C**	**D**
a)	s	r	q	p
b)	q	p	s	r
c)	q	r	p	s
d)	r	s	q	p

526.

	Column-I		Column- II
(A)	In triangle ABC, $3\sin A+4\cos B=6$ and $3\cos A+4\sin B=1$, then $\angle C$ can be	(p)	60°
(B)	In any triangle, if $(\sin A+\sin B+\sin C \ \sin A+\sin B-\sin C=3\sin A\sin B$, then the angle C	(q)	30°
(C)	If $8\sin x\cos^5 x-8\sin^5 x\cos x=1$, then $x=$	(r)	165°
(D)	$'O'$ is the centre of the inscribed circle in a $30°-60°-90°$ triangle ABC with right angled at C. If the circle is tangent to AB at D, then the angle $\angle COD$ is	(s)	7.5°

CODES :

	A	**B**	**C**	**D**
a)	p	q	r	s
b)	q	b	s	r
c)	r	s	p	q
d)	s	p	r	q

527.

	Column-I		Column- II
(A)	The value of $\log_2 \log_2 \log_4 256 + 2\log \sqrt{2}^2$ is	(p)	1
(B)	If $\log_3(5x-2) - 2\log_3\sqrt{3x+1} = 1 - \log_3 4$, then $x =$	(q)	6
(C)	Product of roots of the equation $7^{\log_7(x^2-4x+5)} = (x-1)$ is	(r)	3
(D)	Number of integers satisfying $\log_2\sqrt{x} - 2\left(\log_{1/4} x\right)^2 x + 1 > 0$ are	(s)	5

CODES :

	A	B	C	D
a)	p	q	r	s
b)	s	p	q	r
c)	r	s	q	p
d)	q	p	r	s

528.

	Column-I		Column- II
(A)	$x^3 + x^2 + 4x + 2\sin x = 0$ in $0 \le x \le 2\pi$	(p)	4
(B)	$\sin e^x \cos e^x = 2^{x-2} + 2^{-x-2}$	(q)	1
(C)	$\sin 2x + \cos 4x = 2$	(r)	2
(D)	$30\lvert\sin x\rvert = x$ in $0 \le x \le 2\pi$	(s)	0

CODES :

	A	B	C	D
a)	s	q	p	s
b)	q	s	s	p
c)	p	r	s	s
d)	s	p	q	s

529.

	Column-I		Column- II
(A)	$2^{\log_{(2\sqrt{2})} 15}$ is	(p)	Rational
(B)	$3\sqrt{\left(5^{1/\log_7 5} + \frac{1}{\sqrt{(-\log_{10} 0.1)}}\right)}$ is	(q)	Irrational

(C)	$\log_3 5\ .\log_{25} 27$ is	(r)	Composite
(D)	Product of roots of equation $x^{\log_{10} x} = 100\ x$ is	(s)	Prime

CODES :

	A	B	C	D
a)	P,r	q	r	s
b)	p	p, r	q	p
c)	q	p,s	p	p,r
d)	p	p	p, r	q

530.

	Column-I		Column- II
(A)	$\sin(410° - A)\cos(400° + A) + \cos(410° - A)\sin(400° + A)$ has the value equal to	(p)	-1
(B)	$\dfrac{\cos^2 1° - \cos^2 2°}{2\sin 3° \sin 1°}$ is equal to	(q)	0
(C)	$\sin(-870°) + \text{cosec}\,(-660°) + \tan(-855°) + \cot(840°) + \cos(480°)\ + \sec(900°)$	(r)	$\frac{1}{2}$
(D)	If $\cos\theta = \frac{4}{5}$ where $\theta \in \left(\frac{3\pi}{2}, 2\pi\right)$ and $\cos\phi = \frac{3}{5}$ where $\phi \in \left(0, \frac{\pi}{2}\right)$, then $\cos(\theta - \phi)$ has the value equal to	(s)	1

CODES :

	A	B	C	D
a)	s	r	p	q
b)	p	q	r	s
c)	q	r	p	s
d)	s	p	r	q

531. For all real values of θ

	Column-I		Column- II
(A)	$A = \sin^2\theta + \cos^4\theta$	(p)	$A \in [-1, 1]$
(B)	$A = 3\cos^2\theta + \sin^4\theta$	(q)	$A \in \left[\frac{3}{4}, 1\right]$
(C)	$A = \sin^2\theta - \cos^4\theta$	(r)	$A \in \left[2\sqrt{2}, \infty\right)$
(D)	$A = \tan^2\theta + 2\cot^2\theta$	(s)	$A \in [1, 3]$

CODES :

	A	B	C	D
a)	q	s	p	r
b)	s	p	r	q
c)	p	r	s	q
d)	r	s	p	q

532. If $\cos\alpha + \cos\beta = 1/2$ and $\sin\alpha + \sin\beta = 1/3$

	Column-I		Column- II
(A)	$\cos\left(\frac{\alpha+\beta}{2}\right)$	(p)	$\pm\frac{\sqrt{13}}{12}$
(B)	$\cos\left(\frac{\alpha-\beta}{2}\right)$	(q)	$\frac{2}{3}$
(C)	$\tan\left(\frac{\alpha+\beta}{2}\right)$	(r)	$\pm\frac{3}{\sqrt{13}}$
(D)	$\tan\left(\frac{\alpha-\beta}{2}\right)$	(s)	$\pm\sqrt{\frac{131}{13}}$

CODES :

	A	B	C	D
a)	r	p	q	s
b)	p	q	r	s
c)	q	r	p	s
d)	r	p	q	s

533.

