1. $\frac{d}{dx}\tan^{-1}\left[\frac{\cos x-\sin x}{\cos x+\sin x}\right]=$

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

(c) 1 (d) – 1

2. If $y=\frac{x}{2}\sqrt{a^2+x^2}+\frac{a^2}{2}\log(x+\sqrt{x^2+a^2})$,then $\frac{dy}{dx}=$

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

(c) $2\sqrt{x^2+a^2}$ (d) $\frac{2}{\sqrt{x^2+a^2}}$

3. If $y=\cot^{-1}(\cos 2x)^{1/2}$, then the value of $\frac{dy}{dx}$ at $x=\frac{\pi}{6}$ will be

(a) $\left(\frac{2}{3}\right)^{1/2}$ (b) $\left(\frac{1}{3}\right)^{1/2}$

(c) $(3)^{1/2}$ (d) $(6)^{1/2}$

4. If $f(x+y)=f(x).f(y)$ for all x and y and $f(5)=2$, $f'(0)=3$, then $f'(5)$ will be

(a) 2 (b) 4

(c) 6 (d) 8

5. If $xe^{xy}=y+\sin^2 x$, then at $x=0, \frac{dy}{dx}=$

(a) –1 (b) – 2

(c) 1 (d) 2

6. If $u(x,y)=y\log x+x\log y$, then $u_x u_y-u_x\log x-u_y\log y+\log x\ \log y=$

(a) 0 (b) –1

(c) 1 (d) 2

7. If $y=f\left(\frac{2x-1}{x^2+1}\right)$ and $f'(x)=\sin x^2$, then $\frac{dy}{dx}=$

(a) $\frac{6x^2-2x+2}{(x^2+1)^2}\sin\left(\frac{2x-1}{x^2+1}\right)^2$

(b) $\frac{6x^2-2x+2}{(x^2+1)^2}\sin^2\left(\frac{2x-1}{x^2+1}\right)$

(c) $\frac{-2x^2+2x+2}{(x^2+1)^2}\sin^2\left(\frac{2x-1}{x^2+1}\right)$

(d) $\frac{-2x^2+2x+2}{(x^2+1)^2}\sin\left(\frac{2x-1}{x^2+1}\right)^2$

8. The focal distance of a point on the parabola $y^2=16x$ whose ordinate is twice the abscissa, is

(a) 6 (b) 8

(c) 10 (d) 12

9. The co-ordinates of the extremities of the latus rectum of the parabola $5y^2=4x$ are

(a) $(1/5, 2/5), (-1/5, 2/5)$

(b) $(1/5, 2/5), (1/5, -2/5)$

(c) $(1/5, 4/5), (1/5, -4/5)$

(d) None of these

10. The distance between the foci of the ellipse $3x^2+4y^2=48$ is

(a) 2 (b) 4

(c) 6 (d) 8

11. The equation of the ellipse whose vertices are $(\pm 5, 0)$ and foci are $(\pm 4, 0)$ is

(a) $9x^2+25y^2=225$ (b) $25x^2+9y^2=225$

(c) $3x^2+4y^2=192$ (d) None of these

12. If the length of the transverse and conjugate axes of a hyperbola be 8 and 6 respectively, then the difference focal distances of any point of the hyperbola will be

(a) 8 (b) 6

(c) 14 (d) 2

13. If $(0, \pm 4)$ and $(0, \pm 2)$ be the foci and vertices of a hyperbola, then its equation is

(a) $\frac{x^2}{4}-\frac{y^2}{12}=1$ (b) $\frac{x^2}{12}-\frac{y^2}{4}=1$

(c) $\frac{y^2}{4}-\frac{x^2}{12}=1$ (d) $\frac{y^2}{12}-\frac{x^2}{4}=1$

14. The value of $\binom{30}{0}\binom{30}{10}-\binom{30}{1}\binom{30}{11}$

$+\binom{30}{2}\binom{30}{12}+.......+\binom{30}{20}\binom{30}{30}$

(a) ${}^{60}C_{20}$ (b) ${}^{30}C_{10}$

(c) ${}^{60}C_{30}$ (d) ${}^{40}C_{30}$

15. Middle term in the expansion of $(1+3x+3x^2+x^3)^6$ is

(a) 4^{th} (b) 3^{rd}

(c) 10^{th} (d) None of these

16. Let A = {a, b, c} and B = {1, 2}. Consider a relation R defined from set A to set B. Then R is equal to set

(a) A (b) B

(c) $A \times B$ (d) $B \times A$

17. Let $n(A) = n$. Then the number of all relations on A is

(a) 2^n (b) $2^{(n)!}$

(c) 2^{n^2} (d) None of these

18. If R is a relation from a finite set A having m elements to a finite set B having n elements, then the number of relations from A to B is

