MATHS

BOOKS - CHHAYA PUBLICATION MATHS (BENGALI ENGLISH)

MCQ ZONE

Question Paper 1

1. The principal value of $\cos^{-1}\left(\cos\frac{11\pi}{6}\right)$ is -

A. $\frac{11\pi}{6}$

B. $\frac{\pi}{6}$

C. $\frac{5\pi}{6}$

D. $-\frac{5\pi}{6}$

Answer: B

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2. If $g(x) = x^2 + x - 2$ and $\frac{1}{2}(gof)(x) = 2x^2 - 5x + 2$, then f(x) is equal to -

A. $2x + 3$

B. $2x^2 + 3x + 1$

C. $2x^2 - 3x - 1$

D. $2x - 3$

Answer: D

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3. In the set of integers Z, which of the following relation R is not an equivalence relation ?

A. xRy : if x = y

B. xRY : if x $= y$ (mod3)

C. xRy : if x $\leq$ y

D. xRy : if (x - y) is an even integer

Answer: C

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4. If a gt 0 and discriminant of $ax^2 + 2bx + c = 0$ is negative, then the value of -

$$\begin{vmatrix} a & b & ax+b \\ b & c & bx+c \\ ax+b & bx+c & 0 \end{vmatrix}$$ is -

A. positive

B. $\left(ac - b^2\right)\left(ax^2 + bx + c\right)$

C. negative

D. 0

Answer: D

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5. Probability of solving specific problem independently by A and B are $\frac{1}{2}$ and $\frac{1}{3}$ respectively. If both try to solve the problem independently, find the probability that

(i) the problem is solved (ii) exactly one of them solves the problem.

A. $\frac{3}{4}$

B. $\frac{1}{2}$

C. $\frac{2}{3}$

D. $\frac{7}{8}$

Answer: A

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6. The probability that a leap year will have 53 Tuesday or Saturday is -

A. $\frac{2}{7}$

B. $\frac{3}{7}$

C. $\frac{4}{7}$

D. $\frac{1}{7}$

Answer: C

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7. The domain of definition of the function

$f(x) = \sqrt{\log_e\left(x^2 - 6x + 6\right)}$ is -

A. $\left(-\infty, 3 - \sqrt{3}\right] \cup \left[3 + \sqrt{3}, \infty\right)$

B. $(-\infty, 1) \cup (5, \infty)$

C. $\left(-\infty, 3 - \sqrt{3}\right) \cup \left(3 + \sqrt{3}, \infty\right)$

D. $(-\infty, 1] \cup [5, \infty)$

Answer: D

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8. The value of the determinant $\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix}$ is -

A. $1 + abc + ab + bc + ca$

B. $abc\left(1 + \frac{1}{a} + \frac{1}{b} + \frac{1}{c}\right)$

C. 4abc

D. $abc\left(\frac{1}{a} + \frac{1}{b} + \frac{1}{c}\right)$

Answer: B

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9. If $A = \begin{pmatrix} 2 & -1 \\ -1 & 2 \end{pmatrix}$ and I is the unit matrix of order 2, then A^2 is equal to -

A. $4A - 3I$

B. $3A - 4I$

C. $A - I$

D. $A + I$

Answer: A

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10. If $\operatorname{cosec}^{-1}x = \sec^{-1}y$, then the value of $\left(\sin^{-1}\frac{1}{x} + \sin^{-1}\frac{1}{y}\right)$ is -

A. π

B. $\frac{\pi}{3}$

C. $\frac{2\pi}{3}$

D. $\frac{\pi}{2}$

Answer: D

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11. If $P(A) = \frac{2}{3}, P(B) = \frac{1}{2}$ and $P(A \cup B) = \frac{5}{6}$, then the events A and B are -

A. mutually exclusive

B. independent as well as mutually exclusive

C. independent

D. none of these

Answer: C

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12. The roots of the equation $\begin{vmatrix} x & 3 & 7 \\ 2 & x & -2 \\ 7 & 8 & x \end{vmatrix} = 0$ are -

A. $-2, \ -7, 5$

B. $-2, \ -5, 7$

C. $2, 5, \ -7$

D. $2, 5, 7$

Answer: C

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13. If $f(x) = \begin{vmatrix} \sin x & \cos x & \tan x \\ x^3 & x^2 & x \\ 2x & 1 & 1 \end{vmatrix}$ then the value of $\lim_{x \to 0} \frac{f(x)}{x^2}$ is -

A. -3

B. 3

C. -1

D. 1

Answer: D

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14. If $\vec{a}$ is a non-zero vector of modulus $|\vec{a}|$ and m is a non-zero scalar, then $m\vec{a}$ is a unit vector if -

A. $m = \pm 1$

B. $m = \frac{1}{|\vec{a}|}$

C. $m = |\vec{a}|$

D. $m = \pm 2$

Answer: B

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15. The position vector of a point A is $\vec{a} + 2\vec{b}$ and $\vec{a}$ divides AB internally in the ratio $2:3$, then the position vector of the point B is -

A. $2\vec{a}$ - $\vec{b}$

B. $\vec{b}$ - $2\vec{a}$

C. $\vec{b}$

D. $\vec{a}$ - $3\vec{b}$

Answer: D

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16. The multiplicative inverse of matrix $\begin{bmatrix} 2 & 1 \\ 7 & 4 \end{bmatrix}$ is -

A. $\begin{bmatrix} 4 & -1 \\ -7 & -2 \end{bmatrix}$

B. $\begin{bmatrix} 4 & -1 \\ -7 & 2 \end{bmatrix}$

C. $\begin{bmatrix} 4 & -7 \\ 7 & 2 \end{bmatrix}$

D. $\begin{bmatrix} -4 & -1 \\ 7 & -2 \end{bmatrix}$

Answer: B

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17. The probability that at least one of the events A and B occurs is $\frac{3}{5}$. If A and B occur simultaneously with probability $\frac{1}{5}$, then the value of $P(A') + P(B')$ is -

A. $\frac{2}{5}$

B. $\frac{4}{5}$

C. $\frac{6}{5}$

D. $\frac{7}{5}$

Answer: C

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18. If $\vec{a}$ and $\vec{b}$ are mutually perpendicular unit vectors, then the value of $\left(3\vec{a} - 4\vec{b}\right) \cdot \left(2\vec{a} + 5\vec{b}\right)$ is -

A. -14

B. 14

C. 9

D. -9

Answer: A

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19. For a real number α, let $A(\alpha)$ denote the matrix $\begin{pmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{pmatrix}$.

Then for real numbers α_1 and α_2, the value of $A(\alpha_1)A(\alpha_2)$ is -

A. $A(\alpha_1\alpha_2)$

B. $A(\alpha_1 + \alpha_2)$

C. $A(\alpha_1 - \alpha_2)$

D. $A(\alpha_2 - \alpha_1)$

Answer: B

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20. If the system of equations $x + 2y + 3z = 1, 2x + ky + 5z = 1, 3x + 4y + 7z = 1$ has no solutions, then -

A. k=-1

B. k=1

C. k=3

D. k=2

Answer: C

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21. The probability that the same number appears on throwing three dice simultaneously is -

A. $\frac{1}{6}$

B. $\frac{1}{36}$

C. $\frac{5}{36}$

D. none of these

Answer: B

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22. A is a square matrix such that $A^3 = I$, then A^{-1} is equal to -

A. A^2

B. A

C. A^3

D. none of these

Answer: A

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23. If $D = \begin{vmatrix} 1 & a & a^2 - bc \\ 1 & b & b^2 - ca \\ 1 & c & c^2 - ab \end{vmatrix}$, then D is -

A. 0

B. independent of a

C. independent of b

D. independent of c

Answer: A

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24. A unit vector perpendicular to both the vectors $2\hat{i} - 3\hat{j} + 6\hat{k}$ and $3\hat{j} - 4\hat{j}$ is -

A. $\frac{1}{\sqrt{34}}\left(3\hat{i} - 4\hat{j} + 3\hat{k}\right)$

B. $\frac{1}{\sqrt{34}}\left(3\hat{i} + 4\hat{j} - 3\hat{k}\right)$

C. $\frac{1}{\sqrt{34}}\left(3\hat{i} - 4\hat{j} - 3\hat{k}\right)$

D. $\frac{1}{\sqrt{34}}\left(- 3\hat{i} + 4\hat{j} + 3\hat{k}\right)$

Answer: D

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25. Let $\vec{a} = 2\hat{i} + p\hat{j} - 3\hat{k}$ and $\vec{b} = q\hat{i} - 4\hat{j} + 2\hat{k}$ be two vectors, if $\vec{a} || \vec{b}$, then the values of p and q are -

A. $p = 6, q = - \frac{4}{3}$

B. $p = \frac{4}{3}, q = -6$

C. $p = 6, q = \frac{4}{3}$

D. $p = 4, q = 6$

Answer: A

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26. In the equation $x^2 - px + q = 0$ one root is twice of other then prove that $2p^2 = 9q$

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27. If k is a constant, then Var(k) is equal to -

A. k

B. k^2

C. 0

D. $2k^2$

Answer: C

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28. If $\begin{vmatrix} y & x & 0 \\ 0 & y & x \\ x & 0 & y \end{vmatrix} = 0$ and $x \neq 0$, then which one of the following is correct ?

A. x is one of the cube roots of 1

B. y is one of the cube roots of 1

C. $\dfrac{y}{x}$ is one of the cube roots of 1

D. $\dfrac{y}{x}$ is one of the cube roots of (-1)

Answer: D

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29. If σ^2 be the variance of a binomial distribution with parameters n and p then -

A. $4\sigma^2 \leq n$

B. $4\sigma^2 = n$

C. $4\sigma^2 > n$

D. $4\sigma^2 \geq n$

Answer: A

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30. The value of $\cos^{-1}\left(\cos\frac{5\pi}{3}\right) + \sin^{-1}\left(\sin\frac{5\pi}{3}\right)$ is -

A. $\frac{10\pi}{3}$

B. $\frac{4\pi}{3}$

C. 2π

D. 0

Answer: D

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31. A straight line makes angles $\frac{\pi}{4}$ and $\frac{\pi}{3}$ with the positive directions of x-axis and z-axis respectively. Then, the acute angle made by the line with y-axis is -

A. $\frac{\pi}{6}$

B. $\frac{\pi}{4}$

C. $\frac{\pi}{3}$

D. $\cos^{-1}\frac{1}{3}$

Answer: C

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

A. $\frac{\pi}{3}$

B. $\frac{\pi}{2}$

C. $\cos^{-1}\frac{3}{5}$

D. $\cos^{-1}\frac{4}{5}$

Answer: B

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33. The ratio in which the line segment joining the points (1, 2, 3) and (-3, 4, -5) is divided by the xy -plane is -

A. $3:5$

B. $4:3$

C. $-3:5$

D. $5:2$

Answer: A

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34. The coordinates of the foot of the perpendicular drawn from the point A(2, 4, -1) on the line $\frac{x+5}{1} = \frac{y+3}{4} = \frac{z-6}{-9}$ are -

A. (1, -3, 4)

B. (-4, 1, -3)

C. (4, 1, 3)

D. none of these

Answer: B

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35. The equation of the joining the points (2, -1, 4) and (1, 1, -2) is -

A. $\frac{x-2}{1} = \frac{y+1}{2} = \frac{z-4}{6}$

B. $\frac{x-2}{-1} = \frac{y+1}{2} = \frac{z-4}{-6}$

C. $\frac{x-1}{1}=\frac{y-1}{2}=\frac{z+2}{6}$

D. $\frac{x-1}{-1}=\frac{y+1}{2}=\frac{z+2}{-6}$

Answer: B

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36. The distance of the point (a, b, c) form the y -axis is -

A. b

B. $a+c$

C. $\sqrt{a^2+c^2}$

D. $b(a+c)$

Answer: C

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37. If the z-coordinate of a point C on the line joining the points A(2, 2, 1) and B(5, 1, -2) is (-1), then x-coordinate of C is -

A. 4

B. 1

C. -2

D. -4

Answer: A

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38. A plane meets the coordinate axes at P, Q, R such that the centroid of the triangle PQR ar (a, b, c). If the equation of the plane is $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = m$, then the value of m is -

A. 2

B. 3

C. 1

D. 6

Answer: B

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39. The equation of the plane passing through the points (0, 1, 0) and (3, 4, 1) and parallel to the line $\frac{x+3}{2} = \frac{y-3}{7} = \frac{z-2}{5}$ is -

A. $4x - 13y + 15z = 13$

B. $8x - 13y + 15z = 15$

C. $8x - 13y + 15z + 13 = 0$

D. none of these

Answer: C

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40. The equation of the plane passing through the point (2, -3, 5) and parallel to zx-plane is -

A. $z + x = 7$

B. $z - 5 = 0$

C. $x - 2 = 0$

D. $y + 3 = 0$

Answer: D

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41. f(x) and g(x) are two differentiable functions on [0, 2] such that $f''(x) - g''(x) = 0, f'(1) = 2, g'(1) = 4, f(2) = 3$ and $g(2) = 9$, then $[f(x) - g(x)]$ at $x = \frac{3}{2}$ is equal to -

A. 0

B. 2

C. 10

D. -5

Answer: D

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42. If $x = e^{\tan^{-1}\left(\frac{y - x^2}{x^2}\right)}$ then the value of $\frac{dy}{dx}$ is -

A. $2x[1 + \tan(\log x)] + x\sec^2(\log x)$

B. $x[1+\tan(\log x)]+\sec^2(\log x)$

C. $2x[1+\tan(\log x)]+x^2\sec^2(\log x)$

D. $2x[1+\tan(\log x)]+\sec^2(\log x)$

Answer: A

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43. If $x=a\cos^4\theta, y=a\sin^4\theta$ then the value of $\frac{dy}{dx}$ at $\theta=\frac{3\pi}{4}$ is -

A. 0

B. 1

C. -1

D. -2

Answer: C

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44. $\frac{d}{dx}\left(x^x\right)$ is equal to -

A. $x^x(1 - \log x)$

B. $x^x \log x$

C. $x^{x+1}(1 + \log x)$

D. $x^x(1 + \log x)$

Answer: D

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45. The differential coefficient of e^{x^3} w.r.t logx is -

A. e^{x^3}

B. $3x^3e^{x^3}$

C. $3x^2e^{x^3}$

D. $3x^2e^{x^3}+3x^2$

Answer: B

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46. The second derivative of $a\sin^3 t$ w.r.t. $a\cos^3 t$ at $t=\frac{\pi}{4}$ is -

A. 2

B. $\frac{1}{12a}$

C. $\frac{4\sqrt{2}}{3a}$

D. 0

Answer: C

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47. The derivative of the function $f(x) = 3|x + 2|$ at the point, x = -3 is -

A. -3

B. 3

C. 0

D. does not exist

Answer: A

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48. Let $f(x) = e^x, x \in [0, 1]$, then the number c of Lagrange's mean value theorem is -

A. $\log(e+1)$

B. $\log(e-1)$

C. loge

D. none of these

Answer: B

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49. If the function f(x) stisfies the conditions of Rolle's theorem in [1, 2] and f'(x) is continuous in [1, 2], then $\int_1^2 f'(x)dx$ is equal to -

A. 3

B. 1

C. 2

D. 0

Answer: D

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50. let $y = \sqrt{x + \sqrt{x + \sqrt{x \ldots \infty}}})$ then dy/dx equals

A. $\frac{x}{2y - 1}$

B. $\frac{2}{2y - 1}$

C. $\frac{1}{2y - 1}$

D. $\frac{x}{y - 1}$

Answer: C

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51. If $y = \sin x + e^x$, then the value of $\frac{d^2x}{dy^2}$ is -

A. $\dfrac{\sin x - e^x}{\left(\cos x + e^x\right)^3}$

B. $\dfrac{1}{e^x - \sin x}$

C. $\dfrac{\sin x - e^x}{\left(\cos x + e^x\right)^2}$

D. $\dfrac{\sin x + e^x}{\left(\cos x + e^x\right)^3}$

Answer: A

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52. If $\sin^{-1}x + \sin^{-1}y = \frac{\pi}{2}$, then the value of $\frac{dy}{dx}$ is -