	Column-I		Column- II
(A)	$\cos 20° + \cos 80° - \sqrt{3}\cos 50°$	(p)	-1
(B)	$\cos 0° + \cos\frac{\pi}{7} + \cos\frac{2\pi}{7} + \cos\frac{3\pi}{7} + \cos\frac{4\pi}{7} + \cos\frac{5\pi}{7} + \cos\frac{6\pi}{7}$	(q)	$-\frac{3}{4}$
(C)	$\cos 20° + \cos 40° + \cos 60° - 4\cos 10°\cos 20°\cos 30°$	(r)	1
(D)	$\cos 20°\cos 100° + \cos 100°\cos 140° - \cos 140°\cos 200°$	(s)	0

CODES :

	A	B	C	D
a)	p	q	r	s
b)	s	r	p	q

c)	r	p	s	q
d)	r	q	s	p

534.

	Column-I		Column- II
(A)	$b > c \sin B$, $b < c$ and B is an acute angle	(p)	0
(B)	$b > c \sin B$, $c < b$, and B is an acute angle	(q)	2
(C)	$b > c \sin B$, $c < b$ and B is an obtuse angle	(r)	Data insufficient
(D)	$b > c \sin B$, $c > b$ and B is an obtuse angle	(s)	1

CODES :

	A	**B**	**C**	**D**
a)	q	s	s	p
b)	s	q	p	s
c)	p	r	q	s
d)	r	s	s	q

535.

	Column-I		Column- II
(A)	If $x^2 + y^2 = 1$ and $P = (3x - 4x^3)^2 + (3y - 4y^3)^2$, then P is equal to	(p)	1
(B)	If $a + b = 3 - \cos 4\theta$ and $a - b = 4 \sin 2\theta$, then the maximum value of (ab) is	(q)	4
(C)	The least positive integral value of x for which $3 \cos \theta = x^2 - 8x + 19$ holds good is	(r)	5
(D)	If $x = \frac{4\lambda}{1+\lambda^2}$ and $y = \frac{2-2\lambda^2}{1+\lambda^2}$, where λ is a real parameter, then $x^2 - xy + y^2$ lies between $[a, b]$ then $(a + b)$ is	(s)	8

CODES :

	A	**B**	**C**	**D**
a)	p	p	q	s
b)	s	q	p	p
c)	s	p	q	p
d)	q	s	p	p

Linked Comprehension Type

This section contain(s) 42 paragraph(s) and based upon each paragraph, multiple choice questions have to be answered. Each question has atleast 4 choices (a), (b), (c) and (d) out of which **ONLY ONE** is correct.

Paragraph for Question Nos. 536 to -536

If $P_n = \sin^n \theta + \cos^n \theta$ where $n \in W$ (whole number) and $\theta \in R$ (real number)

536. If $P_1 = m$, then the value of $4(1 - P_6)$ is

a) $3(m-1)^2$ b) $3(m^2-1)^2$ c) $3(m+1)^2$ d) $3(m^2+1)^2$

Paragraph for Question Nos. 537 to - 537

Let α is a root of the equation $(2\sin x - \cos x)(1+\cos x) = \sin^2 x$, β is a root of the equation $3\cos^2 x - 10\cos x + 3 = 0$ and γ is a root of the equation $1 - \sin 2x = \cos x - \sin x$, $0 \le \alpha, \beta, \gamma \le \pi 2$

537. $\cos\alpha + \cos\beta + \cos\gamma$ can be equal to

a) $\frac{3\sqrt{6}+2\sqrt{2}+6}{6\sqrt{2}}$ b) $\frac{3\sqrt{3}+8}{6}$ c) $\frac{3\sqrt{3}+2}{6}$ d) None of these

Paragraph for Question Nos. 538 to - 538

Let ABC is a triangle, O is a point inside the triangle so that its distance from A, B, C is respectively a, b, c. L, M, N are the feet of the perpendiculars from O to AB, BC, CA respectively. x, y, z are respectively the distance of O from L, M, N

$\angle OAL = \alpha, \angle OBM = \beta, \angle OCN = \gamma$

538. $AL + BM + CN$ is equal to

a) $a\cos\alpha + b\cos\beta + c\cos\gamma$ b) $a\sin\alpha + b\sin\beta + c\sin\gamma$

c) $x\cos\alpha + y\sin\beta + z\cos\gamma$ d) $x\sin\alpha + y\sin\beta + z\sin\gamma$

Paragraph for Question Nos. 539 to - 539

Whenever the terms on the two sides of the equation are of different nature, then equations are known as non-standard form, some of them are in the form of an ordinary equation but cannot be solved by standard procedures.