(a) 2^{mn} (b) $2^{mn}-1$

(c) $2mn$ (d) m^n

19. Let R be a reflexive relation on a finite set A having n-elements, and let there be m ordered pairs in R. Then

(a) $m \geq n$ (b) $m \leq n$

(c) $m = n$ (d) None of these

20. The relation R defined on the set $A = \{1, 2, 3, 4, 5\}$ by

$R = \{(x, y) : |x^2 - y^2| < 16\}$ is given by

(a) $\{(1, 1), (2, 1), (3, 1), (4, 1), (2, 3)\}$

(b) $\{(2, 2), (3, 2), (4, 2), (2, 4)\}$

(c) $\{(3, 3), (3, 4), (5, 4), (4, 3), (3, 1)\}$

(d) None of these

21. If the set A has p elements, B has q elements, then the number of elements in $A \times B$ is

(a) $p+q$ (b) $p+q+1$

(c) pq (d) p^2

22. If $A = \{a,b\}, B = \{c,d\}, C = \{d,e\}$, then

$\{(a,c),(a,d),(a,e),(b,c),(b,d),(b,e)\}$ is equal to

(a) $A \cap (B \cup C)$ (b) $A \cup (B \cap C)$

(c) $A \times (B \cup C)$ (d) $A \times (B \cap C)$

23. If P, Q and R are subsets of a set A, then $R \times (P^c \cup Q^c)^c =$

(a) $(R \times P) \cap (R \times Q)$ (b) $(R \times Q) \cap (R \times P)$

(c) $(R \times P) \cup (R \times Q)$ (d) None of these

24. The total number of different combinations of one or more letters which can be made from the letters of the word 'MISSISSIPPI' is

(a) 150 (b) 148

(c) 149 (d) None of these

25. A person goes in for an examination in which there are four papers with a maximum of m marks from each paper. The number of ways in which one can get $2m$ marks is

(a) ${}^{2m+3}C_3$

(b) $\frac{1}{3}(m+1)(2m^2+4m+1)$

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

(d) None of these

26. If α, β be the roots of $x^2+px+q=0$ and $\alpha+h, \beta+h$ are the roots of $x^2+rx+s=0$, then

(a) $\frac{p}{r}=\frac{q}{s}$ (b) $2h=\left[\frac{p}{q}+\frac{r}{s}\right]$

(c) $p^2-4q=r^2-4s$ (d) $pr^2=qs^2$

27. If $x^2+px+q=0$ is the quadratic equation whose roots are $a-2$ and $b-2$ where a and b are the roots of $x^2-3x+1=0$, then

(a) $p=1, q=5$ (b) $p=1, q=-5$

(c) $p=-1, q=1$ (d) None of these

28. The value of 'a' for which one root of the quadratic equation $(a^2-5a+3)x^2+(3a-1)x+2=0$ is twice as large as the other, is

(a) $\frac{2}{3}$ (b) $-\frac{2}{3}$

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

29. If a,b,c are in G.P., then the equations $ax^2+2bx+c=0$ and $dx^2+2ex+f=0$ have a common root if $\frac{d}{a},\frac{e}{b},\frac{f}{c}$ are in

(a) A.P. (b) G.P.

(c) H.P. (d) None of these

30. The value of 'a' for which the equations $x^2-3x+a=0$ and $x^2+ax-3=0$ have a common root is

(a) 3 (b) 1

(c) – 2 (d) 2

31. If $(x+1)$ is a factor of

$x^4-(p-3)x^3-(3p-5)x^2+(2p-7)x+6$, then $p=$

(a) 4 (b) 2

(c) 1 (d) None of these

32. The roots of the equation

$4x^4-24x^3+57x^2+18x-45=0$,

If one of them is $3+i\sqrt{6}$, are

(a) $3-i\sqrt{6}, \pm\sqrt{\frac{3}{2}}$ (b) $3-i\sqrt{6}, \pm\frac{3}{\sqrt{2}}$

(c) $3-i\sqrt{6}, \pm\frac{\sqrt{3}}{2}$ (d) None of these

33. The values of a for which $2x^2 - 2(2a+1)x + a(a+1) = 0$ may have one root less than a and other root greater than a are given by