A. $\frac{x}{y}$

B. $-\frac{x}{y}$

C. $\frac{y}{x}$

D. $-\frac{y}{x}$

Answer: B

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53. If $\frac{dx}{dy} = u$ and $\frac{d^2x}{dy^2} = v$, then the value of $\frac{d^2y}{dx^2}$ is -

A. $-\frac{v}{u^2}$

B. $\frac{v}{u^2}$

C. $-\frac{v}{u^3}$

D. $\frac{v}{u^3}$

Answer: C

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54. The value of $\lim h \to 0 \dfrac{e^{(x+h)^2} - e^{x^2}}{h}$ is -

A. xe^{x^2}

B. $2e^{x^2}$

C. $4xe^{x^2}$

D. $2xe^{x^2}$

Answer: D

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55. The value of $\int e^x\left(1 - \cot x + \cot^2 x\right)dx$ is -

A. $e^x \cot x + c$

B. $e^x \operatorname{cosec} x + c$

C. $-e^x \cot x + c$

D. $-e^{x}\operatorname{cosec}x + c$

Answer: C

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56. The value of $\int \frac{dx}{\sqrt{e^{2x} - 1}}$ is equal to -

A. $\sin^{-1}\left(e^{x}\right) + c$

B. $\cos^{-1}\left(e^{x}\right) + c$

C. $\tan^{-1}\left(e^{x}\right) + c$

D. $\sec^{-1}\left(e^{x}\right) + c$

Answer: D

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57. The value of $\int \frac{\sin x}{\sin(x - a)} dx$ is equal to -

A. $(x - a)\cos a + \sin a \log|\sin(x - a)| + c$

B. $(x - a)\cos x + \log|\sin(x - a)| + c$

C. $\sin(x - a) + \sin x + c$

D. $\cos(x - a) + \cos x + c$

Answer: A

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58. $\int_0^1 \frac{d}{dx}\left[\sin^{-1}\frac{2x}{1 + x^2}\right]dx$ is equal to -

A. 0

B. π

C. $\frac{\pi}{2}$

D. $\frac{\pi}{4}$

Answer: C

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59. $\int_{-2}^{2}\left|1-x^{2}\right|dx$ is equal to -

A. 0

B. 1

C. 2

D. 4

Answer: D

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60. The value of $\int_0^{\sqrt{2}}\left[x^2\right]dx$ is -

A. $2 - \sqrt{2}$

B. $\sqrt{2} - 1$

C. $2 + \sqrt{2}$

D. $\sqrt{2} + 1$

Answer: B

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61. The value of $\int_0^{\frac{\pi}{2}} \sin 2x \log(\tan x) dx$ is equal to -

A. 0

B. π

C. $\frac{\pi}{2}$

D. 1

Answer: A

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62. The value of of $\int \frac{dx}{\sqrt{2x - x^2}}$ is -

A. $\sin^{-1}(x + 1) + c$

B. $\sqrt{2x - x^2} + c$

C. $-\sqrt{x - x^2} + c$

D. $\sin^{-1}(x - 1) + c$

Answer: D

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63. The value of $\int \frac{xe^x}{(x+1)^2}dx$ is equal to -

A. $\frac{e^x}{(x+1)^2} + c$

B. $\frac{e^x}{x+1} + c$

C. $-\frac{e^x}{x+1} + c$

D. none of these

Answer: B

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64. The value of $\int \cos^{-1}\left(\frac{1}{x}\right)dx$ is equal to -

A. $x\sec^{-1}x + \log\left|x + \sqrt{x^2 - 1}\right| + c$

B. $x\sec^{-1}x - \sin^{-1}x + c$

C. $x\sec^{-1}x - \log\left|x + \sqrt{x^2 - 1}\right| + c$

D. $x\sec^{-1}x - 2\log\left|x + \sqrt{x^2 - 1}\right| + c$

Answer: C

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65. The value of the integral $\int_{\frac{1}{n}}^{\frac{an-1}{n}} \frac{\sqrt{x}dx}{\sqrt{a-x}+\sqrt{x}}$ is -

A. $\frac{an-2}{2n}$

B. $\frac{a}{2}$

C. $\frac{an+2}{2n}$

D. none of these

Answer: A

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66. The value of $\int \frac{xdx}{x^2 + 4x + 5}$ is equal to -

A. $\frac{1}{2}\log\left|x^2 + 4x + 5\right| + 2\tan^{-1}x + c$

B. $\frac{1}{2}\log\left|x^2 + 4x + 5\right| - \tan^{-1}(x + 2) + c$

C. $\frac{1}{2}\log\left|x^2 + 4x + 5\right| + \tan^{-1}(x + 2) + c$

D. $\frac{1}{2}\log\left|x^2 + 4x + 5\right| - 2\tan^{-1}(x + 2) + c$

Answer: D

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67. The value of

$$\left[\lim_{n \to \infty} \frac{1 + 2^4 + 3^4 + \dots + n^4}{n^5} - \lim_{n \to \infty} \frac{1 + 2^3 + 3^3 + \dots + n^3}{n^5}\right]$$

is equal to -

A. $\frac{1}{5}$

B. $\frac{1}{30}$

C. 0

D. $\frac{1}{4}$

Answer: A

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68. If $f(a+b-x)=f(x)$, then $\int_a^b xf(x)dx$ is equal to -

A. $\frac{a+b}{2}\int_a^b f(a+b-x)dx$

B. $\frac{a+b}{2}\int_a^b f(b-x)dx$

C. $\frac{a-b}{2}\int_a^b f(x)dx$

D. $\frac{b-a}{2}\int_a^b f(x)dx$

Answer: A

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69. The value of the integral $\int_{-1}^{1} x|x|dx$ is equal to -

A. 1

B. 2

C. 4

D. 0

Answer: D

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70. The value of $\lim_{n \to \infty} \left[\frac{n!}{n^n}\right]^{\frac{1}{n}}$ is equal to -

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71. The value of $\int \frac{1 + x + \sqrt{x + x^2}}{\sqrt{x} + \sqrt{1 + x}} dx$ is equal to -

A. $\frac{1}{2}\sqrt{x + 1} + c$

B. $\frac{2}{3}(1 + x)^{\frac{3}{2}} + c$

C. $\sqrt{x + 1} + c$

D. $2(1 + x)^{\frac{3}{2}} + c$

Answer: B

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72. If the order and degree of the differential equation $\sqrt{\frac{dy}{dx}} - 4\frac{dy}{dx} - 7x = 0$ are m and n respectively, then -

A. $m = 1, n = \frac{1}{2}$

B. $m = 2, n = 1$

C. $m = 1, n = 1$

D. $m = 1, n = 2$

Answer: D

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73. The general solution of the differential equation $(x + y)dx + xdy = 0$ is -

A. $y^2 + 2xy = c$

B. $x^2 + y^2 = c$

C. $x^2 + 2xy = c$

D. $2x^2 - y^2 = c$

Answer: C

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74. The solution of the differential equation $\frac{dy}{dx} = xy + 2y$ subject to the condition y=1 at x=1 is -

A. $y = e^{2x + \frac{x^2}{2} - 2}$

B. $y = e^{2x + \frac{x^2}{2} - \frac{5}{2}}$

C. $y = e^{2x + \frac{x^2}{2} - \frac{2}{3}}$

D. $y = e^{2x + \frac{x^2}{2} - \frac{3}{2}}$

Answer: B

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75. The general solution of the differential equation $\frac{dy}{dx} = 2^{y-x}$ is -

A. $2^{-x} - 2^{-y} = c$

B. $2^{-x} + 2^{-y} = c$

C. $2^{x} + 2^{y} = c$

D. $2^{x} - 2^{y} = c$

Answer: A

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76. The solution of the differential equation $\frac{dy}{dx} = e^{x-y} + 1$ is -

A. $e^{y-x} = y + c$

B. $e^{x-y} = y + c$

C. $e^{x-y} = x + c$

D. $e^{y-x} = x + c$

Answer: D

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77. The differential equation for which $y = a\cos x + b\sin x$ is a solution is -

A. $\dfrac{d^2y}{dx^2} = y$

B. $\dfrac{d^2y}{dx^2} + (a + b)y = 0$

C. $\dfrac{d^2y}{dx^2} + y = 0$

D. $\dfrac{d^2y}{dx^2} + (a - b)y = 0$

Answer: C

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78. The integrating factor of the differential equation $x\log x\frac{dy}{dx} + 2y = \log x$ is -

A. $\log x$

B. $(\log x)^2$

C. $\frac{1}{\log x}$

D. x^2

Answer: B

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79. If $f(x) = \begin{cases} x & \text{when } 0 \leq x \leq 1 \\ 2x - 1 & \text{when } x > 1 \end{cases}$ then -

A. f(x) is continuous but not differentiable at x=1

B. f(x) is discontinuous at x=1

C. f(x) is differentiable at x=1

D. none of these

Answer: A

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80. The differential equation of the family of parabolas whose vertex is at (1, 2) and axis is parallel to x-axis is -

A. $x\frac{dy}{dx} = y - 2$

B. $\left(\frac{dy}{dx}\right)^2 - 3xy = 0$

C. $(x - 1)\frac{dy}{dx} = y - 2$

D. $2(x - 1)\frac{dy}{dx} = y - 2$

Answer: D

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81. The area (in square unit) of the region bounded by the curve $x^2 = 4y$, the line $x = 2$ and x- axis is -

A. 1

B. $\frac{2}{3}$

C. $\frac{4}{3}$

D. $\frac{8}{3}$

Answer: B

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82. Let $P(a\sec\theta, b\tan\theta)$ and $Q(a\sec\phi, b\tan\phi)$ where $\theta + \phi = \frac{\pi}{2}$ be two point on the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ .If (h, k) be the point of intersection of the normals at P and Q , then the value of k is -

A. $\frac{a^2 + b^2}{a}$

B. $-\frac{a^2 + b^2}{a}$

C. $\frac{a^2 + b^2}{b}$

D. $-\frac{a^2 + b^2}{b}$

Answer: D

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83. The equation of the tangent to the curve $\left(1 + x^2\right)y = 2 - x$ where it crosses the x -axis is-

A. x + 5y = 2

B. x - 5y = 2

C. 5y - y = 2

D. 5x + y = 2

Answer: A

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84. The area (in square unit) bounded by the parabolas $y^2 = 4ax$ and $x^2 = 4ay$ is -

A. $\frac{64a^2}{3}$

B. $\frac{32a^2}{3}$

C. $\frac{16a^2}{3}$

D. $\frac{8a^2}{3}$

Answer: C

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85. Equations of the tangent and the normal drawn at the point (6, 0) on the ellipse $\frac{x^2}{36} + \frac{y^2}{9} = 1$ respectively are-

A. $x = 6, y = 0$

B. $x + y = 6, y - x + 6 = 0$

C. $x = 0, y = 3$

D. $x = -6, y = 0$

Answer: A

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86. The are (in square unit) of the figure bounded by the curves $y = \cos x$ and $y = \sin x$ and the ordinates $x = 0, x = \frac{\pi}{4}$ is-

A. $\sqrt{2} + 1$

B. $\sqrt{2} - 1$

C. $\frac{1}{\sqrt{2}}$

D. $\frac{\sqrt{2} - 1}{\sqrt{2}}$

Answer: B

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87. The straight line $x + y = a$ will be a tangent to the ellipse $\frac{x^2}{9} + \frac{y^2}{16} = 1$ if the value of a is -

A. 8

B. ± 10

C. ± 5

D. ± 6

Answer: C

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88. The equation of the tangent to the parabola $y^2 = 8x$ which is perpendicular to the line $x - 3y + 8 = 0$ is -

A. $3x + y + 2 = 0$

B. $3x - y - 1 = 0$

C. $9x - 3y + 2 = 0$

D. $9x + 3y + 2 = 0$

Answer: D

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89. The area (in square unit) bounded by the parabola $y^2 = 8x$ and its latus rectum is -

A. $\frac{16}{3}$

B. $\frac{25}{3}$

C. $\frac{16\sqrt{2}}{3}$

D. $\frac{32}{3}$

Answer: D

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90. If the curves $y^2 = 4x$ and $xy = k$ cut orthogonally, then the value of k^2 will be-

A. 16

B. 32

C. 36

D. 8

Answer: B

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91. Find the area bounded by the curve $x^2 = 4y$ and the line x = 4y

- 2.

A. $\frac{8}{3}$

B. $\frac{3}{8}$

C. 8

D. 3

Answer: C

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92. If the slope of the normal to the curve $x^3 = 8a^2y$ at P is $\left(\frac{-2}{3}\right)$,

then the coordinates of P are-

A. $(2a, a)$

B. (a, a)

C. $(2a, -a)$

D. none of these

Answer: A

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93. If $a > 2b > 0$, then the positive value of m for which the line $y = mx - b\sqrt{1 + m^2}$ is a common tangent to the circles $x^2 + y^2 = b^2$ and $(x - a)^2 + y^2 = b^2$ is-

A. $\dfrac{2b}{\sqrt{a^2 - 4b^2}}$

B. $\dfrac{\sqrt{a^2 - 4b^2}}{2b}$

C. $\dfrac{2b}{a - 2b}$

D. $\frac{b}{a - 2b}$

Answer: A

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94. The area (in square unit) of the region bounded by the line $y = |x - 1|$ and $y = 3 - |x|$ is -

A. 6

B. 2

C. 4

D. 3

Answer: C

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95. The minimum value of $f(x) = x^2 + \frac{250}{x}$ is-

A. 55

B. 25

C. 50

D. 75

Answer: D

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96. If $f(x) = kx^3 - 9x^2 + 9x + 3$ is an increasing function then-

A. $k < 3$

B. $k \leq 3$

C. $k > 3$

D. k is indeterminate

Answer: C

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97. If $f(x) = \frac{1}{4x^2 + 2x + 1}$ then its maximum value is -

A. $\frac{2}{3}$

B. $\frac{4}{3}$

C. $\frac{3}{4}$

D. 1

Answer: B

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98. If $f(x) = \frac{1}{x+1} - \log(1+x), x > 0$ then f(x) is-

A. a decreasing function

B. an increasing function

C. neither increasing nor decreasing

D. increasing when $x > 1$

Answer: A

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99. Let α, β be the roots of $x^2 + (3 - \lambda)x - \lambda = 0$, then the value of λ for which $\alpha^2 + \beta^2$ is minimum, is-

A. 0

B. 1

C. 3

D. 2

Answer: D

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100. The function $f(x) = 2x^3 - 3x^2 - 12x + 4$ has-

A. no maxima and minima

B. one maximum and one minimum

C. two maxima

D. two minima

Answer: B

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101. The height of the cylinder of maximum volume that can be inscribed in a sphere of radius a, is-

A. $\frac{3a}{2}$

B. $\frac{\sqrt{2}a}{3}$

C. $\frac{2a}{\sqrt{3}}$

D. $\frac{a}{\sqrt{3}}$

Answer: C

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102. Maximum value of $\frac{\log x}{x}$ in $[2, \infty)$ is-

A. $\frac{\log 2}{2}$

B. 0

C. $\frac{1}{e}$

D. e

Answer: C

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103. Let the function $f: R \rightarrow R$ be defined by $f(x) = 2x + \cos x$, then f(x)-

A. has maximum value at x=0

B. has minimum value at $x = \pi$

C. is a decreasing function

D. is an increasing function

Answer: D

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104. The maximum distance from the origin of a point on the curve $x = a\sin t - b\sin\left(\frac{at}{b}\right), y = a\cos t - b\cos\left(\frac{at}{b}\right)$, both $a, b > 0$, is-

A. $a - b$

B. $a + b$

C. $\sqrt{a^2 + b^2}$

D. $\sqrt{a^2 - b^2}$

Answer: B

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105. If the slope of the tangent line to the curve $y = \frac{6}{x^2 - 4x + 6}$ at some point on it is zero, then the equation of the tangent is-