Non-standard problems require high degree of logic, they also require the use of graphs, inverse properties of functions, inequalities

539. The number of solutions of the equation $2\cos\left(\frac{x}{2}\right) = 3^x + 3^{-x}$ is

a) 1 b) 2 c) 3 d) None of these

Paragraph for Question Nos. 540 to - 540

If $\sin\alpha = A\sin(\alpha+\beta)$, $A \ne 0$, then

540. The value of $\tan\alpha$ is

a) $\frac{A\sin\beta}{1-A\cos\beta}$ b) $\frac{A\sin\beta}{1+A\cos\beta}$ c) $\frac{A\cos\beta}{1-A\sin\beta}$ d) $\frac{A\sin\beta}{1+A\cos\beta}$

Paragraph for Question Nos. 541 to - 541

If $\alpha, \beta, \gamma, \delta$ are the solutions of the equation $\tan\left(\theta + \frac{\pi}{4}\right) = 3\tan 3\theta$, no two of which have equal tangents

541. The value of $\tan\alpha + \tan\beta + \tan\gamma + \tan\delta$ is

a) 1/3 b) 8/3 c) $-8/3$ d) 0

Paragraph for Question Nos. 542 to - 542

$\sin\alpha + \sin\beta = \frac{1}{4}$ and $\cos\alpha + \cos\beta = \frac{1}{3}$

542. The value of $\sin(\alpha + \beta)$ is

a) $\frac{24}{25}$ b) $\frac{13}{25}$ c) $\frac{12}{13}$ d) None of these

Paragraph for Question Nos. 543 to - 543

To find the sum $\sin^2\frac{2\pi}{7} + \sin^2\frac{4\pi}{7} + \sin^2\frac{8\pi}{7}$ we follow the following method.
Put $7\theta = 2n\pi$, where n is any integer
Then $\sin 4\theta = \sin(2n\pi - 3\theta) = -\sin 3\theta$
This means that $\sin\theta$ takes the values $0, \pm\sin(2\pi/7), \pm\sin(4\pi/7)$ and $\pm\sin(8\pi/7)$.
Since $\sin(6\pi/7) = \sin(8\pi/7)$, from equation (1), we now get
$2\sin 2\theta\cos 2\theta = 4\sin^3\theta - 3\sin\theta$
$\Rightarrow 4\sin\theta\cos\theta\,(1 - 2\sin^2\theta) = \sin\theta\,(4\sin^2\theta - 3)$
Rejecting the value $\sin\theta = 0$, we get
$4\cos\theta\,(1 - 2\sin^2\theta) = 4\sin^2\theta - 3$
$\Rightarrow 16\cos^2\theta\,(1 - 2\sin^2\theta)^2 = (4\sin^2\theta - 3)^2$
$\Rightarrow 16(1 - \sin^2\theta)(1 - 4\sin^2\theta + 4\sin^4\theta) = 16\sin^4\theta - 24\sin^2\theta + 9$
$\Rightarrow 64\sin^6\theta - 112\sin^4\theta - 56\sin^2\theta - 7 = 0$
This is cubic in $\sin^2\theta$ with the roots $\sin^2(2\pi/7), \sin^2(4\pi/7)$ and $\sin^2(8\pi/7)$
The sum of these roots is $\sin^2\frac{2\pi}{7} + \sin^2\frac{4\pi}{7} + \sin^2\frac{8\pi}{7} = \frac{112}{64} = \frac{7}{4}$
Now answer the following questions

543. The value of $\left(\tan^2\frac{\pi}{7} + \tan^2\frac{2\pi}{7} + \tan^2\frac{3\pi}{7}\right)\left(\cot^2\frac{\pi}{7} + \cot^2\frac{2\pi}{7} + \cot^2\frac{3\pi}{7}\right)$ is

a) 105 b) 35 c) 210 d) None of these

Paragraph for Question Nos. 544 to - 544

An altitude BD and a bisector BE are drawn in the triangle ABC from the vertex B. It is known that the length of side $AC = 1$, and the magnitudes of the angles BEC, ABD, ABE, BAC form an arithmetic progression

544. The area of circle circumscribing ΔABC is

a) $\frac{\pi}{8}$ b) $\frac{\pi}{4}$ c) $\frac{\pi}{2}$ d) π

Paragraph for Question Nos. 545 to - 545

Consider the cubic equation
$x^3 - (1 + \cos\theta + \sin\theta)x^2 + (\cos\theta\sin\theta + \cos\theta + \sin\theta)x - \sin\theta\cos\theta = 0$ whose roots are x_1, x_2 and x_3