(a) $1 > a > 0$ (b) $-1 < a < 0$

(c) $a \geq 0$ (d) $a > 0$ or $a < -1$

34. Let a, b, c be real numbers $a \neq 0$. If α is a root $a^2x^2 + bx + c = 0$, β is a root of $a^2x^2 - bx - c = 0$ and $0 < \alpha < \beta$, then the equation $a^2x^2 + 2bx + 2c = 0$ has a root γ that always satisfies

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

(c) $\gamma = \alpha$ (d) $\alpha < \gamma < \beta$

35. The solution of the differential equation $x\frac{d^2y}{dx^2} = 1$, given that $y = 1, \frac{dy}{dx} = 0$ when $x = 1$, is

(a) $y = x\log x + x + 2$ (b) $y = x\log x - x + 2$

(c) $y = x\log x + x$ (d) $y = x\log x - x$

36. The solution of the differential equation $\frac{d^2y}{dx^2} = -\frac{1}{x^2}$ is

(a) $y = \log x + c_1x + c_2$ (b) $y = -\log x + c_1x + c_2$

(c) $y = -\frac{1}{x} + c_1x + c_2$ (d) None of these

37. The solution of the differential equation $\cos^2 x\frac{d^2y}{dx^2} = 1$ is

(a) $y = \log\cos x + cx$ (b) $y = \log\sec x + c_1x + c_2$

(c) $y = \log\sec x - c_1x + c_2$ (d) None of these

38. The solution of $\frac{d^2y}{dx^2} = \sec^2 x + xe^x$ is

(a) $y = \log(\sec x) + (x-2)e^x + c_1x + c_2$

(b) $y = \log(\sec x) + (x+2)e^x + c_1x + c_2$

(c) $y = \log(\sec x) - (x+2)e^x + c_1x + c_2$

(d) None of these

39. If $\frac{d^2y}{dx^2} = 0$, then

(a) $y = ax + b$ (b) $y^2 = ax + b$

(c) $y = \log x$ (d) $y = e^x + c$

40. If $\frac{d^2y}{dx^2} + \sin x = 0$, then solution of the differential equation is.

(a) $\sin x + c_1x + c_2$ (b) $\cos x + c_1x + c_2$

(c) $\tan x + c_1x + c_2$ (d) $\log\sin x + c_1x + c_2$

41. If P and Q be the middle points of the sides BC and CD of the parallelogram $ABCD$, then $\overrightarrow{AP} + \overrightarrow{AQ} =$

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

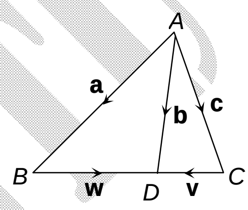
(c) $\frac{2}{3}\overrightarrow{AC}$ (d) $\frac{3}{2}\overrightarrow{AC}$

42. P is a point on the side BC of the ΔABC and Q is a point such that $\overrightarrow{PQ}$ is the resultant of $\overrightarrow{AP}, \overrightarrow{PB}, \overrightarrow{PC}$. Then $ABQC$ is a

(a) Square (b) Rectangle

(c) Parallelogram (d) Trapezium

43. In the figure, a vector $\mathbf{x}$ satisfies the equation $\mathbf{x} - \mathbf{w} = \mathbf{v}$. Then $\mathbf{x}$ =



(a) $2\mathbf{a} + \mathbf{b} + \mathbf{c}$ (b) $\mathbf{a} + 2\mathbf{b} + \mathbf{c}$

(c) $\mathbf{a} + \mathbf{b} + 2\mathbf{c}$ (d) $\mathbf{a} + \mathbf{b} + \mathbf{c}$

44. A vector coplanar with the non-collinear vectors **a** and **b** is

(a) $\mathbf{a} \times \mathbf{b}$ (b) $\mathbf{a} + \mathbf{b}$

(c) $\mathbf{a} . \mathbf{b}$ (d) None of these

45. If $ABCD$ is a parallelogram, $\overrightarrow{AB} = 2\mathbf{i} + 4\mathbf{j} - 5\mathbf{k}$ and $\overrightarrow{AD} = \mathbf{i} + 2\mathbf{j} + 3\mathbf{k}$, then the unit vector in the direction of BD is

(a) $\frac{1}{\sqrt{69}}(\mathbf{i} + 2\mathbf{j} - 8\mathbf{k})$ (b) $\frac{1}{69}(\mathbf{i} + 2\mathbf{j} - 8\mathbf{k})$