A. $y = 3$

B. $2y - 1 = 0$

C. $y = 2$

D. $y + 3 = 0$

Answer: A

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106. If the slope of the tangent at (x, y) to a curve passing through the point $(2, 1)$ is $\frac{x^2 + y^2}{2xy}$, then the equation of the curve is-

A. $2\left(x^2 - y^2\right) = 3x$

B. $2\left(x^2 - y^2\right) = 3y$

C. $x\left(x^2 - y^2\right) = 6$

D. $x\left(x^2 + y^2\right) = 6$

Answer: A

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107. The region represented by the system of in equations $y \leq 7, 2x + y \leq 4, x \geq 0, y \geq 0$ is

A. bounded in first and second quadrants

B. bounded in first quadrant

C. unbounded in first quadrant

D. none of these

Answer: B

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108. If the radius of a sphere is measured as 14 cm with an error of 0.03 cm , then approximate error in the calculation of its volume is-

A. $20.52\pi cm^3$

B. $18.96\pi cm^3$

C. $23.52\pi cm^3$

D. $24.96\pi cm^3$

Answer: C

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109. If $y = 3x^2 + 2$ and if x changes from 10 to 10.1 , then the approximate change in y will be-

A. 8

B. 6

C. 5

D. 4

Answer: B

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110. The rate of change of surface area of a sphere of radius r when the radius is increasing at the rate of 2 cm/s. is proportional to

A. $\frac{1}{r^2}$

B. r^2

C. r

D. $\frac{1}{r}$

Answer: C

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Question Paper 2

1. Assuming that the sums and products given below are defined, which of the following is not true for matrices ?

A. AB=AC does not imply B=C

B. A + B = B + A

C. (AB)' = B'A'

D. AB=0 implies A=0 or, B=0

Answer: D

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2. The value k for which the line $\frac{x-1}{8}=\frac{y+2}{k}=\frac{z-3}{-6}$ is perpendicular to the plane $4x+2y-3z=5$ is -

A. 6

B. -6

C. 4

D. -4

Answer: C

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3. A fair die is thrown till we get 6, then the probability of getting 6 exactly in even number of turns is -

A. $\frac{11}{36}$

B. $\frac{5}{11}$

C. $\frac{6}{11}$

D. $\frac{1}{6}$

Answer: B

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4. If $\vec{\alpha}| = 4, |\vec{\beta}\ | \ = 3$ and $\left|\vec{\alpha} \times \vec{\beta}\right| = 6$, then the angle between the vectors $\vec{\alpha}$ and $\vec{\beta}$ is -

A. $\frac{\pi}{6}$

B. $\frac{\pi}{3}$

C. $\frac{2\pi}{3}$

D. none of these

Answer: A

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5. The equation of the plane through the line of intersection of the planes $2x + y - z + 5 = 0$ and $x + 2y + 3z = 4$ and perpendicular to the plane $5x + 3y + 6z = 10$ is -

A. $51x + 15y - 50z = 173$

B. $5x - 15y + 50z + 117 = 0$

C. $51x + 15y - 50z + 173 = 0$

D. $63x - 43y - 50z + 117 = 0$

Answer: C

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6. If l, m, n are p -th, q-th and r-th terms of a GP, all positive, then

the value of $\begin{vmatrix} \log l & p & 1 \\ \log m & q & 1 \\ \log n & r & 1 \end{vmatrix}$ is -

A. -1

B. 2

C. 1

D. 0

Answer: D

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7. If the straight line joining the points A(3, 4, -1) and B(4, p, 2) is parallel to the straight line joining the points C(2, 1, q) and D(4, -3, 1), then -

A. p=-5 , q=2

B. p=2, q=-5

C. p=5, q=-2

D. p=-2, q=5

Answer: B

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8. A and B are two events such that $P(A \cup B) = \frac{3}{4}, P(A \cap B) = \frac{1}{4}, P(\bar{A}) = \frac{2}{3}$, then the value of $P(\bar{A} \cap B)$ is -

A. $\frac{5}{12}$

B. $\frac{3}{8}$

C. $\frac{5}{8}$

D. $\frac{1}{4}$

Answer: A

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9. One root of the equation $\begin{vmatrix} x+a & b & c \\ b & x+c & a \\ c & a & x+b \end{vmatrix} = 0$ is -

A. -$(a+b)$

B. -$(b+c)$

C. -a

D. $-(a + b + c)$

Answer: D

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10. The coordinates of the foot of the perpendicular drawn from the point P(1, 2, 1) to the straight line joining the points Q(1, 4, 6) and R(5, 4, 4) are -

A. (3, -5, -4)

B. (3, 4, 5)

C. (3, -4, 5)

D. (-3, -4, 5)

Answer: B

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11. If ω is a cube root of unity then the value of $\begin{vmatrix} 1 & \omega & \omega^2 \\ \omega & \omega^2 & 1 \\ \omega^2 & 1 & \omega \end{vmatrix}$ is -

A. 1

B. ω

C. 0

D. ω^2

Answer: C

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12. The angle between the pair of straight lines whose direction cosines are given by the equations $2l - m + 2n = 0$ and

$mn + nl + lm = 0$ is -

A. $\frac{\pi}{2}$

B. $\frac{\pi}{4}$

C. $\frac{\pi}{3}$

D. $\frac{\pi}{6}$

Answer: A

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13. If A and B are two events such that $P(A \cup B) = \frac{5}{6}, P(A \cap B) = \frac{1}{3},$ then which one of the following is not correct ?

A. A and B are independent

B. A and $\bar{B}$ are independent

C. $\bar{A}$ and B are independent

D. A and B are dependent

Answer: D

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14. If $A=\begin{bmatrix}1 & 0 & 2\\ -1 & 1 & -2\\ 0 & 2 & 1\end{bmatrix}$ and Adj $A=\begin{bmatrix}5 & a & -2\\ 1 & 1 & 0\\ -2 & -2 & b\end{bmatrix}$, then the values of a and b are -

A. a=-4, b=1

B. a=-4, b=-1

C. a=4, b=1

D. a=4, b=-1

Answer: C

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15. If the straight lines $\frac{x-2}{a}=\frac{y+3}{-4}=\frac{z-2}{3}$ and $\frac{x+2}{3}=\frac{y-1}{2a}=\frac{z+3}{5}$ are perpendicular to each other, then the value of a is -

A. $\frac{15}{11}$

B. 3

C. -3

D. $-\frac{15}{11}$

Answer: B

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16. The coordinates of the point where the line $\frac{x - 3}{1} = \frac{y - 4}{2} = \frac{z - 5}{2}$ meets the plane $x + y + z = 17$ are -

A. (-4, -6, 7)

B. (4, 6, -7)

C. (4, -6, 7)

D. (4, 6, 7)

Answer: D

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17. If $a = 1 + 2 + 4 + \ldots$ to n terms, $b = 1 + 3 + 9\ldots$ to n terms and $c = 1 + 5 + 25 + \ldots$ to n terms, then the value of $\begin{vmatrix} a & 2b & 4c \\ 2 & 2 & 2 \\ 2^n & 3^n & 5^n \end{vmatrix}$ is -

A. $(30)^n$

B. $(10)^n$

C. 0

D. $2^n + 3^n + 5^n$

Answer: C

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18. The distance between the point (-1, -5, -10) and the point of intersection of the line $\frac{x-2}{3} = \frac{y+1}{4} = \frac{z-2}{12}$ with the plane $x - y + z = 5$ is -

A. 13 unit

B. 7 unit

C. $5\sqrt{3}$ unit

D. $4\sqrt{2}$ unit

Answer: A

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19. If the direction ratios of two lines are 2, -3, 6 and 1, -2, 2 respectively then the angle between the lines is -

A. $\frac{\pi}{2}$

B. $\cos^{-1}\frac{20}{21}$

C. $\cos^{-1}\frac{3}{5}$

D. $\cos^{-1}\frac{8}{21}$

Answer: B

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20. A coin and a six faced die, both unbiased, are thrown simultaneously. The probability of getting a head on the coin and an odd number on the die is -

A. $\frac{1}{2}$

B. $\frac{3}{4}$

C. $\frac{1}{4}$

D. $\frac{2}{3}$

Answer: C

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21. A number is chosen at random among the first 120 natural numbers. What is the probability that the number chosen being a multiple of 5 or 15 ?

A. $\frac{1}{5}$

B. $\frac{1}{8}$

C. $\frac{1}{15}$

D. $\frac{1}{6}$

Answer: A

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22. If $A = \begin{pmatrix} -1 & 0 \\ 0 & 2 \end{pmatrix}$ then the value of A^3 - A^2 is equal to -

A. I

B. A

C. 2A

D. 2I

Answer: C

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23. If $1, \omega, \omega^2$ are the cube roots of unity then the vlue of m for which the matrix $\begin{bmatrix} 1 & \omega & m \\ \omega & m & 1 \\ m & 1 & \omega \end{bmatrix}$ is singular, is -

A. 1

B. -1

C. ω

D. ω^2

Answer: D

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24. If $A = \begin{bmatrix} -x & -y \\ z & t \end{bmatrix}$, then the transpose of adj A is -

A. $\begin{bmatrix} t & z \\ -y & -x \end{bmatrix}$

B. $\begin{bmatrix} t & y \\ -z & -x \end{bmatrix}$

C. $\begin{bmatrix} t & -z \\ y & -x \end{bmatrix}$

D. none of these

Answer: C

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25. A die is thrown if it shows a six, we draw ball from is bag containing 2 black balls and 6 white balls. If it does not show a six then we toss a coin. Then the number of event points in the sample space of this experiment is -

A. 18

B. 14

C. 12

D. 10

Answer: A

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26. The solutions of the equation $\begin{vmatrix} x & 2 & -1 \\ 2 & 5 & x \\ -1 & 2 & x \end{vmatrix} = 0$ are -

A. $-3, 1$

B. $3, -1$

C. $3, 1$

D. $-3, \ -1$

Answer: B

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27. The vector of magnitude 12, which is perpendicular to both the vectors $4\hat{i} - \hat{j} + 3\hat{k}$ and $-2\hat{i} + \hat{j} - 2\hat{k}$ is -

A. $-4\hat{i} + 8\hat{j} + 8\hat{k}$

B. $-2\hat{i} + 4\hat{j} + 4\hat{k}$

C. $-6\hat{i} + 12\hat{j} + 12\hat{k}$

D. none of these

Answer: A

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28. If A is a square matrix of order 3×3 and λ is a scalar, then adj (λA) is equal to -

A. λ adj A

B. λ^2 adj A

C. λ^3 adj A

D. λ^4 adj A

Answer: B

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29. If $\vec{a}, \vec{b}, \vec{c}$ are unit vectors such that $\vec{a} + \vec{b} + \vec{c} = \vec{o}$, then the value of $\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}$ is -

A. $-\frac{3}{2}$

B. $\frac{3}{2}$

C. 3

D. -3

Answer: A

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30. The points with position vectors $60\hat{i} + 3\hat{j}$, $40\hat{i} - 8\hat{j}$ and $a\hat{i} - 52\hat{j}$ are collinear if -

A. a=40

B. a=-40

C. a=20

D. a=-20

Answer: B

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31. If the diagonals of a parallelogram are $3\hat{i}+\hat{j}-2\hat{k}$ and $\hat{i}-3\hat{j}+4\hat{k}$, then the area of the parallelogram is -

A. $5\sqrt{3}$ square units

B. $10\sqrt{3}$ square units

C. $\frac{10}{\sqrt{3}}$ square units

D. $20\sqrt{3}$ square units

Answer: A

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32. Let PQRS be a parallelogram whose diagonals PR and QS intersect at O'. If O is the origin, then $\left(\overrightarrow{OP} + \overrightarrow{OQ} + \overrightarrow{OR} + \overrightarrow{OS}\right)$ is equal to -

A. $2\overrightarrow{OO'}$

B. $\overrightarrow{OO'}$

C. $4\overrightarrow{OO'}$

D. $3\overrightarrow{OO'}$

Answer: C

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33. If $f(x) = \dfrac{2x + 1}{3x - 2}$, then (fof)(2) is equal to -

A. 3

B. 1

C. 2

D. 4

Answer: C

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34. The relation R is defined on the set of natural numbers N as x is a factor of y where x, y $\in$ N. Then R is -

A. an equivalence relations

B. relexive and transitive

C. symmetric and transitive

D. reflexive and symmetric

Answer: B

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35. The value of $\sin\left(\frac{1}{2}\cos^{-1}\frac{4}{5}\right)$ is -

A. $\frac{1}{10}$

B. $\frac{1}{\sqrt{10}}$

C. $-\frac{1}{10}$

D. $-\frac{1}{\sqrt{10}}$

Answer: B

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36. Let C and R be the sets of complex numbers and real numbers respectively. Then the mapping $f: c \rightarrow R$ defined by f(z)=|z| for all $z \in C$, is -

A. injective

B. surjective

C. bijective

D. none of these

Answer: D

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37. Let X be the random variable of the number of points obtained in single throw of an unbiased die. Then, the value of $\bar{X}$ is -

A. 7

B. 14

C. $\frac{7}{2}$

D. 4

Answer: C

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38. If n and p are two parameters of a binomial distribution, state which one of the following is not true -

A. mean = 3, S.D. = $\sqrt{2}$

B. mean = 4, variance = 3

C. mean = 4, variance = 3.2

D. mean = 4, S.D. = 3

Answer: D

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39. The domain of definition of the function $\sin^{-1}\left[\log_3\left(\frac{x}{3}\right)\right]$ is -

A. [-9, -1]

B. [-1, 9]

C. [1, 9]

D. [-9, 1]

Answer: C

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40. The value of $\cot\left(\frac{\pi}{4} - 2\cot^{-1}3\right)$ is -

A. 5

B. 6

C. 8

D. 7

Answer: D

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41. If $y = \sqrt{\sin\sqrt{x}}$, then the value of $\frac{dy}{dx}$ is -

A. $\frac{1}{2\sqrt{\sin\sqrt{x}}}$

B. $\frac{\sqrt{\cos\sqrt{x}}}{2x}$

C. $\dfrac{1}{2\sqrt{\cos\sqrt{x}}}$

D. $\dfrac{\cos\sqrt{x}}{4\sqrt{x}\sqrt{\sin\sqrt{x}}}$

Answer: D

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42. If $f(x) = \cos^{-1}\left[\dfrac{1 - (\log x)^2}{1 + (\log x)^2}\right]$, then the value of f'(e) is -

A. $\dfrac{2}{e}$

B. $\dfrac{1}{e}$

C. 1

D. $\dfrac{1}{e^2}$

Answer: B

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43. If $y = a\cos mx - b\sin mx$, then the value of $\frac{d^2y}{dx^2}$ is -

A. $-m^2y$

B. m^2y

C. $-my$

D. my

Answer: A

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44. If $y = x^{e^x}$, then the value of $\frac{dy}{dx}$ is -

A. $y\left(\log x + e^x\right)$

B. $y\log x\left(e^{x}+\frac{1}{2}\right)$

C. $ye^{x}\left(\log x+\frac{1}{x}\right)$

D. $ye^{x}(x+\log x)$

Answer: C

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45. If $2^{x}+2^{y}=2^{x+y}$, then the value of $\frac{dy}{dx}$ at $x=y=1$ is -

A. 0

B. -1

C. 1

D. 2

Answer: B

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46. If $f(x) = x(x - 1)(x - 2), 0 \leq x \leq 4$, then the point x=c which satisfies mean value theorem satisfies -

A. $0 < c < 1$

B. $c > 3$

C. $0 < c < \frac{1}{2}$

D. $1 < c < 3$

Answer: D

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47. Let $f(x) = x|x|$. Then the set of points where f(x) is twice differentiable is -

A. $\forall x \in R$

B. $\forall x \in R - \{0\}$

C. $\forall x \in R - \{0, 1\}$

D. $\forall x \in R - \{1\}$

Answer: B

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48. If $x = \sin^{-1}t, y = \log\left(1 - t^2\right), 0 \leq t < 1$, then the value of $\dfrac{d^2y}{dx^2}$ at $t = \dfrac{1}{3}$ is -