545. The value of $x_1^2 + x_2^2 + x_3^2$ equals
a) 1 b) 2 c) $2\cos\theta$ d) $\sin\theta(\sin\theta + \cos\theta)$

Paragraph for Question Nos. 546 to - 546

Consider the equation $\sec\theta + \operatorname{cosec}\theta = a, \theta \in (0, 2\pi) - \{\pi/2, \pi, 3\pi/2\}$

546. If the equation has four real roots, then
a) $|a| \geq 2\sqrt{2}$ b) $|a| < 2\sqrt{2}$ c) $a \geq -2\sqrt{2}$ d) None of these

Paragraph for Question Nos. 547 to - 547

Consider the system of equations
$\sin x \cos 2y = (a^2 - 1)^2 + 1,$
$\cos x \sin 2y = a + 1$

547. Number of values of a for which the system has a solution is
a) 1 b) 2 c) 3 d) Infinite

Paragraph for Question Nos. 548 to - 548

Consider the equation $\int_0^x (t^2 - 8t + 13)\, dt = x\sin(a/x)$

548. The number of real values of x for which the equation has solution is
a) 1 b) 2 c) 3 d) Infinite

Paragraph for Question Nos. 549 to - 549

Consider the system of equations
$x\cos^3 y + 3x\cos y \sin^2 y = 14$
$x\sin^3 y + 3x\cos^2 y \sin y = 13$

549. The value/values of x is/are
a) $\pm 5\sqrt{5}$ b) $\pm\sqrt{5}$ c) $\pm 1\sqrt{5}$ d) None of these

Paragraph for Question Nos. 550 to - 550

Given that $\Delta = 6, r_1 = 2, r_2 = 3, r_3 = 6$

550. Circumradius R is equal to

a) 2.5 b) 3.5 c) 1.5 d) None of these

Paragraph for Question Nos. 551 to - 551

Let $a = 6, b = 3$ and $\cos(A - B) = \frac{4}{5}$

551. Area of the triangle is equal to

a) 9 b) 12 c) 11 d) 10

Paragraph for Question Nos. 552 to - 552

p_1, p_2, p_3 are altitude of triangle ABC from the vertices A, B, C and Δ is the area of the triangle

552. The value of $p_1^{-2} + p_2^{-2} + p_3^{-2}$ is equal to

a) $\frac{a+b+c}{\Delta}$ b) $\frac{a^2+b^2+c^2}{4\Delta^2}$ c) $\frac{a^2+b^2+c^2}{\Delta^2}$ d) None of these

Paragraph for Question Nos. 553 to - 553

Let O be a point inside a ΔABC such that $\angle OAB = \angle OBC = \angle OCA = \theta$

553. $\cot A + \cot B + \cos C$ is equal to

a) $\tan^2\theta$ b) $\cot^2\theta$ c) $\tan\theta$ d) $\cot\theta$

Paragraph for Question Nos. 554 to - 554

Let D, E and F be the feet of altitudes from the vertices of acute-angled triangle ABC to the sides BC, AC and AB, respectively. Triangle DEF is defined as the pedal triangle of triangle ABC. (R and r are circumradius and inradius of triangle ABC, respectively)

554. Consider the following statements:

i. orthocenter of the triangle ABC is incentre of the triangle DEF

ii. A, B, C are excentres of triangle DEF

a) Only (i) is true b) Only (ii) is true

c) Both (i) and (ii) are true d) Both (i) and (ii) are false

Paragraph for Question Nos. 555 to - 555

Incircle of ΔABC touches the sides BC, AC and AB at D, E and F, respectively. Then answer the following questions

555. $\angle DEF$ is equal to

a) $\frac{\pi - B}{2}$ b) $\pi - 2B$ c) $A - C$ d) None of these

Paragraph for Question Nos. 556 to - 556

Internal bisectors of ΔABC meet the circumcircle at points D, E and F,

556. The length of side EF is

a) $2R\cos\left(\frac{A}{2}\right)$ b) $2R\sin\left(\frac{A}{2}\right)$ c) $R\cos\left(\frac{A}{2}\right)$ d) $2R\cos\left(\frac{B}{2}\right)\cos\left(\frac{C}{2}\right)$