(c) $\frac{1}{\sqrt{69}}(-\mathbf{i} - 2\mathbf{j} + 8\mathbf{k})$ (d) $\frac{1}{69}(-\mathbf{i} - 2\mathbf{j} + 8\mathbf{k})$

46. $\mathbf{a}, \mathbf{b}, \mathbf{c}$ are three vectors, such that $\mathbf{a} + \mathbf{b} + \mathbf{c} = 0$, $|\mathbf{a}| = 1, |\mathbf{b}| = 2, |\mathbf{c}| = 3$, then $\mathbf{a.b} + \mathbf{b.c} + \mathbf{c.a}$ is equal to

(a) 0 (b) – 7

(c) 7 (d) 1

47. A unit vector which is coplanar to vector $\mathbf{i} + \mathbf{j} + 2\mathbf{k}$ and $\mathbf{i} + 2\mathbf{j} + \mathbf{k}$ and perpendicular to $\mathbf{i} + \mathbf{j} + \mathbf{k}$, is

(a) $\frac{\mathbf{i} - \mathbf{j}}{\sqrt{2}}$ (b) $\pm\left(\frac{\mathbf{j} - \mathbf{k}}{\sqrt{2}}\right)$

(c) $\frac{\mathbf{k} - \mathbf{i}}{\sqrt{2}}$ (d) $\frac{\mathbf{i} + \mathbf{j} + \mathbf{k}}{\sqrt{3}}$

48. If $|\mathbf{a}| = 3, |\mathbf{b}| = 4$ then a value of λ for which $\mathbf{a} + \lambda\mathbf{b}$ is perpendicular to $\mathbf{a} - \lambda\mathbf{b}$ is

(a) $\frac{9}{16}$ (b) $\frac{3}{4}$

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

49. $\mathbf{a}, \mathbf{b}$ and $\mathbf{c}$ are three vectors with magnitude $|\mathbf{a}| = 4$, $|\mathbf{b}| = 4$, $|\mathbf{c}| = 2$ and such that $\mathbf{a}$ is perpendicular to $(\mathbf{b} + \mathbf{c}), \mathbf{b}$ is perpendicular to $(\mathbf{c} + \mathbf{a})$ and $\mathbf{c}$ is perpendicular to $(\mathbf{a} + \mathbf{b})$. It follows that $|\mathbf{a} + \mathbf{b} + \mathbf{c}|$ is equal to

(a) 9 (b) 6

(c) 5 (d) 4

50. A rifle man is firing at a distant target and has only 10% chance of hitting it. The minimum number of rounds he must fire in order to have 50% chance of hitting it at least once is

(a) 7 (b) 8

(c) 9 (d) 6

51. If the integers m and n are chosen at random between 1 and 100, then the probability that a number of the form $7^m + 7^n$ is divisible by 5 equals

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

(c) $\frac{1}{8}$ (d) $\frac{1}{49}$

52. There are four machines and it is known that exactly two of them are faulty. They are tested, one by one, is a random order till both the faulty machines are identified. Then the probability that only two tests are needed is

(a) $\frac{1}{3}$ (b) $\frac{1}{6}$

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

53. Two persons A and B take turns in throwing a pair of dice. The first person to through 9 from both dice will be avoided the prize. If A throws first then the probability that B wins the game is

(a) $\frac{9}{17}$ (b) $\frac{8}{17}$

(c) $\frac{8}{9}$ (d) $\frac{1}{9}$

54. In four schools B_1, B_2, B_3, B_4 the percentage of girls students is 12, 20, 13, 17 respectively. From a school selected at random, one student is picked up at random and it is found that the student is a girl. The probability that the school selected is B_2, is

(a) $\frac{6}{31}$ (b) $\frac{10}{31}$

(c) $\frac{13}{62}$ (d) $\frac{17}{62}$

55. Probability that a student will succeed in IIT entrance test is 0.2 and that he will succeed in Roorkee entrance test is 0.5. If the probability that he will be successful at both the places is 0.3, then the probability that he does not succeed at both the places is

(a) 0.4 (b) 0.3

(c) 0.2 (d) 0.6

56. If x co-ordinates of a point P of line joining the points $Q(2, 2, 1)$ and $R(5, 2, -2)$ is 4, then the z-coordinates of P is