A. $-\dfrac{9}{4}$

B. $-\dfrac{9}{8}$

C. $\dfrac{9}{4}$

D. $\frac{9}{8}$

Answer: A

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49. If $2a + 3b + 6c = 0 \quad (a, b, c \in R)$, then the quadratic equation $ax^2 + bx + c = 0$ has at least one root -

A. in (0, 1)

B. in (2, 3)

C. in (4, 5)

D. none of these

Answer: A

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50. If $y = \left(x + \sqrt{1 + x^2}\right)^n$, then $\left(1 + x^2\right)\frac{d^2y}{dx^2} + x\frac{dy}{dx}$ is equal to -

A. $-y$

B. n^2y

C. $-n^2y$

D. $2n^2y$

Answer: B

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51. If $\sin y + e^{-x\cos y} = e$, then the value of $\frac{dy}{dx}$ at $(1, \pi)$ is -

A. 0

B. 1

C. e

D. -1

Answer: C

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52. If $x = 2\cos t + \cos 2t$ and $y = 2\sin t - \sin 2t$, then the value of $\frac{dy}{dx}$ at $t = \frac{\pi}{4}$ is -

A. $-\left(\sqrt{2} + 1\right)$

B. $\sqrt{2}$

C. $\sqrt{2} - 1$

D. $1 - \sqrt{2}$

Answer: D

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53. The value of $\lim_{x \to \infty}\left(\sqrt{x^2 + ax} - x\right)$ is -

A. $\frac{a}{2}$

B. 2a

C. a

D. 4a

Answer: A

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54. If $\log x = z$, then the value of $x^2\frac{d^2y}{dx^2}$ is -

A. $\frac{d^2y}{dz^2}$

B. $\frac{d^2y}{dz^2} + \frac{dy}{dz}$

C. $\frac{d^2y}{dz^2} - \frac{dy}{dz}$

D. $\frac{d^2y}{dz^2} - 2\frac{dy}{dz}$

Answer: C

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55. The value of $\int e^{\sqrt{x}}dx$ is -

A. $e^{\sqrt{x}} + c$

B. $2\left(\sqrt{x} - 1\right)e^{\sqrt{x}} + c$

C. $\frac{1}{2}e^{\sqrt{x}} + c$

D. $2\left(\sqrt{x} + 1\right)e^{\sqrt{x}} + c$

Answer: B

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56. If $\int x\sin x dx = -x\cos x + m$, then the value of m is -

A. $\sin x + c$

B. $\cos x + c$

C. $\cos x - \sin x + c$

D. $x\cos x + c$

Answer: A

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57. The value of $\int \frac{a^{\sqrt{x}}}{\sqrt{x}} dx$ is -

A. $2\log a \cdot a^{\sqrt{x}} + c$

B. $\log a \cdot a^{\sqrt{x}} + c$

C. $\dfrac{a^{\sqrt{x}}}{\log a} + c$

D. $\dfrac{2a^{\sqrt{x}}}{\log a} + c$

Answer: D

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58. The value of $\int \dfrac{e^{\tan^{-1}x}dx}{1+x^2}$ is -

A. $\tan^{-1}x + c$

B. $\dfrac{1}{1+x^2} + c$

C. $e^{\tan^{-1}x} + c$

D. $\dfrac{2xe^{\tan^{-1}x}}{\left(1+x^2\right)^2} + c$

Answer: C

Watch Video Solution

59. The value of $\int_0^{\frac{\pi}{2}} \frac{dx}{1+\cot x}$ is -

A. $\frac{\pi}{4}$

B. $\frac{\pi}{2}$

C. 0

D. π

Answer: A

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60. If $I_1 = \int_e^{e^2} \frac{dx}{\log x}$ and $I_2 = \int_1^2 \frac{e^x}{x} dx$, then which of the following is correct ?

A. $I_1 + I_2 = 0$

B. $I_1 = I_2$

C. $I_1 = 2I_2$

D. $2I_1 = I_2$

Answer: B

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61. If $I_n = \int_0^{\frac{\pi}{4}} \tan^n \theta d\theta$, for any positive integer n, then the value of $n\left(I_{n-1} + I_{n+1}\right)$ is -

A. $\frac{\pi}{2}$

B. $\frac{\pi}{4}$

C. 1

D. 5

Answer: C

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62. The value of $\int_1^2 [x^2] dx$ is -

A. $5 - \sqrt{3} - \sqrt{2}$

B. $5 + \sqrt{2} - \sqrt{3}$

C. $4 + \sqrt{3} - \sqrt{2}$

D. $4 + \sqrt{2} - \sqrt{3}$

Answer: A

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63. The value of $\int_{-\pi}^{\pi} \frac{2x(1+\sin x)}{1+\cos^2 x} dx$ is equal to -

A. 0

B. $\frac{\pi}{2}$

C. $\frac{\pi^2}{4}$

D. π^2

Answer: D

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64. The value of $\int \frac{dx}{\sin x - \cos x + \sqrt{2}}$ is -

A. $\frac{1}{\sqrt{2}} \cot\left(\frac{x}{2} + \frac{\pi}{8}\right) + c$

B. $-\frac{1}{\sqrt{2}}\cot\left(\frac{x}{2}+\frac{\pi}{8}\right)+c$

C. $\frac{1}{\sqrt{2}}\tan\left(\frac{x}{2}+\frac{\pi}{8}\right)+c$

D. $-\frac{1}{\sqrt{2}}\tan\left(\frac{x}{2}+\frac{\pi}{8}\right)+c$

Answer: B

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65. The value of $\int_0^{\pi} e^{\sin^2 x}\cos^3 x dx$ is equal to -

A. 0

B. -1

C. 1

D. π

Answer: A

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66. Let $I = \int_{-2}^{2}(x - [x])dx$ where [x] represents the greatest integer in x not greater than x. Then the value of I is -

A. 4

B. 3

C. 2

D. 1

Answer: C

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67. The value of $\int_0^{\pi}\frac{dx}{5 + 3\cos x}$ is -

A. $\frac{\pi}{4}$

B. $\frac{\pi}{8}$

C. $\frac{\pi}{2}$

D. 0

Answer: A

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68. The value of $\int e^x[f(x) + f'(x)]dx$ is equal to -

A. $e^x + f(x) + c$

B. $e^x f'(x) + c$

C. $e^x f(x) + c$

D. $e^x - f(x) + c$

Answer: C

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69. The value of $\int e^{\log(\tan x)}dx$ is equal to -

A. $\log(\tan x) + c$

B. $e^{\tan x} + c$

C. $\log(\cos x) + c$

D. $\log(\sec x) + c$

Answer: D

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70. The integral $\int\left(1 + x - \frac{1}{x}\right)e^{x + \frac{1}{x}}dx$ is equal to

A. $(x+1)e^{x+x^{-1}}+c$

B. $x \cdot e^{x+x^{-1}}+c$

C. $(x-1)e^{x+x^{-1}}+c$

D. $-xe^{x+x^{-1}}+c$

Answer: B

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71. The value of $\int_0^{\pi} \frac{x}{a^2\cos^2 x + b^2\sin^2 x}dx$ is equal to -

A. $\frac{\pi}{2ab}$

B. $\frac{\pi}{ab}$

C. $\frac{\pi^2}{2ab}$

D. $\frac{\pi^2}{ab}$

Answer: C

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72. If m and n are the order and degree respectively of the differential equation $\left(\frac{d^2y}{dx^2}\right)^5 + 4 \cdot \frac{\left(\frac{d^2y}{dx^2}\right)^3}{\frac{d^3y}{dx^3}} + \frac{d^3y}{dx^3} = x^2 - 1$, then -

A. $m = 3, n = 2$

B. $m = 3, n = 3$

C. $m = 3, n = 5$

D. $m = 3, n = 1$

Answer: A

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73. If the function $f(x) = \dfrac{2 - \sqrt{x + 4}}{\sin 2x}(x \neq 0)$ is continuous at x = 0, then f(0) is equal to -

A. $\dfrac{1}{8}$

B. $-\dfrac{1}{8}$

C. $\dfrac{1}{4}$

D. $-\dfrac{1}{4}$

Answer: B

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74. The integrating factor of the differential equation $(x + 1)\dfrac{dy}{dx} - ny = e^x(x + 1)^{n+1}$ is -

A. $e^{(x+1)^n}$

B. $(x+1)^n$

C. $\dfrac{1}{(x+1)^{n+1}}$

D. $\dfrac{1}{(x+1)^n}$

Answer: D

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75. The solution of the differential equation $\dfrac{dy}{dx} - y\tan x = -2\sin x$ is -

A. $y\sec x = \cos 2x + c$

B. $y\sec x = \dfrac{1}{2}\cos 2x + c$

C. $y\cos x = \dfrac{1}{2}\cos 2x + c$

D. $y\cos x = \cos 2x + c$

Answer: C

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76. The differential equation of the family of lines passing through the origin is -

A. $x\frac{dy}{dx} = y$

B. $x + \frac{dy}{dx} = 0$

C. $\frac{dy}{dx} = x$

D. $x\frac{dy}{dx} + y = 0$

Answer: A

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77. Which of the following statements is not true ?

A. a polynomial function is always continuous

B. a differentiable function is always continuous

C. a continuous function is always differentiable

D. $\log_e x$ is continuous for all $x > 0$

Answer: C

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78. If $f(x) = \begin{cases} x\sin\frac{1}{x} & \text{when } x \neq 0 \\ 0 & \text{when } x = 0 \end{cases}$

then at x = 0, the function f(x) is -

A. differentiable but not continuous

B. continuous and differentiable

C. not continuous

D. continuous but not differentiable

Answer: D

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79. The differentiable equation of the family of curves $y = A(x + B)^2$ after eliminating A and B is -

A. $yy'' = (y')^2$

B. $2yy'' = y' + y$

C. $2yy'' = (y')^2$

D. $2yy'' = y' - y$

Answer: C

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80. The solution of the differential equation $\log\left(\frac{dy}{dx}\right) = ax + by$ is

-

A. $\frac{e^{by}}{b} = \frac{e^{ax}}{a} + c$

B. $\frac{e^{ax}}{b} - \frac{e^{-by}}{a} = c$

C. $\frac{e^{ax}}{a} + \frac{e^{-by}}{b} = c$

D. none of these

Answer: C

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81. If the curves $y = a^x$ and $y = b^x$ intersect at an angle α , then the value of $\tan\alpha$ is-

A. $\dfrac{a - b}{1 + ab}$

B. $\dfrac{\log a - \log b}{1 + \log a \log b}$

C. $\dfrac{a + b}{1 - ab}$

D. $\dfrac{\log a + \log b}{1 + \log a \log b}$

Answer: B

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82. If the straight line $y = 4x - 5$ touches the curve $y^2 = px^3 + q$ at (2, 3), then the values of p and q are-

A. $p = 2, q = -7$

B. $p = 2, q = 7$

C. $p = -2, q = -7$

D. $p = -2, q = 7$

Answer: A

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83. The area (in square unit) of the figure bounded by $y^2 = 12x, x = 0$ and $y = 6$ is-

A. 12

B. 16

C. 3

D. 6

Answer: D

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84. The area (in square unit) of the region bounded by the curves $4x + 3y = 12$ is-

A. 6

B. 8

C. 4

D. 3

Answer: C

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85. The ratio of the areas bounded by the curves $y = \cos x$ and $y = \cos 2x$ between $x = 0, x = \frac{\pi}{3}$ and x-axis is-

A. $\sqrt{2} : 1$

B. $1 : 1$

C. $1 : 2$

D. $2 : 1$

Answer: D

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86. The equation of the normal to the parabola $y^2 = 4ax$ at the point $\left(at^2, 2at\right)$ is-

A. $tx + y = 2at + at^3$

B. $x + ty = 2at + at^3$

C. $tx - y = at + 2at^3$

D. $x - ty = at + 2at^3$

Answer: A

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87. If the slope of the normal to the parabola $3y^2 + 4y + 2 = x$ at a point on it is 8, then the coordinates of the point are-

A. $(1, -1)$

B. $(6, -2)$

C. $(9, 1)$

D. $(2, 0)$

Answer: B

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88. If the line $lx + my + n = 0$ is a tangent to the parabola $y^2 = 4ax$, then-

A. $an^2 = ml$

B. $al^2 = mn$

C. $am^2 = nl$

D. $a^2m = nl$

Answer: C

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89. The area (in square unit) in the first quadrant bounded by the parabolas $y^2 = 4x, y^2 = 16x$ and the straight line $x = 9$ is-

A. 36

B. 24

C. 18

D. 9

Answer: A

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90. The equations of the tangents to the hyperbola $3x^2 - 4y^2 = 12$ which are inclined at an angle 60° to the x- axis are-

A. $y = \sqrt{3}x \pm 12$

B. $y = \sqrt{3}x \pm 10$

C. $y = \sqrt{3}x \pm 15$

D. $y = \sqrt{3}x \pm 3$

Answer: D

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91. The equation of tangent to the curve $xy^2 = 4(4 - x)$ where it meets the line $y = x$ is-

A. $x + y + 4 = 0$

B. $x + y = 4$

C. $x - y = 2$

D. $x - y + 2 = 0$

Answer: B

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92. The normal to the curve $x = 3\cos\theta - \cos^3\theta, y = 3\sin\theta - \sin^3\theta$ at $\theta = \frac{\pi}{4}$ -

A. is at a distance of 2 unit from the origin

B. is at a distance of 4 unit from the origin

C. passes through the origin

D. passes through the point(2,3)

Answer: C

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93. The area bounded by the parabolas $y = 4x^2, y = \frac{x^2}{9}$ and the straight line y = 2 is

A. $\frac{20}{3}$

B. $\frac{16}{3}$

C. 8

D. $\frac{32}{3}$

Answer: A

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94. The point on the curve $x^2 + 2y = 10$ at which the tangent to the curve is perpendicular to the line $2x - 4y = 7$, is-

A. $(2, 3)$

B. $(-2, 3)$

C. $(4, -3)$

D. $(-4, -3)$

Answer: A

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95. Let x and y be two variables and $x > 0, xy = 1$, then the minimum value of x+y is-

A. 1

B. $\frac{5}{2}$

C. $\frac{10}{3}$

D. 2

Answer: D

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96. The function $f(x) = 1 - x^3 - x^5$ is decreasing for -

A. $1 \leq x \leq 5$

B. all real values of x

C. $x \leq 3$

D. $x \geq 5$

Answer: B

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97. The function $y = a(1 - \cos x)$ is maximum when x is-

A. $\frac{\pi}{2}$

B. $-\frac{\pi}{2}$

C. π

D. $\frac{\pi}{3}$

Answer: C

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98. Let $f(x) = x^3 + 6x^2 + px + 2$, if the largest possible interval in which f(x) is a decreasing function is $(-3, -1)$, then the value of p is-

A. 3

B. 9

C. -2

D. none of these

Answer: B

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99. In $-4 < x < 4$, the function $f(x) = \int_{-10}^{x} \left(t^4 - 4\right)e^{-4t}dt$ has-

A. no extrema

B. one extremum

C. two extrema

D. four extrema

Answer: C

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100. If $a_1, a_2, a_3, a_4, \dots, a_n$ are n positive real numbers whose product is a fixed number c, then the minimum value of $a_1 + a_2 + \dots + a_{n-1} + 2a_n$ is-

A. $n(2c)^{\frac{1}{n}}$

B. $(n+1)c^{\frac{1}{n}}$

C. $2nc^{\frac{1}{n}}$

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

Answer: A

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101. The length of the longest interval in which the function $3\sin x - 4\sin^3 x$ is increasing, is-

A. $\frac{\pi}{2}$

B. π

C. $\frac{3\pi}{2}$

D. $\frac{\pi}{3}$

Answer: D

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102. The real number x when added to its inverse gives the minimum value of the sum at x equal to-