Integer Answer Type

557. Number of solution(s) of the equation $\frac{\sin x}{\cos 3x} + \frac{\sin 3x}{\cos 9x} + \frac{\sin 9x}{\cos 27x} = 0$ in the interval $\left(0, \frac{\pi}{4}\right)$ is ________
558. Consider a ΔABC in which the sides are $a = (n+1), b = (n+2), c = n$ with $\tan C = 4/3$, then the value of $\Delta/12$ is ________
559. Number of integral values of a for which the eqution $\cos^2 x - \sin x + a = 0$ has roots when $x \in (0, \pi/2)$ is ________
560. Number of integers ≤ 10 satisfying the inequality $2\log_{1/2}(x-1) \leq \frac{1}{3} - \frac{1}{\log_{x^2-x} 8}$ is ________
561. Number of solutions of the equation $\left(\sqrt{3}+1\right)^{2x} + \left(\sqrt{3}-1\right)^{2x} = 2^{3x}$ is ________
562. Number of solution of the equation $\sin^4 x - \cos^2 x \sin x + 2\sin^2 x + \sin x = 0$ in $0 \leq x \leq 3\pi$ is ________
563. If $f(\theta) = \frac{1 - \sin 2\theta + \cos 2\theta}{2\cos 2\theta}$ then value of $8f(11°) \cdot f(34°)$ is________.
564. Number of integral value(s) of m for the equation $\sin x - \sqrt{3}\cos x = \frac{4m-6}{4-m}$ has solutions $x \in [0, 2\pi]$ is ________
565. Suppose x and y are real numbers such that $\tan x + \tan y = 42$ and $\cot x + \cot y = 49$. Then the prime number by which the value of $\tan(x+y)$ is not divisible by 5 is ________
566. The altitudes from the angular points A, B and C on the opposite sides BC, CA and AB of ΔABC are $210, 195$ and 182, respectively. Then the value of $a/30$ is (where $a = BC$) ________
567. If a, b and c represent the lengths of sides of a triangle, then the possible integral value of $\frac{a}{b+c} + \frac{b}{c+a} + \frac{c}{a+b}$ is ________
568. Number of roots the equation $2^{\tan\left(x-\frac{\pi}{4}\right)} - 2(0.25)^{\frac{\sin^2\left(x-\frac{\pi}{4}\right)}{\cos 2x}} + 1 = 0$ is ________
569. Two equilateral triangles are constructed from a line segment of length L. If M and m are the maximum and minimum value of the sum of the areas of two plane figures, then the value of M/m is ________
570. If $f(x) = 2(7\cos x + 24\sin x)(7\sin x - 24\cos x)$, for every $x \in R$, then maximum value of $\left(f(x)\right)^{1/4}$ is ________
571. In $\Delta ABC, AB = 52, BC = 56, CA = 60$. Let D be the foot of the altitude from A, and E be the intersection of the internal angle bisector of $\angle BAC$ with BC. Find the length DE is ________
572. Sum of all integral values of x satisfying the inequality $\left(3^{5/2\log_3(12-3x)}\right) - \left(3^{\log_2 x}\right) > 32$ is ________
573. In triangle ABC, $\sin A \sin B + \sin B \sin c + \sin C \sin A = 9/4$ and $a = 2$, then the value of $\sqrt{3}\Delta$, where Δ is area of triangle, is ________
574. The value of $\operatorname{cosec} 10° + \operatorname{cosec} 50° - \operatorname{cosec} 70°$ is________
575. In ΔABC, if $r = 1, R = 3$ and $s = 5$, then the value of $\frac{a^2+b^2+c^2}{3}$ is ________

576. If $\log_4 A = \log_6 B = \log_9(A+B)$, then $\left[4\frac{B}{A}\right]$ (where $[\cdot]$ represents the greatest integer function) equals ________

577. The difference of roots of the equation $(\log_{27} x^3)^2 = \log_{27} x^6$ is ________

578. Suppose α, β, γ and δ are the interior angles of regular pentagon, hexagon, decagon and dodecagon, respectively, then the value of $|\cos\alpha \sec\beta \cos\gamma \ \operatorname{cosec}\delta|$ is ________

579. The maximum integral value of a for which the equation $a\sin x + \cos 2x = 2a - 7$ has a solution is ________

580. Number of values of p for which equation $\sin^3 x + 1 + p^3 - 3p\sin x = 0$ $(p > 0)$ has a root is ________

581. The sides of triangle ABC satisfy the relations $a + b - c = 2$ and $2ab - c^2 = 4$, then square of the area of triangle is ________

582. Suppose A and B are two angles such that $A, B \in (0, \pi)$, and satisfy $\sin A + \sin B = 1$ and $\cos A + \cos B = 0$. Then the value of $12\cos 2A + 4\cos 2B$ is ________.