(a) – 2 (b) –1

(c) 1 (d) 2

57. The points $A(5, -1, 1)$; $B(7, -4, 7)$; $C(1, -6, 10)$ and $D(-1, -3, 4)$ are vertices of a

(a) Square (b) Rhombus

(c) Rectangle (d) None of these

58. The distance of the point (2, 3, 4) from the line $1 - x = \frac{y}{2} = \frac{1}{3}(1 + z)$ is

(a) $\frac{1}{7}\sqrt{35}$ (b) $\frac{4}{7}\sqrt{35}$

(c) $\frac{2}{7}\sqrt{35}$ (d) $\frac{3}{7}\sqrt{35}$

59. The angle between the straight lines $\frac{x-2}{2} = \frac{y-1}{5} = \frac{z+3}{-3}$ and $\frac{x+1}{-1} = \frac{y-4}{8} = \frac{z-5}{4}$ is

(a) $\cos^{-1}\left(\frac{13}{9\sqrt{38}}\right)$ (b) $\cos^{-1}\left(\frac{26}{9\sqrt{38}}\right)$

(c) $\cos^{-1}\left(\frac{4}{\sqrt{38}}\right)$ (d) $\cos^{-1}\left(\frac{2\sqrt{2}}{\sqrt{19}}\right)$

60. The distance of the plane $6x - 3y + 2z - 14 = 0$ from the origin is

(a) 2 (b) 1

(c) 14 (d) 8

61. The value of $aa' + bb' + cc'$ being negative the origin will lie in the acute angle between the planes $an + by + cz + d = 0$ and $a'x + b'y + c'z + d' = 0$, if

(a) $a = a' = 0$

(b) d and d' are of same sign

(c) d and d' are of opposite sign

(d) None of these

62. If $a = \cos(2\pi/7) + i\sin(2\pi/7)$, then the quadratic equation whose roots are $\alpha = a + a^2 + a^4$ and $\beta = a^3 + a^5 + a^6$ is
(a) $x^2 - x + 2 = 0$ (b) $x^2 + x - 2 = 0$
(c) $x^2 - x - 2 = 0$ (d) $x^2 + x + 2 = 0$

63. Let z_1 and z_2 be n^{th} roots of unity which are ends of a line segment that subtend a right angle at the origin. Then n must be of the form
(a) $4k + 1$ (b) $4k + 2$
(c) $4k + 3$ (d) $4k$

64. Let ω is an imaginary cube roots of unity then the value of

$$2(\omega+1)(\omega^2+1) + 3(2\omega+1)(2\omega^2+1) + \ldots + (n+1)(n\omega+1)(n\omega^2+1)$$ is

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

65. ω is an imaginary cube root of unity. If $(1+\omega^2)^m = (1+\omega^4)^m$, then least positive integral value of m is
(a) 6 (b) 5
(c) 4 (d) 3

66. If $a^x = b^y = c^z$ and a, b, c are in G.P. then x, y, z are in
(a) A. P. (b) G. P.
(c) H. P. (d) None of these

67. If G_1 and G_2 are two geometric means and A the arithmetic mean inserted between two numbers, then the value of $\frac{G_1^2}{G_2} + \frac{G_2^2}{G_1}$ is
(a) $\frac{A}{2}$ (b) A
(c) $2A$ (d) None of these

68. If $\log(x+z) + \log(x+z-2y) = 2\log(x-z)$, then x, y, z are in
(a) H.P. (b) G.P.
(c) A.P. (d) None of these

69. 20 *metre* high flag pole is fixed on a 80 *metre* high pillar, 50 *metre* away from it, on a point on the base of pillar the flag pole makes and angle α, then the value of $\tan\alpha$, is
(a) $\frac{2}{11}$ (b) $\frac{2}{21}$
(c) $\frac{21}{2}$ (d) $\frac{21}{4}$

70. A tower subtends angles $\alpha, 2\alpha, 3\alpha$ respectively at points A, B and C, all lying on a horizontal line through the foot of the tower. Then $AB/BC =$
(a) $\frac{\sin 3\alpha}{\sin 2\alpha}$ (b) $1 + 2\cos 2\alpha$
(c) $2 + \cos 3\alpha$ (d) $\frac{\sin 2\alpha}{\sin \alpha}$

71. The equation $\sin x + \sin y + \sin z = -3$ for $0 \le x \le 2\pi$, $0 \le y \le 2\pi$, $0 \le z \le 2\pi$, has
(a) One solution (b) Two sets of solutions
(c) Four sets of solutions (d) No solution

72. If $\sin 2\theta = \cos\theta, 0 < \theta < \pi$, then the possible values of θ are
(a) $90^o, 60^o, 30^o$ (b) $90^o, 150^o, 60^o$
(c) $90^o, 45^o, 150^o$ (d) $90^o, 30^o, 150^o$