A. -2

B. 2

C. 1

D. -1

Answer: C

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103. If minimum value of $f(x) = x^2 + 2bx + 2c^2$ is greater than maximum value of $g(x) = -x^2 - 2cx + b^2$, then for real value of x-

A. $\sqrt{2}|c| > |b|$

B. $|c| > \sqrt{2}|b|$

C. $0 < c < 2b$

D. none of these

Answer: B

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104. Let $f(x) = x^3 + bx^2 + cx + d, 0 < b^2 < c$. Then f(x)-

A. has a local maximum

B. has a local minimum

C. is strictly decreasing

D. is strictly increasing

Answer: D

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105. If $v = \frac{4}{3}\pi r^3$, then the rate (in cubic unit) at which v is increasing when $r = 10$ and $\frac{dr}{dt} = 0.01$, is-

A. 4π

B. π

C. 40π

D. $\frac{4\pi}{3}$

Answer: A

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106. If the time rate of change of the radius of a sphere is $\frac{1}{2\pi}$, then the rate of change of its surface area(in square cm), when the radius is 5 cm , is-

A. 20

B. 10

C. 4

D. 5

Answer: A

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107. The length of a side of a cube is 10 cm, if an error of 0.05 cm is made in measuring the side, then the percentage error made in calculating its volume is-

A. 2.5

B. 1.6

C. 2.6

D. 1.5

Answer: D

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108. Let $y = 2x^2 - 3x + 2$, if x changes to 3.02 from 3 , then the approximate change in y is-

A. 0.16

B. 0.18

C. 0.09

D. 0.12

Answer: B

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109. Objective function of a linear programming problem is a-

A. function to be optimized

B. constraint

C. linear function of the variables to be optimized

D. relation among the variables

Answer: C

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110. If the rate of change of y with respect to x is 4 and y is changing at the rate of 12 units/s, then the rate of change of x per second is-

A. 6

B. 4

C. 3

D. 2

Answer: C

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1. Let A={x, y, z} be a given set and a relation R on A ios defined as follows :

$R = \{(x, x), (y, y), (z, z), (x, y), (y, z), (z, x)\}$

Then the relation R on A is -

A. symmetric only

B. transitive only

C. reflexive only

D. an equivalence relation

Answer: C

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2. Let the function $f: R \rightarrow R$ be defined by $f(x) = x + \sin x$ for all x in R. Then f is -

A. one-one but not onto

B. one-one and onto

C. onto but not one-one

D. neither one-one nor onto

Answer: B

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3. Let the mappings $f: R \rightarrow R$ and $g: R \rightarrow R$ be defined respectively by $f(x) = 5|x| - x^2$ and $g(x) = 2x - 3$. Then the value of (gof)(-2) is -

A. 9

B. 8

C. 7

D. 10

Answer: A

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4. Let A={1, 2, 3} and R={(2, 2),(3, 3),(1, 2)} be a relation on A. Then the minimum number of ordered pairs to be added to R to make it an equivalence relation is -

A. 3

B. 1

C. 4

D. 2

Answer: D

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5. State which one of the following is true -

A. $\sec\left(\tan^{-1}x\right) = \tan\left(\sec^{-1}x\right)$

B. $\cos\left(\tan^{-1}x\right) = \tan\left(\cos^{-1}x\right)$

C. $\sin\left(\cos^{-1}x\right) = \cos\left(\sin^{-1}x\right)$

D. none of these

Answer: C

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6. If $\cos^{-1}\sqrt{p} + \cos^{-1}\sqrt{1-p} + \cos^{-1}\sqrt{1-q} = \frac{3\pi}{4}$, then the value of q is -

A. $\frac{1}{2}$

B. $\frac{1}{\sqrt{2}}$

C. 1

D. $\frac{1}{4}$

Answer: A

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7. In the equation $px^2 + rx + r = 0$ ratio of the roots are $a:b$then prove that $p(a+b)^2 = rab$

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8. If n and p are two parameters of binomial distribution then its standard deviation is -

A. $np^2 - np$

B. $np - np^2$

C. $\sqrt{np - np^2}$

D. none of these

Answer: C

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9. If the cartesian equation of a line AB is $\frac{x-1}{2} = \frac{2y-1}{12} = \frac{z+5}{3}$, then the direction cosines of a line parallel to AB are -

A. $\frac{2}{\sqrt{157}}, \frac{2}{\sqrt{157}}, \frac{3}{\sqrt{157}}$

B. $\frac{1}{\sqrt{37}}, \frac{6}{\sqrt{37}}, \frac{3}{2\sqrt{37}}$

C. $\frac{2}{7}, \frac{12}{7}, \frac{3}{7}$

D. $\frac{2}{7}, \frac{6}{7}, \frac{3}{7}$

Answer: D

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10. The straight line $\frac{x-3}{2} = \frac{y+4}{0} = \frac{z-2}{5}$ is perpendicular to -

A. y-axis

B. x-axis

C. z-axis

D. both x-axis and z-axis

Answer: A

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11. The angle between the lines $-6x = y = 4z$ and $2x = 3y = -z$ is -

A. $\frac{\pi}{3}$

B. $\frac{\pi}{2}$

C. $\cos^{-1}\frac{5}{13}$

D. none of these

Answer: B

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12. The shortest distance between the lines whose vector equations are $\vec{r} = \hat{i} - 2\hat{j} + 3\hat{k} + \lambda\left(\hat{i} - \hat{j} + \hat{k}\right)$ and $\vec{r} = \hat{i} - \hat{j} - \hat{k} + \mu\left(\hat{i} + 2\hat{j} - 2\hat{k}\right)$ is -

A. $\frac{7}{3\sqrt{2}}$

B. $\frac{5}{\sqrt{2}}$

C. $\frac{3}{\sqrt{2}}$

D. $\sqrt{2}$

Answer: C

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13. Two events A and B are such that $P(A) = \frac{1}{4}, P(B/A) = \frac{1}{2}$ and $P(A/B) = \frac{1}{4}$, then the value of $P\left(A^c/B^c\right)$ is -

A. $\frac{1}{4}$

B. $\frac{3}{4}$

C. $\frac{1}{2}$

D. $\frac{2}{3}$

Answer: B

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14. The probability that a regularly scheduled flight departs on time is 0.9, the probability that it arrives on time is 0.8 and the probability that it departs and arrives on time is 0.7. Then the probability that a plane arrives on time, given that it departs on time, is -

A. 0.72

B. $\frac{8}{9}$

C. $\frac{7}{9}$

D. 0.56

Answer: C

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15. A sample of 4 items is drawn at random from a lot of 10 items, containing 3 defectives. If x denotes the number of defective items in the sample, then $P(0 < x < 3)$ is equal to -

A. $\frac{4}{5}$

B. $\frac{3}{10}$

C. $\frac{1}{2}$

D. $\frac{1}{6}$

Answer: A

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16. A and B are two independent events such that $P(A) = \frac{1}{2}$ and $P(B) = \frac{1}{3}$. Then the value of $P\left(A^c \cap B^c\right)$ is -

A. $\frac{2}{3}$

B. $\frac{1}{6}$

C. $\frac{5}{6}$

D. $\frac{1}{3}$

Answer: D

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17. If n things are arranged at random in a row then the probability that m particular things are never together is -

A. $\frac{m!(n - m)!}{n!}$

B. $1 - \frac{m!(n-m)!}{n!}$

C. $1 - \frac{m!}{n!}$

D. $1 - \frac{m!(n-m+1)!}{n!}$

Answer: D

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18. If $A = \begin{bmatrix} 3 & 5 \\ 2 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 17 \\ 0 & -10 \end{bmatrix}$ then |AB| is equal to -

A. 80

B. 100

C. -110

D. 92

Answer: B

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19. The inverse of the matrix $\begin{bmatrix} 5 & -2 \\ 3 & 1 \end{bmatrix}$ is -

A. $\frac{1}{3}\begin{bmatrix} -2 & 5 \\ 1 & 3 \end{bmatrix}$

B. $\begin{bmatrix} 1 & 2 \\ -3 & 5 \end{bmatrix}$

C. $\frac{1}{11}\begin{bmatrix} 1 & 2 \\ -3 & 5 \end{bmatrix}$

D. $\begin{bmatrix} 1 & 3 \\ -2 & 5 \end{bmatrix}$

Answer: C

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20. If $A_i = \begin{bmatrix} a^i & b^i \\ b^i & a^i \end{bmatrix}$ and $|a| < 1, |b| < 1$ then the value of $\sum_{i=1}^{\infty}$ det $\left(A_i\right)$ is -

A. $\dfrac{a^2 - b^2}{\left(1 - a^2\right)\left(1 - b^2\right)}$

B. $\dfrac{a^2}{(1 - a)^2} - \dfrac{b^2}{(1 - b)^2}$

C. $\dfrac{a^2}{(1 - a)^2} + \dfrac{b^2}{(1 - b)^2}$

D. $\dfrac{a^2}{(1 + a)^2} - \dfrac{b^2}{(1 + b)^2}$

Answer: A

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21. If A is a singular matrix of order n then $A \cdot$ (adj A) is equal to -

A. a null matrix

B. a row matrix

C. a column matrix

D. none of these

Answer: A

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22. If the determinant of the matrix $\begin{bmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{bmatrix}$ is denoted by D, then the determinant of the matrix $\begin{bmatrix} a_1 + 3b_1 - 4c_1 & b_1 & 4c_1 \\ a_2 + 3b_2 - 4c_2 & b_2 & 4c_2 \\ a_3 + 3b_3 - 4c_3 & b_3 & 4c_3 \end{bmatrix}$ will be -

A. D

B. 2D

C. 3D

D. 4D

Answer: D

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23. If $\begin{vmatrix} x - 2 & 2x - 3 & 3x - 4 \\ x - 4 & 2x - 9 & 3x - 16 \\ x - 8 & 2x - 27 & 3x - 64 \end{vmatrix} = 0$, then the value of x is -

A. -2

B. 3

C. 4

D. 0

Answer: C

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24. If a, b, c, d , e and f are in G.P. then the value of $\begin{vmatrix} a^2 & d^2 & x \\ b^2 & e^2 & y \\ c^2 & f^2 & z \end{vmatrix}$

depends on -

A. x and y

B. y and z

C. z and x

D. none of x, y and z

Answer: D

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25. If a, b, c are respectively the p-th, q-th, r-th terms of an A.P.

then the value of $\begin{vmatrix} a & p & 1 \\ b & q & 1 \\ c & r & 1 \end{vmatrix}$ is -

A. $p+q+r$

B. 0

C. 1

D. pqr

Answer: B

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26. If for a triangle ABC, $\begin{vmatrix} 1 & a & b \\ 1 & c & a \\ 1 & b & c \end{vmatrix} = 0$ then the value of $\sin^2 A + \sin^2 B + \sin^2 C$ is -

A. $\frac{4}{9}$

B. $\frac{9}{4}$

C. 1

D. $\frac{3\sqrt{3}}{4}$

Answer: B

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27. If the points with position vectors $10\hat{i} + 3\hat{j}, 12\hat{i} - 5\hat{j}$ and $p\hat{i} + 11\hat{j}$ be collinear, then the value of p is -

A. 4

B. 12

C. 8

D. -8

Answer: C

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28. If ABCDEF be a regular hexagon then $\left(\overrightarrow{AD}+\overrightarrow{EB}+\overrightarrow{FC}\right)$ is equal to -

A. $4\overrightarrow{AB}$

B. $3\overrightarrow{AB}$

C. $2\overrightarrow{AB}$

D. $\vec{0}$

Answer: A

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29. The value of $\cos\left[\cos^{-1}\left(-\frac{1}{7}\right)+\sin^{-1}\left(-\frac{1}{7}\right)\right]$ is -

A. $\frac{4}{9}$

B. $\frac{1}{3}$

C. $-\frac{1}{3}$

D. 0

Answer: D

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30. The vector equation of yz-plane is -

A. $\vec{r} \cdot \hat{k} = 0$

B. $\vec{r} \cdot \hat{j} = 0$

C. $\vec{r} \cdot \hat{i} = 0$

D. $\vec{r} \cdot \left(\hat{j} + \hat{k}\right) = 0$

Answer: C

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31. The foot of the perpendicular drawn from the origin to a plane is (2, -3, 4), then the equation of the plane is -

A. $2x - 3y + 4z = 25$

B. $2x - 3y + 4z = 20$

C. $2x - 3y + 4z = 29$

D. none of these

Answer: C

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32. The direction cosines of the line $\frac{x+3}{2} = \frac{2y-3}{-3} = \frac{z-1}{0}$ are -

A. 2, -3, 0

B. $\frac{2}{\sqrt{13}}, -\frac{2}{\sqrt{13}}, 0$

C. $\frac{2}{5}, \frac{3}{5}, 0$

D. $\frac{4}{5}, -\frac{3}{5}, 0$

Answer: D

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33. Let $f(x) = a^x (a > 0)$ be written as $f(x) = g(x) + h(x)$ where g(x) is an even function and h(x) is an odd function. Then the value of $g(x + y) + g(x - y)$ is -

A. g(x)h(x)

B. 2g(x)

C. 2g(x)g(y)

D. $2g(x + y)g(x - y)$

Answer: C

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34. The area of the parallelogram formed by the vectors $3\hat{i} - 2\hat{j} + \hat{k}$ and $\hat{i} + 2\hat{j} + 3\hat{k}$ is -

A. $8\sqrt{3}$sq. unit

B. $4\sqrt{3}$ sq. unit

C. $6\sqrt{3}$ sq. unit

D. $16\sqrt{3}$ sq. unit

Answer: A

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35. If $\vec{a} = 2\hat{i} - 5\hat{j} + 4\hat{k}$ and $\vec{b} = \hat{i} - 4\hat{j} + 6\hat{k}$, then a unit vector in the direction of the vector $2\vec{a} - \vec{b}$ is -

A. $\frac{1}{7}\left(2\hat{i} - 3\hat{j} + 6\hat{k}\right)$

B. $\frac{1}{7}\left(6\hat{i} - 3\hat{j} + 2\hat{k}\right)$

C. $\frac{1}{7}\left(3\hat{i} - 6\hat{j} + 2\hat{k}\right)$

D. none of these

Answer: C

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36. If $\vec{a} + \vec{b} + \vec{c} = \vec{0}$ and $\left|\vec{a}\right| = 3, \left|\vec{b}\right| = 5$ and $\left|\vec{c}\right| = 7,$ then the cosine of the angle between the vectors $\vec{a}$ and $\vec{b}$ is -

A. $\frac{3}{5}$

B. $\frac{1}{2}$

C. - $\frac{1}{2}$

D. - $\frac{3}{5}$

Answer: B

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37. If $\vec{\alpha}, \vec{\beta}, \vec{\gamma}$ be three unit vectors such that $\left|\vec{\alpha} + \vec{\beta} + \vec{\gamma}\right| = 1$ and $\vec{\alpha}$ is perpendicular to $\vec{\beta}$ while $\vec{\gamma}$ makes angles θ and ϕ with $\vec{\alpha}$ and $\vec{\beta}$ respectively, then the value of $\cos\theta + \cos\phi$ is -

A. $\frac{5}{4}$

B. $-\frac{5}{4}$

C. 1

D. -1

Answer: D

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38. If $\vec{a} = 2\hat{i} + 5\hat{j} + 7\hat{k}$ and $\vec{b} = \hat{i} - \hat{j} + 5\hat{k}$, then the vecor components of the vector $2\vec{a} - 3\vec{b}$ along the coordinate axes are -

A. $13\hat{i}, -\hat{j}, -\hat{k}$

B. $\hat{i}, 13\hat{j}, -\hat{k}$

C. $-\hat{i}, 6\hat{j}, -\hat{k}$

D. none of these

Answer: B

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39. The image of the point (-3, 5, 2) in the plane $2x - y + z + 3 = 0$ is -

A. (1, 3, 4)

B. (3, 1, 4)

C. (-1, 4, -3)

D. (-1, -3, 4)

Answer: A

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40. The equation of the plane passing through the points (1, -1, 2) and (2, -2, 2) and perpendicular to the plane $6x - 2y + 2z = 10$ is -

A. $x + 4y + z + 1 = 0$

B. $x + 4y + z + 4 = 0$

C. $x + y - 2z + 4 = 0$

D. none of these

Answer: C

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41. The values of x, at which the first derivative of the function $\left(x+\frac{1}{x}\right)$ w.r.t. x is $\frac{3}{4}$, are -

A. $\pm\frac{1}{2}$

B. $\pm\frac{2}{\sqrt{3}}$

C. $\pm\frac{\sqrt{3}}{2}$

D. ± 2

Answer: D

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42. If $f(x) = \sin 3x \cos 4x$, then the value of $f''\left(\frac{\pi}{2}\right)$ is -

A. 24

B. 25

C. -25

D. -24

Answer: B

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43. Let f(x) be a differentiable even function, consider the following statements :

(i) f'(x) is an even function.