583. The area of a right triangle is 6864 square units. If the ratio of its legs is 143: 24, then the value of $[r/4]$, where $[\cdot]$ represents the greatest integer function, is ________

584. α and β are the positive acute angles and satisfying equations $5\sin 2\beta = 3\sin 2\alpha$ and $\tan\beta = 3\tan\alpha$ simultaneously. Then the value of $\tan\alpha + \tan\beta$ is ________

585. If $\sin^3 x\cos 3x + \cos^3 x\sin 3x = 3/8$, then the value of $8\sin 4x$ is ________

586. Number of roots of the equation $|\sin x\cos x| + \sqrt{2 + \tan^2 x + \cot^2 x} = \sqrt{3}$, $x \in [0, 4\pi]$, are ________

587. Integral value of x which satisfies the equation $\log_6 54 + \log_x 16 = \log_{\sqrt{2}} x - \log_{36}\frac{4}{9}$ is ________

588. In ΔABC, if $\angle C = 3\angle A$, $BC = 27$ and $AB = 48$. Then the value of $AC/7$ is ________

589. ΔABC, $\angle C = 2\angle A$ and $AC = 2\,BC$, then the value of $\frac{a^2+b^2+c^2}{R^2}$ (where R is circum-radius of triangle) is ________

590. Number of roots of the equation $(3 + \cos x)^2 = 4 - 2\sin^8 x$, $x \in [0, 5\pi]$ are ________

591. The value of $(\log_{10} 2)^3 + \log_{10} 8 \,.\log_{10} 5 + (\log_{10} 5)^3$ is ________

592. The value of $\dfrac{\sin 1° + \sin 3° + \sin 5° + \sin 7°}{\cos 1° \cdot \cos 2° \cdot \sin 4°}$ is ________.

593. The absolute value of the expression $\tan\frac{\pi}{16} + \tan\frac{5\pi}{16} + \tan\frac{9\pi}{16} + \tan\frac{13\pi}{16}$ is ________

594. If $x, y \in R$ satisfy $(x+5)^2 + (y-12)^2 = (14)^2$, then the minimum value of is ________

595. The value of $9\dfrac{\sin^4 t + \cos^4 t - 1}{\sin^6 t + \cos^6 t - 1}$ is ________

596. Number of integers satisfying the inequality $\log_{1/2}|x - 3| > -1$ is ________

597. The value of $\sqrt{3}\left|\dfrac{\frac{2\sin(140°)\sec(280°)}{\sec(220°)} + \frac{\sec(340°)}{\operatorname{cosec}(20°)}}{\frac{\cot(200°) - \tan(280°)}{\cot(200°)}}\right|$ is ________.

598. Let $ABCDEFGHIJKL$ be a regular dodecagon. Then the value of $\frac{AB}{AF} + \frac{AF}{AB}$ is equal to ________

599. In a triangle ABC, $\angle C = \frac{\pi}{2}$. If $\tan\left(\frac{A}{2}\right)$ and $\tan\left(\frac{B}{2}\right)$ are the roots of the equation $ax^2 + bx + c = 0 (a \neq 0)$, then the value of $\frac{a+b}{c}$ (where, a, b, c are sides of Δ opposite to angles A, B, C resp.) is ________.

600. The reciprocal of $\frac{2}{\log_4(2000)^6} + \frac{3}{\log_5(2000)^6}$ is ________

601. If $\log_{10}\sin x + \log_{10}\cos x = -1$ and$\log_{10}(\sin x + \cos x) = \frac{(\log_{10} n) - 1}{2}$, then the value of $'n/3'$ is ________

602. Number of triangles ABC if $\tan A = x$, $\tan B = x + 1$ and $\tan C = 1 - x$ is ________.

603. The lengths of the tangents drawn from the vertices A, B and C to the incircle of ΔABC are 5, 3 and 2, respectively. If the lengths of the parts of tangents within the triangle which are drawn parallel to the sides BC, CA and AB of the triangle to the incircle are α, β and γ, respectively, then the value the value of $[\alpha + \beta + \gamma]$ (where $[\cdot]$ represents greatest integer function) is ________

604. Sum of integers satisfying $\sqrt{\log_2 x - 1} - 1/2\log_2(x^3) + 2 > 0$ is ________

605. If $(1 + \tan 5°)(1 + \tan 10°)(1 + \tan 15°) \ldots (1 + \tan 45°) = 2^k$, then the value of $'k'$ is________

606. In $\Delta AEX, T$ is the midpoint of XE, and P is the midpoint of ET. If ΔAPE is equilateral of side length equal to unity, then the value of $[(AX)^2/2]$ is (where $[\cdot]$ represents greatest integer function) ________

607. The value of $\log_{\left(\sqrt{3+2\sqrt{2}}+\sqrt{3-2\sqrt{2}}\right)} 2^9$ is __________

608. The maximum value of $y = \frac{1}{\sin^6 x + \cos^6 x}$ is________

609. If $\cos 4x = a_0 + a_1 \cos^2 x + a_2 \cos^4 x$ is true for all values of $x \in R$, then the value of $5a_0 + a_1 + a_2$ is ________

610. If $\log_a b = 2; \log_b c = 2$ and $\log_3 c = 3 + \log_3 a$, then the value of $c/(ab)$ is __________.

611. The least integer greater than $\log_2 15 \ . \log_{1/6} 2 \ . \log_3 1/6$ is __________

612. In a triangle ABC, if $A - B = 120°$ and $\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2} = \frac{1}{32}$ then, the value of $8\cos C$ is ________