73. If $2\sin^2\theta = 3\cos\theta$, where $0 \le \theta \le 2\pi$, then $\theta =$
(a) $\frac{\pi}{6}, \frac{7\pi}{6}$ (b) $\frac{\pi}{3}, \frac{5\pi}{3}$
(c) $\frac{\pi}{3}, \frac{7\pi}{3}$ (d) None of these

74. If $\cos 6\theta + \cos 4\theta + \cos 2\theta + 1 = 0$, where $0 < \theta < 180^o$, then $\theta =$
(a) $30^o, 45^o$ (b) $45^o, 90^o$
(c) $135^o, 150^o$ (d) $30^o, 45^o, 90^o, 135^o, 150^o$

75. Values of $\theta (0 < \theta < 360^o)$ satisfying $\text{cosec}\theta + 2 = 0$ are
(a) $210^o, 300^o$ (b) $240^o, 300^o$
(c) $210^o, 240^o$ (d) $210^o, 330^o$

76. In a ΔABC, $b = 2, C = 60^o, c = \sqrt{6}$, then $a =$
(a) $\sqrt{3} - 1$ (b) $\sqrt{3}$
(c) $\sqrt{3} + 1$ (d) None of these

77. In a ΔABC, $a = 5, b = 4$ and $\cos(A - B) = \frac{31}{32}$, then side c is equal to
(a) 6 (b) 7
(c) 9 (d) None of these

78. In a ΔABC, if $A = 30^o$ $b = 2, c = \sqrt{3} + 1$, then $\frac{C - B}{2} =$
(a) 15^o (b) 30^o
(c) 45^o (d) None of these

79. The smallest angle of the triangle whose sides are $6 + \sqrt{12}, \sqrt{48}, \sqrt{24}$ is
(a) $\frac{\pi}{3}$ (b) $\frac{\pi}{4}$

(c) $\frac{\pi}{6}$ (d) None of these

80. If $A = 30^o, c = 7\sqrt{3}$ and $C = 90^o$ in ΔABC, then a =

(a) $7\sqrt{3}$ (b) $\frac{7\sqrt{3}}{2}$

(c) $\frac{7}{2}$ (d) None of these

81. The maximum value of exp $(2+\sqrt{3}\cos x+\sin x)$ is

(a) $\exp(2)$ (b) $\exp(2-\sqrt{3})$

(c) $\exp(4)$ (d) 1

82. If the function $f(x) = 2x^3 - 9ax^2 + 12a^2x + 1$, where $a > 0$ attains its maximum and minimum at p and q respectively such that $p^2 = q$, then a equals

(a) 3 (b) 1

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

83. The function $f(x) = \frac{\ln(\pi + x)}{\ln(e+x)}$ is

(a) Increasing on $[0,\infty)$

(b) Decreasing on $[0,\infty)$

(c) Decreasing on $\left[0,\frac{\pi}{e}\right)$ and increasing on $\left[\frac{\pi}{e},\infty\right)$

(d) Increasing on $\left[0,\frac{\pi}{e}\right)$ and decreasing on $\left[\frac{\pi}{e},\infty\right)$

84. The equation to a circle whose centre lies at the point (–2, 1) and which touches the line $3x - 2y - 6 = 0$ at (4, 3), is

(a) $x^2 + y^2 + 4x - 2y - 35 = 0$

(b) $x^2 + y^2 - 4x + 2y + 35 = 0$

(c) $x^2 + y^2 + 4x + 2y + 35 = 0$

(d) None of these

85. The equation of a circle passing through the point (4, 5) and having the centre at (2, 2) is

(a) $x^2 + y^2 + 4x + 4y - 5 = 0$

(b) $x^2 + y^2 - 4x - 4y - 5 = 0$

(c) $x^2 + y^2 - 4x = 13$

(d) $x^2 + y^2 - 4x - 4y + 5 = 0$

86. Two forces P and Q acting parallel to the length and base of an inclined plane respectively would each of them singly support a weight W, on the plane , then $\frac{1}{P^2} - \frac{1}{Q^2}$ =

(a) $1/W^2$ (b) $2/W^2$

(c) $3/W^2$ (d) None of these

87. A string ABC has its extremities tied to two fixed points A and B in the same horizontal line. If a weight W is knotted at a given point C, then the tension in the portion CA is (where a, b, c are the sides and Δ is the area of triangle ABC)