(ii) f'(x) is an odd function.

(iii) f'(x) may be even or odd.

Which of the above statements is/are correct ?

A. (i) only

B. (i) and (iii)

C. (ii) only

D. (ii) and (iii)

Answer: C

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44. If $y = x + x^2 + x^3 + \ldots\infty$ where $|x| < 1$, then for $|y| < 1$ the value of $\frac{dx}{dy}$ is equal to -

A. $1 - 2y + 3y^2 - \ldots\infty$

B. $y + y^2 + y^3 + \ldots\infty$

C. $1 - y + y^2 - y^3 + \ldots\infty$

D. $1 + 2y + 3y^2 + \ldots\infty$

Answer: A

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45. Find which function does not obey mean value theorem in [0, 1] -

A. $f(x) = \begin{cases} \frac{1}{2} - x & \text{when } x < \frac{1}{2} \\ \left(\frac{1}{2} - x\right)^2 & \text{when } x \geq \frac{1}{2} \end{cases}$

B. $f(x) = |x|$

C. $f(x) = x|x|$

D. $f(x) = \begin{cases} \frac{\sin x}{x} & \text{when } x \neq 0 \\ 1 & \text{when } x = 0 \end{cases}$

Answer: A

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46. The derivative of $\sec^{-1}\left(\frac{1}{2x^2-1}\right)$ w.r.t. $\sqrt{1-x^2}$ at $x=\frac{1}{2}$ is -

A. 2

B. 4

C. 1

D. -2

Answer: B

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47. The derivative of the function $f(x)=\log_5\left(\log_7 x\right)[x>7]$ is -

A. $\frac{1}{x\log_e x}$

B. $\frac{1}{x\log_e 5\log_e 7}$

C. $\dfrac{1}{x\log_e 5\log_e 7\log_7 x}$

D. none of these

Answer: C

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48. If $2y = (x - a)\sqrt{2ax - x^2} + a^2\sin^{-1}\dfrac{x - a}{a}$, then the value of $\dfrac{dy}{dx}$ is equal to -

A. $\sqrt{ax - x^2}$

B. $\sqrt{x^2 - ax}$

C. $\sqrt{x^2 - 2ax}$

D. $\sqrt{2ax - x^2}$

Answer: D

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49. The value of $\lim_{x \to 0}(1+3x)^{\frac{x+2}{x}}$ is -

A. e^3

B. e^6

C. e^5

D. e

Answer: B

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50. If $y = x^3$ then the value of $\dfrac{\frac{d^2y}{dx^2}}{\left[1+\left(\frac{dy}{dx}\right)^2\right]^{\frac{3}{2}}}$ at the point (1, 1) is -

A. $\dfrac{3}{5\sqrt{10}}$

B. $\dfrac{5}{3\sqrt{10}}$

C. $\dfrac{4}{3\sqrt{10}}$

D. $\dfrac{3}{4\sqrt{10}}$

Answer: A

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51. If $x = \dfrac{1}{z}, y = f(x)$ and $\dfrac{d^2y}{dx^2} = kz^3\dfrac{dy}{dz} + z^4\dfrac{d^2y}{dz^2}$, then the value of k is -

A. -1

B. 1

C. 2

D. -2

Answer: C

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52. If $xy = ax^2 + \frac{b}{x}$, then the value of $x^2\frac{d^2y}{dx^2} + 2x\frac{dy}{dx}$ is -

A. y

B. $-y$

C. $-2y$

D. 2y

Answer: D

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53. The value of c in Rolle's theorem when

$f(x) = 2x^3 - 5x^2 - 4x + 3, x \in \left[\frac{1}{2}, 3\right]$ is -

A. $-\frac{1}{3}$

B. $\frac{2}{3}$

C. 2

D. -2

Answer: C

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54. Let $f(x) = \begin{cases} \frac{\sin \pi x}{5x} & \text{when } x \neq 0 \\ k & \text{when } x = 0 \end{cases}$

If f(x) is continuous at x=0, then the value of k is -

A. 1

B. $\frac{\pi}{5}$

C. $\frac{5}{\pi}$

D. 0

Answer: B

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55. If $\int f(x)dx = f(x)$, then $\int \{f(x)\}^2 dx$ is equal to -

A. $\frac{1}{2}\{f(x)\}^2 + c$

B. $\{f(x)\}^3 + c$

C. $\frac{|f(x)|^3}{3} + c$

D. $\{f(x)\}^2 + c$

Answer: A

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56. The value of $\int \frac{\sqrt{\tan x}}{\sin x \cos x} dx$ is equal to -

A. $2\sqrt{\sec x} + c$

B. $\frac{2}{\sqrt{\tan x}} + c$

C. $2\sqrt{\cos x} + c$

D. $2\sqrt{\tan x} + c$

Answer: D

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57. The value of $\int_0^{\frac{\pi}{2}} x \sin x dx$ is equal to -

A. $\frac{\pi}{4}$

B. $\frac{\pi}{2}$

C. 1

D. π

Answer: C

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58. $\int_{-2}^{2} (|x| + |x - 1|) dx$ is equal to -

A. 10

B. 9

C. 8

D. 7

Answer: B

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59. The value of $\int_0^{\frac{\pi}{2}} \log(\tan x)dx$ is equal to -

A. $\frac{\pi}{8}\log 2$

B. 1

C. $\frac{\pi}{4}\log 2$

D. 0

Answer: D

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60. The value of $\int_0^{\pi} \log \sin^2 x dx$ is equal to -

A. $2\pi \log \frac{1}{2}$

B. $\pi \log 2$

C. $\frac{\pi}{2} \log \frac{1}{2}$

D. $\pi \log \frac{1}{2}$

Answer: A

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61. The value of the integral $\int_1^{e} (\log x)^2 dx$ is -

A. e

B. 2e

C. e - 2

D. $e - 1$

Answer: C

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62. The value of $\int \frac{dx}{e^x + e^{-x}}$ is equal to -

A. $\log(e^x + e^{-x}) + c$

B. $\tan^{-1}(e^x) + c$

C. $\tan^{-1}(e^{2x}) + c$

D. $e^x - e^{-x} + c$

Answer: B

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63. For an integrable function f(x) in [-3, 3], $\int_{-3}^{3} f(x)dx = 0$ when f(x) is -

A. an even function

B. any function

C. only a trigonometric function

D. an odd function

Answer: D

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64. If $I_m = \int_1^e (\log_e x)^m dx$, then the value of $(I_m + mI_{m-1})$ is -

A. < 3

B. $= 3$

C. > 3

D. none of these

Answer: A

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65. If $\frac{d}{dx}f(x) = g(x)$, then the value of $\int_a^b f(x)g(x)dx$ is -

A. $\frac{1}{2}[f(b) - f(a)]$

B. $\frac{1}{2}[g(b) - g(a)]$

C. $\frac{1}{2}\left[\{f(b)\}^2 - \{f(a)\}^2\right]$

D. $\frac{1}{2}\left[\{g(b)\}^2 - \{g(a)\}^2\right]$

Answer: C

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66. The value of the integral $\int_0^1 x(1 - x)^n dx$ is -

A. $\dfrac{1}{n + 1} + \dfrac{1}{n + 2}$

B. $\dfrac{1}{n + 1}$

C. $\dfrac{1}{n + 2}$

D. $\dfrac{1}{n + 1} - \dfrac{1}{n + 2}$

Answer: D

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67. The value of $\lim_{n \to \infty} \sum_{r=1}^{n} \dfrac{r^2}{r^3 + n^3}$ is -

A. $\dfrac{\pi}{4}$

B. $\dfrac{\pi}{2}$

C. $\frac{1}{3}\log_e 2$

D. $\frac{1}{2}\log_e 2$

Answer: C

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68. The value of $\int_0^1 \frac{\log(1+x)dx}{1+x^2}$ is -

A. $\frac{\pi}{4}$

B. $\frac{\pi}{4}\log 2$

C. π

D. $\frac{\pi}{8}\log 2$

Answer: D

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69. The value of $\lim_{x \to 0} \frac{\int_0^{x^2} \sec^2 t dt}{x \sin x}$ is equal to -

A. 1

B. 2

C. 3

D. 0

Answer: A

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70. If $\phi(x) = f(x) + xf'(x)$, then the value of $\int \phi(x) dx$ is -

A. $\frac{1}{2} f(x) + c$

B. $xf(x) + c$

C. $\frac{1}{2}xf(x) + c$

D. $2xf(x) + c$

Answer: B

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71. The value of the integral $\int_0^{2\pi}(\sin x + |\sin x|)dx$ is equal to -

A. 1

B. 2

C. 4

D. 0

Answer: C

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72. The solution of the differential equation $\cos x \sin y dx + \sin x \cos y dy = 0$ is -

A. $|\sin x \sin y| = c$

B. $\left|\frac{\sin x}{\sin y}\right| = c$

C. $|\cos x \cos y| = c$

D. $\left|\frac{\cos x}{\cos y}\right| = c$

Answer: A

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73. If m and n denote respectively the order and degree of a differential equation, then for the equation

$\left[a + \left(\frac{dy}{dx}\right)^6\right]^{\frac{7}{5}} = b\frac{d^2y}{dx^2}$, the value of (m, n) will be -

A. (1, 6)

B. (1, 7)

C. (2, 6)

D. (2, 5)

Answer: D

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74. The solution of the differential equation $\frac{dy}{dx} = \frac{x - y}{x + y}$ is -

A. $x^2 - y^2 + 2xy = c$

B. $x^2 - y^2 + xy = c$

C. $x^2 - y^2 - 2xy = c$

D. $x^2 - y^2 - xy = c$

Answer: C

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75. The solution of the differential equation $y - x\frac{dy}{dx} = a\left(y^2 + \frac{dy}{dx}\right)$ is -

A. $|(x+a)(x+ay)| = c|y|$

B. $|(x+a)(1-ay) = c|y|$

C. $|(x+a)(1-ay)| = c$

D. none of these

Answer: B

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76. The integrating factor of the differential equation $x\frac{dy}{dx} + (x - 1)y = x^2$ is -

A. $\frac{e^x}{x}$

B. $\frac{x}{e^x}$

C. xe^x

D. $(x + 1)e^x$

Answer: A

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77. The solution of differential $\frac{dy}{dx} = \frac{y}{x} + \frac{\phi\left(\frac{y}{x}\right)}{\phi'\left(\frac{y}{x}\right)}$ is -

A. $\left|y\phi\left(\frac{y}{x}\right)\right| = k$

B. $\left|\phi\left(\frac{y}{x}\right)\right| = k|y|$

C. $\left|x\phi\left(\frac{y}{x}\right)\right| = k$

D. $\left|\phi\left(\frac{y}{x}\right)\right| = k|x|$

Answer: D

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78. The order and degree of the differential equation of the family of all parabolas whose axis is x-axis are -

A. 3, 2

B. 1, 2

C. 2, 1

D. 2, 3

Answer: C

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79. If y(t) is the solution of the differential equation $(t+1)\frac{dy}{dt} - ty = 1$ and $y(0) = -1$, then the value of y at $t = 1$ is -

A. $e + \frac{1}{2}$

B. $-\frac{1}{2}$

C. $e - \frac{1}{2}$

D. $\frac{1}{2}$

Answer: B

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80. If $f(x) = |x - 3| + |x - 4|$, then in the interval $0 \le x \le 5$, the function f(x) is -

A. not differentiable at x=3 and x=4

B. not continuous in $0 \le x \le 5$

C. differentiable at x=3

D. differentiable at x=4

Answer: A

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81. Two perpendicular tangents to $y^2 = 4ax$ always intersect on the line-

A. $x = a$

B. $x + a = 0$

C. $x + 2a = 0$

D. $x = 2a$

Answer: B

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82. If the gradient of the tangent at any point (x, y) of a curve which passes through the point $\left(1, \frac{\pi}{4}\right)$ is $\left\{\frac{y}{x} - \sin^2\left(\frac{y}{x}\right)\right\}$, then the equation of the curve is-

A. $y = \cot^{-1}(\log x)$

B. $y = \cot^{-1}\left\{\log\left(\frac{x}{e}\right)\right\}$

C. $y = x\cot^{-1}\{\log(xe)\}$

D. $y = \cot^{-1}\left\{\log\left(\frac{e}{x}\right)\right\}$

Answer: C

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83. The number of tangents that can be drawn from the point $(6, 2)$ on the hyperbola $\frac{x^2}{9} - \frac{y^2}{4} = 1$ is-

A. 0

B. 1

C. 2

D. 4

Answer: A

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84. The equation of the tangent to the curve $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$ at the point $\left(a\cos^3\alpha, a\sin^3\alpha\right)$ is-

A. $x\cos\alpha + y\sin\alpha = a\sin\alpha\cos\alpha$

B. $x\cos\alpha$ - $y\sin\alpha = a\sin 2\alpha$

C. $x\sin\alpha$ - $y\cos\alpha = a\sin 2\alpha$

D. $x\sin\alpha + y\cos\alpha = a\sin\alpha\cos\alpha$

Answer: D

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85. If the area enclosed by the parabola $x^2 = 72y$ and the line $y = k$ be $64\sqrt{2}$ square unit, then the value of k is-

A. 2

B. 3

C. 4

D. 6

Answer: C

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86. Two intersecting circles have their radii 1 metre and $\sqrt{3}$ metre. The distance between their centres is 2 metre Then the overlapping area (in square metre) is-

A. $\dfrac{19\pi + 6\sqrt{3}}{6}$

B. $\dfrac{5\pi + 6\sqrt{3}}{6}$

C. $\dfrac{\pi}{6}$

D. $\frac{5\pi - 6\sqrt{3}}{6}$

Answer: D

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87. The equation of the tangent to the curve $y = be^{-\frac{x}{a}}$ at the point where it crosses the y-axis is-

A. $bx + ay = ab$

B. $ax + by = 1$

C. $bx - ay = ab$

D. $ax - by = 1$

Answer: A

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88. The equations of the two common tangents to the circle $x^2 + y^2 = 2a^2$ and the parabola $y^2 = 8ax$ are-

A. $x = \pm (y + 2a)$

B. $y = \pm (x + 2a)$

C. $x = \pm (y + a)$

D. $y = \pm (x + a)$

Answer: B

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89. If the curve $y = a\sqrt{x} + bx$ passes through the point $(1, 2)$ and the area bounded by the curve, the line $x = 4$ and x-axis is 8 square unit, then the values of a and b are-

A. $a = 3, b = 1$

B. $a = -3, b = 1$

C. $a = 3, b = -1$

D. $a = -3, b = -1$

Answer: C

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90. The area (in square unit) bounded by the curve $y = \sin x$ between the ordinates $x = 0, x = \pi$ and the x -axis is-

A. 2

B. 4

C. 3

D. 6

Answer: A

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91. The equation of the normal to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ at the point $(a\cos\theta, b\sin\theta)$ on it is-

A. $ax\sin\theta - by\cos\theta = a^2 - b^2$

B. $ax\sin\theta + by\cos\theta = a^2 - b^2$

C. $ax\cos\theta - by\sin\theta = \left(a^2 - b^2\right)\sin\theta\cos\theta$

D. $ax\sin\theta - by\cos\theta = \left(a^2 - b^2\right)\sin\theta\cos\theta$

Answer: D

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92. The point on the curve $\sqrt{x} + \sqrt{y} = \sqrt{a}$, the normal at which is parallel to the x-axis is-