613. If $a = \log_{245} 175$ and $b = \log_{1715} 875$, then the value of $\frac{1-ab}{a-b}$ is __________

614. A circle inscribed in a triangle ABC touches the side AB at D such that $AD = 5$ and $BD = 3$. If $\angle A = 60°$, then the value of $[BC/3]$ (where $[\cdot]$ represents greatest integer function) is ________

615. The value of a for which system of equations $\sin^2 x + \cos^2 y = \frac{3a}{2}$ and $\cos^2 x + \sin^2 y = \frac{a^2}{2}$ has a solution is ________

616. The greatest integer less than or equal to $\frac{1}{\cos 290°} + \frac{1}{\sqrt{3}\sin 250°}$ is ________

617. In a triangle ABC if $\tan A = \frac{1}{2}, \tan B = k + \frac{1}{2}$ an $\tan C = 2k + \frac{1}{2}$, then the possible value of $[k]$, where $[\cdot]$ represents greatest integer function is ________.

618. The minimum value of $\sqrt{(3\sin x - 4\cos x - 10)(3\sin x + 4\cos x - 10)}$ is________

619. In ΔABC, if $\cos A + \sin A - \frac{2}{\cos B + \sin B} = 0$, then the value of $\left(\frac{a+b}{c}\right)^4$ is ________

620. In ΔABC the incircle touches the sides BC, CA and AB, representively, at D, E and F. If the radius of the incircle is 4 units and BD, CE and AF are consecutive integers, then the value of $s/3$, where s is a semi-perimeter of triangle, is ________

621. Let $0 \le a, b, c, d \le \pi$ where b and c are not complementary, such that $2\cos a + 6\cos b + 7\cos c + 9\cos d = 0$ and $2\sin a - 6\sin b + 7\sin c - 9\sin d = 0$, then the value of $3\frac{\cos(a+d)}{\cos(b+c)}$ is ________

622. The maximum value of $\cos^2(45° + x) + (\sin x - \cos x)^2$ is ________

: ANSWER KEY :

1)	c	2)	b	3)	a	4)	d	189)	d	190)	b	191)	a	192)	a
5)	a	6)	d	7)	c	8)	b	193)	c	194)	b	195)	b	196)	b
9)	b	10)	b	11)	a	12)	c	197)	d	198)	c	199)	a	200)	b
13)	b	14)	b	15)	b	16)	d	201)	b	202)	c	203)	d	204)	c
17)	a	18)	c	19)	d	20)	b	205)	d	206)	d	207)	a	208)	d
21)	b	22)	b	23)	c	24)	a	209)	b	210)	b	211)	c	212)	c
25)	d	26)	b	27)	d	28)	a	213)	b	214)	a	215)	b	216)	b
29)	a	30)	d	31)	b	32)	c	217)	b	218)	b	219)	d	220)	a
33)	a	34)	b	35)	a	36)	b	221)	d	222)	a	223)	c	224)	b
37)	b	38)	c	39)	b	40)	c	225)	c	226)	c	227)	a	228)	a
41)	d	42)	c	43)	c	44)	c	229)	a	230)	b	231)	b	232)	c
45)	d	46)	a	47)	a	48)	c	233)	a	234)	b	235)	c	236)	a
49)	d	50)	a	51)	a	52)	c	237)	c	238)	a	239)	c	240)	c
53)	a	54)	d	55)	a	56)	d	241)	c	242)	b	243)	a	244)	b
57)	a	58)	a	59)	d	60)	b	245)	b	246)	c	247)	b	248)	b
61)	b	62)	d	63)	b	64)	b	249)	a	250)	a	251)	d	252)	b
65)	a	66)	a	67)	b	68)	a	253)	b	254)	c	255)	c	256)	a
69)	a	70)	b	71)	c	72)	a	257)	b	258)	b	259)	a	260)	b
73)	b	74)	b	75)	c	76)	c	261)	c	262)	a	263)	d	264)	c
77)	b	78)	a	79)	a	80)	d	265)	a	266)	a	267)	a	268)	c
81)	b	82)	c	83)	a	84)	c	269)	d	270)	a	271)	c	272)	a
85)	a	86)	d	87)	c	88)	b	273)	c	274)	b	275)	c	276)	a
89)	b	90)	b	91)	b	92)	d	277)	d	278)	d	279)	c	280)	c
93)	b	94)	a	95)	a	96)	a	281)	b	282)	b	283)	c	284)	d
97)	c	98)	a	99)	c	100)	a	285)	d	286)	d	287)	d	288)	a
101)	c	102)	d	103)	d	104)	b	289)	c	290)	b	291)	a	292)	b
105)	b	106)	b	107)	a	108)	a	293)	d	294)	a	295)	a	296)	a
109)	a	110)	b	111)	c	112)	a	297)	a	298)	a	299)	a	300)	b
113)	a	114)	a	115)	c	116)	c	301)	d	302)	d	303)	c	304)	c
117)	b	118)	c	119)	b	120)	a	305)	d	306)	b	307)	c	308)	b
121)	d	122)	b	123)	d	124)	c	309)	d	310)	c	311)	a	312)	b
125)	b	126)	d	127)	a	128)	a	313)	d	314)	c	315)	a	316)	b
129)	d	130)	b	131)	d	132)	b	317)	c	318)	d	319)	a	320)	d
133)	a	134)	c	135)	c	136)	c	321)	b	322)	c	323)	b	324)	c
137)	a	138)	a	139)	a	140)	c	325)	c	326)	a	327)	a	328)	a
141)	b	142)	b	143)	c	144)	d	329)	b	330)	c	331)	b	332)	a
145)	c	146)	a	147)	d	148)	a	333)	d	334)	c	335)	c	336)	a
149)	c	150)	c	151)	c	152)	b	337)	b	338)	b	339)	d	340)	d
153)	d	154)	b	155)	d	156)	a	341)	b	342)	d	343)	c	344)	a
157)	c	158)	b	159)	d	160)	a	345)	a	346)	b	347)	d	348)	a
161)	b	162)	b	163)	c	164)	c	349)	b	350)	a	351)	c	352)	c
165)	c	166)	b	167)	b	168)	c	353)	c	354)	c	355)	b	356)	a
169)	d	170)	b	171)	b	172)	d	357)	a	358)	a	359)	b	360)	b
173)	a	174)	d	175)	a	176)	c	361)	c	362)	c	363)	c	364)	b
177)	b	178)	c	179)	a	180)	b	365)	a	1)	a,c	2)	a,c	3)	
181)	b	182)	d	183)	a	184)	d		a,b	4)	a,b,c				
185)	c	186)	b	187)	c	188)	c	5)	a,c	6)	a,d	7)	a,c	8)	