(a) $\frac{Wb}{4c\Delta}(a^2+b^2+c^2)$ (b) $\frac{Wb}{4c\Delta}(b^2+c^2-a^2)$

(c) $\frac{Wb}{4c\Delta}(c^2+a^2-b^2)$ (d) $\frac{Wb}{4c\Delta}(a^2+b^2-c^2)$

88. The resultant of three equal like parallel forces acting at the vertices of a triangle act at its

(a) Incentre (b) Circumcentre

(c) Orthocentre (d) Centroid

89. If the force acting along the sides of a triangle, taken in order, are equivalent to a couple, then the forces are

(a) Equal

(b) Proportional to sides of triangle

(c) In equilibrium

(d) In arithmetic progression

90. If two like parallel forces of $\frac{P}{Q}$ *Newton* and $\frac{Q}{P}$ *Newton* have a resultant of 2 *Newton*, then

(a) $P = Q$ (b) $P = 2Q$

(c) $2P = Q$ (d) None of these

91. A force of 35 *kg* is required to pull a block of wood weighing 140 *kg* on a rough horizontal surface. The coefficient of friction is

(a) 1 (b) 0

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

92. A uniform ladder rests in limiting equilibrium, its lower end on a rough horizontal plane and its upper end against a smooth vertical wall. If θ is the angle of inclination of the ladder to the vertical wall and μ is the coefficient of friction, then $\tan\theta$ is equal to

(a) μ (b) 2μ

(c) $\frac{3\mu}{2}$ (d) μ + 1

93. $\sin\left\{\sin^{-1}\frac{1}{2}+\cos^{-1}\frac{1}{2}\right\} =$

(a) 0 (b) –1

(c) 2 (d) 1

94. $\sin^{-1}\frac{4}{5}+2\tan^{-1}\frac{1}{3}=$

(a) $\frac{\pi}{2}$ (b) $\frac{\pi}{3}$

(c) $\frac{\pi}{4}$ (d) None of these

95. $\sin^{-1}x+\cos^{-1}x$ is equal to

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

(c) –1 (d) 1

96. The range of $f(x)=\cos 2x-\sin 2x$ contains the set

(a) [2, 4] (b) [–1, 1]

(c) [–2, 2] (d) [–4, 4]

97. Range of the function $\frac{1}{2-\sin 3x}$ is

(a) [1, 3] (b) $\left[\frac{1}{3},1\right]$

(c) (1, 3) (d) $\left(\frac{1}{3},1\right)$

98. $\lim_{x\to 0}\frac{3\sin x-\sin 3x}{x^3}=$

(a) 4 (b) –4

(c) $\frac{1}{4}$ (d) None of these

99. $\lim_{x\to 0}\frac{x^3}{\sin x^2}=$

(a) 0 (b) $\frac{1}{3}$

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

100. Which of the following statements is true

(a) A continuous function is an increasing function

(b) An increasing function is continuous

(c) A continuous function is differentiable

(d) A differentiable function is continuous

101. The function $f(x)=\frac{2x^2+7}{x^3+3x^2-x-3}$ is discontinuous for

(a) $x=1$ only

(b) $x=1$ and $x=-1$ only

(c) $x=1, x=-1, x=-3$ only

(d) $x=1, x=-1, x=-3$ and other values of x

102. Let $f(x)=\begin{cases} x^p\sin\frac{1}{x}, & x\neq 0\\ 0 & , x=0\end{cases}$ then $f(x)$ is continuous but not differential at $x=0$ if

(a) $0<p\le 1$ (b) $1\le p<\infty$

(c) $-\infty<p<0$ (d) $p=0$

103. A line $4x+y=1$ passes through the point $A(2,-7)$ meets the line BC whose equation is $3x-4y+1=0$ at the point B. The equation to the line AC so that $AB = AC$, is

(a) $52x+89y+519=0$ (b) $52x+89y-519=0$

(c) $89x+52y+519=0$ (d) $89x+52y-519=0$

104. In what direction a line be drawn through the point (1, 2) so that its points of intersection with the line $x+y=4$ is at a distance $\frac{\sqrt{6}}{3}$ from the given point

(a) 30^o (b) 45^o

(c) 60^o (d) 75^o

105. If straight lines $ax+by+p=0$ and $x\cos\alpha+y\sin\alpha-p=0$ include an angle $\pi/4$ between them and meet the straight line $x\sin\alpha-y\cos\alpha=0$ in the same point, then the value of a^2+b^2 is equal to