A. $(0, 0)$

B. $(a, 0)$

C. $(0, a)$

D. $\left(\frac{a}{4}, \frac{a}{4}\right)$

Answer: C

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93. The slope of the tangent to the curve $x = 3t^2 + 1, y = t^3 - 1$ at $x = 1$ is-

A. $\frac{1}{2}$

B. 0

C. -2

D. undefined

Answer: B

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94. If the area above the x-axis bounded by the curve $y = 2^{kx}$ and the lines $x = 0, x = 2$ is $\frac{3}{\log 2}$ square unit, then the value of k is-

A. 1

B. $\frac{1}{2}$

C. -1

D. 2

Answer: A

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95. If the line $x + y = 1$ is a tangent to the parabola $y^2 - y + x = 0$, then the point of contact is-

A. $(0, 1)$

B. $(a, 0)$

C. $(1, 1)$

D. $(-1, 0)$

Answer: A

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96. The angle between the curves $y = \sin x$ and $y = \cos x$ is-

A. $\tan^{-1}(5\sqrt{2})$

B. $\tan^{-1}(3\sqrt{3})$

C. $\tan^{-1}(3\sqrt{2})$

D. $\tan^{-1}(2\sqrt{2})$

Answer: D

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97. The function $f(x) = \cos x - 2ax$ is monotonically decreasing when-

A. $a < \frac{1}{2}$

B. $a > \frac{1}{2}$

C. $a < 0$

D. $a > 0$

Answer: B

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98. If PQ and PR are the two sides of a triangle, then the angle between them which gives maximum area of the triangle is-

A. $\frac{\pi}{4}$

B. $\frac{\pi}{3}$

C. $\frac{\pi}{2}$

D. $\frac{2\pi}{3}$

Answer: C

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99. The function $f(x) = x^3 + 3x^2 + 4x + 7$ is increasing for-

A. all real values of x

B. $x < 0$

C. $x > 0$

D. $x = 0$

Answer: A

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100. If $x + y = 60, x, y > 0$, then the maximum value of xy^3 is-

A. 30

B. 60

C. $45 \times (15)^3$

D. $15 \times (45)^3$

Answer: D

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101. The points of extrema of $f(x) = \int_0^x \frac{\sin t}{t} dt$ in the domain $x > 0$, are-

A. $(2n+1)\frac{\pi}{2}$

B. $n\pi$

C. $(4n+1)\frac{\pi}{2}$

D. $(2n+1)\frac{\pi}{4}$

Answer: B

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

A. $\frac{1}{2}$

B. 3

C. 1

D. 2

Answer: D

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103. A land in the form of a circular sector has been fenced by wire of 40 metre length. The area of the land will be maximum when the radius of the circular sector (in metre) is-

A. 25

B. 20

C. 10

D. 15

Answer: C

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104. The maximum value of the function $f(x) = 3\cos x - 4\sin x$ is-

A. 5

B. 4

C. 3

D. 2

Answer: A

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105. The function $f(x) = \frac{\lambda \sin x + 6\cos x}{2\sin x + 3\cos x}$ is monotonic increasing when-

A. $\lambda > 1$

B. $\lambda > 4$

C. $\lambda < 1$

D. $\lambda < 4$

Answer: B

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106. The surface area of a spherical bubble is increasing at the rate of $2cm^2/s$. Then the rate at which the volume of the bubble is increasing at the instant when its radius is 6 cm, is-

A. $3cm^3/s$

B. $2cm^3/s$

C. $4cm^3/s$

D. $6cm^3/s$

Answer: D

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107. A point on the parabola $y^2 = 18x$ at which the ordinate increases at twice the rate of the abscissa is-

A. $\left(-\frac{9}{8}, \frac{9}{2}\right)$

B. $(2, -6)$

C. $(2, 6)$

D. $\left(\frac{9}{8}, \frac{9}{2}\right)$

Answer: D

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108. A function $y = f(x)$ has a second order derivative $f''(x) = 6(x-1)$. If its graph passes through the point (2, 1) and at that point the tangent to the graph is $y = 3x - 5$, then the function is-

A. $(x + 1)^3$

B. $(x - 1)^3$

C. $(x - 1)^2$

D. $(x - 1)^3 + 2$

Answer: B

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109. Maximize : $Z = 5y + 2x$ subject to constraints-

$x + 2y \leq 4, 7x + 8y \geq 56, x \geq 0, y \geq 0.$ The solution of the above LPP is-

A. 30

B. 48

C. 36

D. none of these

Answer: D

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110. An open box with a square base is made out of a given iron sheet of area 27 sq.m. Then, the maximum volume of the box is-

A. $9m^3$

B. $27m^3$

C. $13.5m^3$

D. $18m^3$

Answer: C

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1. A function f from the set of natural numbers N to the set of integers Z is defined by

$$f(n) = \begin{cases} \frac{n-1}{2} & \text{when n is odd} \\ -\frac{n}{2} & \text{when n is even} \end{cases}$$

Then f(n) is -

A. neither one-one nor onto

B. one-one but not onto

C. onto but not one-one

D. one-one and onto both

Answer: D

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2. If $\vec{a}$ is unit vector in xy-plane making an angle $\frac{\pi}{4}$ with the x-axis, then $\vec{a}$ is equal to -

A. $\hat{i} + \hat{j}$

B. $\hat{i} - \hat{j}$

C. $\frac{1}{\sqrt{2}}\left(\hat{i} + \hat{j}\right)$

D. $\frac{1}{\sqrt{2}}\left(\hat{i} - \hat{j}\right)$

Answer: C::D

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3. If $f: R \rightarrow R$ and $g: R \rightarrow R$ are defined by $f(x) = 2x + 3$ and $g(x) = x^2 + 7$, then the values of x such that (gof)(x)=8 are -

A. 1, -2

B. $-1, 2$

C. $-1, \ -2$

D. 1, 2

Answer: C

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4. The relation $R = \{(1, 1), (2, 2), (3, 3)\}$ on the set $A = \{1, 2, 3\}$ is -

A. symmetric

B. reflexive

C. transitive

D. an equivalence relation

Answer: D

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5. If $e^{f(x)} = \frac{10+x}{10-x}, x \in (-10, 10)$ and $f(x) = kf\left(\frac{200x}{100+x^2}\right)$, then the value the value of k is -

A. $\frac{1}{2}$

B. $\frac{4}{5}$

C. $\frac{7}{10}$

D. $\frac{2}{3}$

Answer: A

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6. The position vectors of the three vertices of a triangle are $\left(-\hat{i}-3\hat{j}+2\hat{k}\right), \left(5\hat{i}+7\hat{j}-5\hat{k}\right)$ and $\left(2\hat{i}+5\hat{j}+6\hat{k}\right)$, then the position vector of the point of intersection of the medians of the triangle is -

A. $\hat{i}+3\hat{j}-\hat{k}$

B. $2\hat{i}+3\hat{j}+\hat{k}$

C. $2\hat{i}+2\hat{j}+\hat{k}$

D. $3\hat{i}+2\hat{j}-\hat{k}$

Answer: B

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7. The inverse of the function $f(x)=\dfrac{10^x-10^{-x}}{10^x+10^{-x}}$ is -

A. $f^{-1}(x)=\dfrac{1}{2}\log_{10}\dfrac{1+x}{1-x}$

B. $f^{-1}(x) = \log_{10}(2 - x)$

C. $f^{-1}(x) = \frac{1}{2}\log_{10}(2x - 1)$

D. $f'(x) = \frac{1}{4}\log_{10}\frac{2x}{2 - x}$

Answer: A

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8. Let R be the set of real numbers and $f: R \rightarrow R$ be defined by $f(x) = x^2 + 2$, then the set $f^{-1}(11 \leq x \leq 27)$ is -

A. $\{x: -3 \leq x \leq 3\}$

B. $\{x: -5 \leq x \leq -3 \text{ or }, 3 \leq x \leq 5\}$

C. $\{x: 0 \leq x \leq 6\}$

D. $\{x: -5 \leq x \leq 5\}$

Answer: D

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9. Domain of definition of the function $f(x) = \frac{3}{4 - x^2} + \log_{10}\left(x^3 - x\right)$ is -

A. $(1, 2) \cup (2, \infty)$

B. $(-1, 0) \cup (1, 2) \cup (2, \infty)$

C. (1, 2)

D. $(-1, 0) \cup (1, 2)$

Answer: B

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10. If $f(x) = \begin{vmatrix} 1 & x & x+1 \\ 2x & x(x-1) & x(x+1) \\ 3x(x-1) & x(x-1)(x-2) & x(x-1)(x+1) \end{vmatrix}$ then the value of f(11) is -

A. 0

B. 1

C. 11

D. -11

Answer: A

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11. the value of the determinant

$$\begin{vmatrix} 0 & b^3 - a^3 & c^3 - a^3 \\ a^3 - b^3 & 0 & c^3 - b^3 \\ a^3 - c^3 & b^3 - c^3 & 0 \end{vmatrix}$$ is equal to -

A. $a^3 + b^3 + c^3$

B. $a^3 - b^3 - c^3$

C. 0

D. $2(a^3 + b^3 + c^3)$

Answer: C

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12. If $a^2 + b^2 + c^2 = -2$ and

$$f(x) = \begin{vmatrix} 1 + a^2x & (1 + b^2)x & (1 + c^2)x \\ (1 + a^2)x & 1 + b^2x & (1 + c^2)x \\ (1 + a^2)x & (1 + b^2)x & 1 + c^2x \end{vmatrix}$$ then f(x) is a polynomial

of degree-

A. 3

B. 2

C. 1

D. 0

Answer: B

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13. If a, b, c are all different and $\begin{vmatrix} a & a^3 & a^4 - 1 \\ b & b^3 & b^4 - 1 \\ c & c^3 & c^4 - 1 \end{vmatrix} = 0$ then the value of $abc(ab + bc + ca)$ is -

A. $a + b + c$

B. 0

C. $a^2 + b^2 + c^2$

D. $a^3 + b^3 + c^3$

Answer: A

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14. If $p \neq 0,$ then the solutions of the equation

$$\begin{vmatrix} 1 & 1 & x \\ p+1 & p+1 & p+x \\ 3 & x+1 & x+2 \end{vmatrix} = 0$$ are -

A. 2, 3

B. 1, p, 2

C. 1, 2, -p

D. 1, 2

Answer: D

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15. If A and B are two square matrices and if A^{-1} and B^{-1} exist, then $(AB)^{-1}$ is equal to -

A. $A^{-1}B^{-1}$

B. AB^{-1}

C. $A^{-1}B$

D. $B^{-1}A^{-1}$

Answer: D

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16. If $A = \begin{bmatrix} 3 & -5 \\ -4 & 2 \end{bmatrix}$, then the value of $A^2 - 5A$ is equal to -

A. I

B. 14I

C. 0

D. none of these

Answer: B

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17. If $A = \begin{vmatrix} 5 & 6 & -3 \\ -4 & 3 & 2 \\ -4 & -7 & 3 \end{vmatrix}$ then the cofactors of the elements of second row are -

A. -3, 3, 11

B. 3, -3, 11

C. $-39, 3, -11$

D. 39, -3, -11

Answer: A

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18. If $A = \begin{bmatrix} a & b \\ b & a \end{bmatrix}$ and $A^2 = \begin{bmatrix} \alpha & \beta \\ \beta & \alpha \end{bmatrix}$, then -

A. $\alpha = 2ab, \beta = a^2 + b^2$

B. $\alpha = a^2 + b^2, \beta = ab$

C. $\alpha = a^2 + b^2, \beta = 2ab$

D. $\alpha = a^2 + b^2, \beta = a^2 - b^2$

Answer: C

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19. If $A = \begin{bmatrix} 1 & 2 \\ 2 & 3 \\ 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$, then -

A. both AB and BA exist

B. neither AB nor BA exist

C. AB exists but BA does not exist

D. AB does not exist but BA exists

Answer: C

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20. If $A = \begin{bmatrix} 2 & -1 \\ 0 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 \\ -1 & -1 \end{bmatrix}$ then $(A+B)^2$ is not equal to -

A. $A^2 + AB + BA + B^2$

B. $A^2 + AB + BA + B^2 I$

C. $A^2 I + AB + BA + B^2$

D. $A^2 + 2AB + B^2$

Answer: D

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21. If A be any $n \times n$ matrix and k any scalar, then detkA is equal to

-

A. k detA

B. n^k detA

C. k^n detA

D. kn detA

Answer: C

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22. The probability that in a year of 22nd century chosen at rendom, there will be 53 Sundays S is -

A. $\frac{3}{28}$

B. $\frac{9}{28}$

C. $\frac{7}{28}$

D. $\frac{5}{28}$

Answer: D

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23. The probability that in a family of 5 members, exactly 2 members have birthday on Sunday is -

A. $\frac{12 \times 5^3}{7^5}$

B. $\frac{10 \times 6^2}{7^5}$

C. $\frac{2}{3}$

D. $\frac{10 \times 6^3}{7^5}$

Answer: D

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24. A bag contains 5 white and 3 black balls and 4 balls are successively drawn out and not replaced. The probability that they are alternately of different colours is -

A. $\frac{1}{7}$

B. $\frac{3}{7}$

C. $\frac{13}{56}$

D. $\frac{1}{196}$

Answer: A

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25. The probability that A speaks truth is $\frac{4}{5}$, while this probability for B is $\frac{3}{4}$, then the probability that they will contradict each when asked to speak on a fact, is -

A. $\frac{1}{5}$

B. $\frac{7}{20}$

C. $\frac{3}{20}$

D. $\frac{2}{5}$

Answer: B

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26. Three distinct numbers are selected from first 100 natural numbers. The probability that all the three numbers are divisible by 2 and 3 is -

A. $\frac{4}{25}$

B. $\frac{4}{35}$

C. $\frac{4}{55}$

D. $\frac{4}{1155}$

Answer: D

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27. In a bolt factory three machines A, B and C manufacture respectively 2000, 2500 and 4000 bolts everyday. Of their outputs $3\%, 4\%$ and 2.5% are defective bolts. One bolts. One bolt is drawn at random from a day's production and is found to be defective. Then the probability that it was produced by machine C is -

A. $\frac{3}{13}$

B. $\frac{4}{13}$

C. $\frac{5}{13}$

D. $\frac{7}{13}$

Answer: C

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28. If $x > 0$, then the value of $\sin\left[\cot^{-1}\cos\left(\tan^{-1}x\right)\right]$ is equal to -

A. $\sqrt{\frac{x^2 - 1}{x^2 + 2}}$

B. $\sqrt{\frac{x^2 + 1}{x^2 + 2}}$

C. $\sqrt{\frac{x - 2}{x^2 + 2}}$

D. $\sqrt{\frac{x^2 - 1}{x^2 - 2}}$

Answer: B

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29. If $\theta = \sin^{-1}\left[\sin\left(-600^{\circ}\right)\right]$, then one of the possible values of θ is -

A. $-\frac{\pi}{3}$

B. $\frac{\pi}{3}$

C. $\frac{2\pi}{3}$

D. $\frac{\pi}{2}$

Answer: B

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30. If vectors $\vec{\alpha}, \vec{\beta}, \vec{\gamma}$ are such that $\vec{\alpha} + \vec{\beta} + \vec{\gamma} = \vec{0}$ and $\left|\vec{a}\right| = 2, \left|\vec{\beta}\right| = 3$ and $\left|\vec{\gamma}\right| = 4,$ then the value of $2\left(\vec{\alpha} \cdot \vec{\beta} + \vec{\beta} \cdot \vec{\gamma} + \vec{\gamma} \cdot \vec{\alpha}\right)$ is -