b, c
9) a,b,c 10) a,d 11) b,c 12)
a,b,d
13) a, c 14) a,b,c,d 15) a,b 16)
a,c
17) a,b,c,d 18) c 19) a,b,c,d 20) c
21) b, c, d 22) b, d 23) c,d 24)
a, b, c, d
25) c 26) c,d 27) a,b,c 28)
a, b, c
29) a,d 30) a,b,c 31) a, d 32)
a,d
33) a,b 34) b 35) a, b 36)
a,c, d
37) a,c 38) a,c,d 39) a,c 40)
a,c
41) a,b,d 42) d 43) a,c,d 44)
a,b
45) b,d 46) b 47) d 48)
a,c
49) a,c,d 50) a,b,d 51) a,c,d 52)
a,b,c
53) b,c,d 54) a,c,d 55) a,d 56)
a,b
57) b, c, d 58) a,c 59) a,b,c,d 60)
a,b,c,d
61) a,c 62) a,d 63) a,b 64)
a,b,c
65) b,c 66) b,c 67) a, b, c, d
68) c
69) a,d 70) a,b,c 71) a,d 72) c
73) a,b,c 74) a,c 75) a,c 76)
b,c
77) b,c 78) a,b,d 79) a,c 80)
b,c,d
81) a,c 82) a,b,d 83) a,b 84)
b,d
85) c,d 86) a,c,d 87) a,b 88)
a,c
89) a,b,c,d 90) a, c, d 91) c,d 92)
a,b,c

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

41) a 42) d 43) b 44) a
45) a 46) b 47) b 48) d
49) c 50) b 51) a 52) b
53) d 54) b 55) a 56) a
57) a 58) d 1) a 2) c
3) c 4) a

5)	c	6)	a	7)	d	8)	d
9)	b	10)	a	11)	b	12)	b
13)	b	14)	c	15)	a	16)	a
17)	d	18)	b	19)	a	20)	a
1)	b	2)	b	3)	a	4)	a
5)	a	6)	d	7)	a	8)	a
9)	b	10)	b	11)	a	12)	a
13)	a	14)	a	15)	a	16)	a
17)	b	18)	d	19)	c	20)	a
21)	a	1)	6	2)	7	3)	1

4) 9

5)	1	6)	4	7)	4	8)	4
9)	5	10)	7	11)	2	12)	0
13)	2	14)	5	15)	6	16)	3
17)	3	18)	6	19)	8	20)	6
21)	8	22)	1	23)	6	24)	1
25)	3	26)	8	27)	5	28)	4
29)	4	30)	0	31)	4	32)	5
33)	8	34)	3	35)	1	36)	4
37)	4	38)	1	39)	6	40)	2
41)	3	42)	4	43)	1	44)	6
45)	4	46)	0	47)	6	48)	5
49)	5	50)	6	51)	6	52)	4
53)	5	54)	3	55)	3	56)	7
57)	5	58)	4	59)	1	60)	2
61)	2	62)	7	63)	4	64)	7
65)	7	66)	3				