(a) 1 (b) 2

(c) 3 (d) 4

106. In a skew symmetric matrix, the diagonal elements are all

(a) Different from each other

(b) Zero

(c) One

(d) None of these

107. If $M=\begin{bmatrix}1 & 2\\ 2 & 3\end{bmatrix}$ and $M^2-\lambda M-I_2=0$, then $\lambda=$

(a) – 2 (b) 2

(c) – 4 (d) 4

108. If $A=\begin{bmatrix}\cos\alpha & -\sin\alpha\\ \sin\alpha & \cos\alpha\end{bmatrix}$ and $B=\begin{bmatrix}\cos\beta & -\sin\beta\\ \sin\beta & \cos\beta\end{bmatrix}$, then the correct relation is

(a) $A^2=B^2$ (b) $A+B=B-A$

(c) $AB=BA$ (d) None of these

109. The values of x in the following determinant equation, $\begin{vmatrix}a+x & a-x & a-x\\ a-x & a+x & a-x\\ a-x & a-x & a+x\end{vmatrix}=0$ are

(a) $x=0, x=4a$ (b) $x=0, x=a$

(c) $x=0, x=2a$ (d) $x=0, x=3a$

110. If $\begin{vmatrix}x-1 & 3 & 0\\ 2 & x-3 & 4\\ 3 & 5 & 6\end{vmatrix}=0$, then $x=$

(a) 0 (b) 2

(c) 3 (d) 1

111. The locus of a point whose difference of distance from points (3, 0) and (–3,0) is 4, is

(a) $\frac{x^2}{4}-\frac{y^2}{5}=1$ (b) $\frac{x^2}{5}-\frac{y^2}{4}=1$

(c) $\frac{x^2}{2}-\frac{y^2}{3}=1$ (d) $\frac{x^2}{3}-\frac{y^2}{2}=1$

112. Locus of centroid of the triangle whose vertices are $(a\cos t, a\sin t)$, $(b\sin t, -b\cos t)$ and (1, 0), where t is a parameter; is

(a) $(3x-1)^2+(3y)^2=a^2-b^2$

(b) $(3x-1)^2+(3y)^2=a^2+b^2$

(c) $(3x+1)^2+(3y)^2=a^2+b^2$

(d) $(3x+1)^2+(3y)^2=a^2-b^2$

113. If the distance of any point P from the point $A(a+b, a-b)$ and $B(a-b, a+b)$ are equal, then the locus of P is

(a) $x-y=0$ (b) $ax+by=0$

(c) $bx-ay=0$ (d) $x+y=0$

114. What is the equation of the locus of a point which moves such that 4 times its distance from the x-axis is the square of its distance from the origin

(a) $x^2+y^2-4y=0$ (b) $x^2+y^2-4|y|=0$

(c) $x^2+y^2-4x=0$ (d) $x^2+y^2-4|x|=0$

115. Let P be the point (1, 0) and Q a point of the locus $y^2=8x$. The locus of mid point of PQ is

(a) $x^2+4y+2=0$ (b) $x^2-4y+2=0$

(c) $y^2-4x+2=0$ (d) $y^2+4x+2=0$

116. The value of $\int \frac{x^3}{\sqrt{1+x^4}}dx$ is

(a) $(1+x^4)^{\frac{1}{2}}+c$ (b) $-(1+x^4)^{\frac{1}{2}}+c$

(c) $\frac{1}{2}(1+x^4)^{\frac{1}{2}}+c$ (d) $-\frac{1}{2}(1+x^4)^{\frac{1}{2}}+c$

117. What is the value of the integral $I=\int \frac{dx}{(1+e^x)(1+e^{-x})}$

(a) $\frac{-1}{1+e^x}$ (b) $\frac{e^x}{1+e^x}$

(c) $\frac{1}{1+e^x}$ (d) None of these

118. The area bounded by the curves $y=|x|-1$ and $y=-|x|+1$ is

(a) 1 (b) 2

(c) $2\sqrt{2}$ (d) 4

119. The volume of spherical cap of height h cut off from a sphere of radius a is equal to

(a) $\frac{\pi}{3}h^2(3a-h)$ (b) $\pi(a-h)(2a^2-h^2-ah)$

(c) $\frac{4\pi}{3}h^3$ (d) None of these

120. $\int_{-\pi}^{\pi}\frac{2x(1+\sin x)}{1+\cos^2 x}dx$ is

(a) $\pi^2/4$ (b) π^2

(c) 0 (d) $\pi/2$

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