A. -29

B. $\dfrac{29}{2}$

C. 25

D. - $\dfrac{29}{2}$

Answer: A

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31. If $\hat{i} + \hat{j} + \hat{k}, 2\hat{i} + 5\hat{j}, 3\hat{i} + 2\hat{j} - 3\hat{k}$ and $\hat{i} - 6\hat{j} - \hat{k}$ are the position vectors of the points A, B, C, D respectively, then the angle between $\overrightarrow{AB}$ and $\overrightarrow{CD}$ is -

A. $\frac{\pi}{6}$

B. $\frac{2\pi}{3}$

C. $\frac{\pi}{3}$

D. π

Answer: D

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32. In the equation $x^2 - px + q = 0$ ratio of the roots are $2:3$,then prove that $6p^2 = 25q$

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33. If the probability that a randomly selected bulb produced by a factory will fuse after 200 days of use is 0.15, then in a random selection of 8 bulbs, the probability of getting not more than one bulb that will fuse after 200 days of use is -

A. $2.05 \times (0.85)^7$

B. $1 - 2.05 \times (0.85)^7$

C. $(0.85)^8$

D. none of these

Answer: A

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34. If $\vec{a} = \hat{i} + 3\hat{j} + \hat{k}, \vec{b} = 2\hat{i} - \hat{j} - \hat{k}$ and $\vec{c} = m\hat{i} + 7\hat{j} + 3\hat{k}$ are coplanar, then the value of m is -

A. m = -2

B. m = 0

C. m = 1

D. m = 3

Answer: B

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35. The direction cosines of the line which is perpendicular to the lines with direction ratios 1, -2, -2 and 0, 2, 1 are -

A. $2, -1, 2$

B. $\frac{2}{3}, \frac{1}{3}, \frac{2}{3}$

C. $\frac{2}{3}, -\frac{1}{3}, \frac{2}{3}$

D. $-2, 1, -2$

Answer: C

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36. The cosine of the angle between the lines $\vec{r} = 3\hat{i} + 2\hat{j} - 4\hat{k} + \lambda\left(\hat{i} + 2\hat{j} + 2\hat{k}\right)$ and $\vec{r} = 5\hat{i} - 2\hat{j} + \mu\left(3\hat{i} + 2\hat{j} + 6\hat{k}\right)$ is -

A. $\frac{17}{21}$

B. $-\frac{17}{21}$

C. $-\frac{19}{21}$

D. $\frac{19}{21}$

Answer: D

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37. The coordinates of the point of intersection of the lines $\vec{r} = \left(\hat{i} + \hat{j} - \hat{k}\right) + \lambda\left(3\hat{i} - \hat{j}\right)$ and $\vec{r} = \left(4\hat{i} - \hat{k}\right) + \mu\left(2\hat{i} + 3\hat{k}\right)$

A. (4, 0, -1)

B. (-4, 0, 1)

C. (0, 4, -1)

D. (4, 0, 1)

Answer: A

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38. The value of a for which the lines $\frac{x-5}{5a+2} = \frac{2-y}{5} = \frac{1-z}{-1}$ and $\frac{x}{1} = \frac{2y+1}{4a} = \frac{1-z}{-3}$ are perpendicular to each other is -

A. $a = -\frac{1}{2}$

B. $a = 1$

C. $a = -1$

D. $a = 2$

Answer: B

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39. The equation of the plane passing through the point (1, -3, -2) and perpendicular to the planes $x + 2y + 2z = 5$ and $3x + 3y + 2z = 8$ is -

A. $2x - 4y + 3z + 8 = 0$

B. $3x + 4y - 3z = 12$

C. $4x - 3y + 2z + 12 = 0$

D. $2x - 4y + 3z = 8$

Answer: D

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40. If a, b be two fixed positive integers such that $f(a+x) = b + \left[b^3 + 1 - 3b^2 f(x) + 3b\{f(x)\}^3 - \{f(x)\}^3\right]^{\frac{1}{3}}$ for all real x, then f(x) is a periodic function with period -

A. b

B. 2b

C. 2a

D. a

Answer: C

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41. The derivative of the function $\dfrac{\sec x + \tan x}{\sec x - \tan x}$ is -

A. $2\sec x(\sec x + \tan x)$

B. $2\sec^2 x(\sec x + \tan x)^2$

C. $2\sec x(\sec x + \tan x)^2$

D. $\sec x(\sec x + \tan x)$

Answer: C

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42. If $y = \sin x°$ and $z = \log_{10} x$, then the value of $\frac{dy}{dz}$ is -

A. $\frac{x° \cos x°}{\log_{10} e}$

B. $\frac{x \cos x°}{\log_e 10}$

C. $\frac{x \cos x°}{\log_{10} e}$

D. $\frac{x° \cos x°}{\log_e 10}$

Answer: A

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43. The value of $\frac{d}{dx}\left[\tan^{-1}\left\{\frac{\sqrt{x}(3-x)}{1-3x}\right\}\right]$ is -

A. $\frac{3}{2(1-x)\sqrt{x}}$

B. $\frac{3}{2(1+x)\sqrt{x}}$

C. $\frac{2}{(1+x)\sqrt{x}}$

D. $\frac{3}{(1+x)\sqrt{x}}$

Answer: B

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44. If $x = \sin t$ and $y = \cos pt$, then which of the following is true ?

A. $(1 - x^2)y_2 + xy_1 + p^2y = 0$

B. $(1 - x^2)y_2 + xy_1 - p^2y = 0$

C. $(1 + x^2)y_2 - xy_1 + p^2y = 0$

D. $(1 - x^2)y_2 - xy_1 + p^2y = 0$

Answer: D

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45. In the mean value theorem $f(b) - f(a) = (b - a)f'(c)(a < c < b)$, if $a = 4, b = 9$ and $f(x) = \sqrt{x}$, then the value of c is -

A. 8

B. 5.25

C. 4

D. 6.25

Answer: D

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46. If the function $f(x) = 4x^3 + ax^2 + bx - 1$ satisfies all the conditions of Rolle's theorem in $-\frac{1}{4} \leq x \leq 1$ and if $f'\left(\frac{1}{2}\right) = 0$, then the values of a and b are -

A. $a = 2, b = 3$

B. $a = 1, b = -4$

C. $a = -1, b = 4$

D. $a = -4, b = -1$

Answer: B

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47. The value of $\lim_{x \to 0} \frac{e^x - \log(e + ex)}{x}$ is -

A. 0

B. 1

C. 2

D. -2

Answer: A

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48. Let $f(x) = \begin{cases} \frac{1 - \sin x}{\pi - 2x}, & \text{when} x \neq \frac{\pi}{2} \\ \lambda, & \text{when} x - \frac{\pi}{2} \end{cases}$ If $\lim_{x \to \frac{\pi}{2}} f(x) = f\left(\frac{\pi}{2}\right)$, then the value of λ is-

A. -2

B. 2

C. 0

D. 1

Answer: C

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49. If $\left(\sqrt{x}\right)^{\left(\sqrt{x}\right)^{\left(\sqrt{x}\right)^{\cdots\infty}}}$ and $x\frac{dy}{dx} = \frac{f(y)}{2 - y\log x}$, then the value of f(y) is -

A. ylogy

B. logy

C. 2y

D. y^2

Answer: D

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50. If $x = e^t\sin t$ and $y = e^t\cos t$, then the value of $(x + y)^2\frac{d^2y}{dx^2} - 2x\frac{dy}{dx}$ is -

A. 2y

B. $2y$

C. 4y

D. -$4y$

Answer: B

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51. If $y = f\left(x^2\right)$ and $f'(x) = \sqrt{3x^2 + 1}$ then the value of $\frac{dy}{dx}$ at $x = 2$ is -

A. $4\sqrt{13}$

B. $2\sqrt{13}$

C. 28

D. 14

Answer: C

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52. If $x = \sec\theta - \cos\theta, y = \sec^n\theta - \cos^n\theta$ and $\left(x^2 + 4\right)\left(\frac{dy}{dx}\right)^2 = k\left(y^2 + 4\right)$ then the value of k is -

A. n^2

B. $2n$

C. $-n^2$

D. $-2n$

Answer: A

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53. If f(x) is a differentiable function for all $x > 0$ and

$\lim_{y \to x} \frac{y^2 f(x) - x^2 f(y)}{y - x} = 2$, then the value of f'(x) is -

A. $\frac{1}{x^2}[xf(x) - 1]$

B. $\frac{2}{x^2}[f(x) - 2]$

C. $\frac{1}{x^2}[xf(x) - 2]$

D. $\frac{2}{x^2}[xf(x) - 1]$

Answer: D

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54. If $y^2 = 4ax$, then the value of $\frac{d^2y}{dx^2} \cdot \frac{d^2x}{dy^2}$ is -

A. $\frac{2a}{y^3}$

B. $-\frac{2a}{y^3}$

C. - $\dfrac{a}{y^3}$

D. $\dfrac{a}{y^3}$

Answer: B

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55. The value of $\lim_{n \to \infty} \dfrac{1^p + 2^p + 3^p + \ldots + n^p}{n^{p+1}}$ is -

A. $\dfrac{1}{p+1}$

B. $\dfrac{1}{1-p}$

C. $\dfrac{1}{p+2}$

D. $\dfrac{1}{p}$

Answer: A

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56. The value of $\int_0^{1.5}\left[x^2\right]dx$ is -

A. $3\sqrt{2}$ - 2

B. $2+\sqrt{2}$

C. $2-\sqrt{2}$

D. $4-2\sqrt{2}$

Answer: C

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57. If $I_n=\int_0^{\frac{\pi}{4}}\tan^n x dx$, then the value of $\lim_{n\to\infty} n\left(I_n+I_{n-2}\right)$ is -

A. 0

B. $\frac{1}{2}$

C. 1

D. 2

Answer: C

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58. The value of $\int_0^{\frac{\pi}{2}} \frac{\sin x dx}{\sin x + \cos x}$ is equal to -

A. π

B. $\frac{\pi}{2}$

C. $\frac{\pi}{3}$

D. $\frac{\pi}{4}$

Answer: D

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59. The value of the integral $\int_{-\frac{\pi}{7}}^{\frac{\pi}{7}} x^3 \sin^2 x dx$ is -

A. $\frac{\pi}{4}$

B. 0

C. 1

D. 2

Answer: B

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60. $\int \operatorname{cosec}^4 x dx$ is equal to -

A. $-\cot x - \frac{1}{3}\cot^3 x + c$

B. $\cot x + \frac{1}{3}\cot^3 x + c$

C. $\tan x + \frac{1}{3}\tan^3 x + c$

D. $-\cot x + \frac{1}{3}\cot^3 x + c$

Answer: A

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61. The value of $\int \frac{dx}{2\sqrt{x}(x+1)}$ is -

A. $\frac{1}{2}\tan^{-1}\left(\sqrt{x}\right) + c$

B. $2\tan^{-1}\left(\sqrt{x}\right) + c$

C. $\tan^{-1}\left(\sqrt{x}\right) + c$

D. $\tan^{-1}\left(2\sqrt{x}\right) + c$

Answer: C

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62. The value of the integral $\int_0^1 \frac{dx}{x^2 + 2x\cos\alpha + 1}$ is equal to -

A. $\sin\alpha$

B. $\alpha\sin\alpha$

C. $\frac{\alpha}{2\sin\alpha}$

D. $\frac{1}{2}\alpha\sin\alpha$

Answer: C

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63. Let $\frac{d}{dx}F(x) = \frac{e^{\sin x}}{x}, x > 0,$

If $\int_1^4 \frac{3}{x} e^{\sin x^3} dx = F(k) - F(1)$, then one of the possible value of k is -

A. 64

B. 15

C. 16

D. 63

Answer: A

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64. The value of $\int_0^{1000} e^{x - [x]} dx$ is equal to -

A. $e^{1000} - 1$

B. $\dfrac{e^{1000} - 1}{e - 1}$

C. $\dfrac{1000}{e - 1}$

D. $1000(e - 1)$

Answer: D

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65. $\int_0^{2a} f(x)dx$ is equal to -

A. $2\int_0^a f(x)dx$

B. $\int_0^a f(x)dx + \int_0^a f(2a - x)dx$

C. 0

D. $\int_0^a f(x)dx + \int_0^{2a} f(2a - x)dx$

Answer: B

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66. $\int \sin^3 x \cos x dx$ is equal to -

A. $\frac{1}{4}\cos^4 x + c$

B. $-\frac{1}{4}\sin^4 x + c$

C. $-\frac{1}{4}\cos^4 x + c$

D. $\frac{1}{4}\sin^4 x + c$

Answer: D

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67. The value of $\int_0^1 \sin\left[2\tan^{-1}\sqrt{\frac{1+x}{1-x}}\right]dx$ is equal to -

A. $\frac{\pi}{4}$

B. $\frac{\pi}{6}$

C. $\frac{\pi}{2}$

D. π

Answer: A

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68. The value of $\int \sqrt{1 + \sin\frac{x}{4}} dx$ is equal to -

A. $8\left(\sin\frac{x}{8} + \cos\frac{x}{8}\right) + c$

B. $8\left(\cos\frac{x}{8} - \sin\frac{x}{8}\right) + c$

C. $8\left(\sin\frac{x}{8} - \cos\frac{x}{8}\right) + c$

D. $4\left(\sin\frac{x}{8} - \cos\frac{x}{8}\right) + c$

Answer: C

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69. The value of $\int_{\frac{1}{e}}^{e} |\log x| dx$ is equal to -

A. $2\left(1 - \frac{1}{e}\right)$

B. $2\left(1 + \frac{1}{e}\right)$

C. 2

D. $\frac{2}{e}$

Answer: A

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70. If f(t) is an odd function, then $\int_0^x f(t)dt$ is -

A. an odd function

B. an even function

C. neither even nor odd

D. 1

Answer: B

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71. The value of $\int_{\frac{\pi}{4}}^{\frac{3\pi}{4}} \frac{dx}{1 + \cos x}$ is -

A. π

B. $\frac{\pi}{2}$

C. 1

D. 2

Answer: D

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72. The solution of the differential equation $\left(x + 2y^3\right)\frac{dy}{dx} = y$ is -

A. $x = y^2 + c$

B. $y = x^2 + c$

C. $x = y\left(y^2 + c\right)$

D. $y = x\left(x^2 + c\right)$

Answer: C

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73. The integrating factor of linear differential equation $\frac{dy}{dx} + y\tan x = \sec x$ is -

A. $\cos x$

B. $\sec x$

C. $e^{\cos x}$

D. $e^{\sec x}$

Answer: B

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74. The order and degree of the differential equation representing the family of curves $y^2 = 2k\left(x + \sqrt{k}\right)$ are respectively -

A. 1, 3

B. 2, 4

C. 1, 4

D. 1, 2

Answer: A

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

A. $y = \tan^{-1}x + c$

B. $x = \tan^{-1}y + c$

C. $\tan(xy) = c$

D. $y - x = c(1 + xy)$

Answer: D

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76. The degree of the differential equation $\frac{dy}{dx} - x = \left(y - x\frac{dy}{dx}\right)^{-4}$ is -

A. 1

B. 3

C. 5

D. 4

Answer: C

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77. The solution of the equation $\frac{dy}{dx} = \sqrt{1 - x^2 - y^2 + x^2y^2}$ is -

A. $\sin^{-1}y = \frac{1}{2}\sqrt{1 - x^2} + \frac{1}{2}\sin^{-1}x + c$

B. $\sin^{-1}y = \frac{1}{2}\sqrt{1 - x^2} + \frac{1}{2}\sin^{-1}x + c$

C. $\sin^{-1}y = \frac{1}{2}x\sqrt{1 - x^2} + \frac{1}{4}\cos^{-1}x + c$

D. $\sin^{-1}y = \frac{1}{2}x\sqrt{1 - x^2} + \frac{1}{2}\sin^{-1}x + c$

Answer: D

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78. The solution of the equation $\frac{dy}{dx} = \frac{x\log x^2 + x}{\sin y + y\cos y}$ is -

A. $y\sin y = x^2\log x + c$

B. $y\sin y = x^2 + c$

C. $y\sin y = x^2 + \log x + c$

D. $y\sin y = x\log x + c$

Answer: A

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79. The solution of the differential equation $ydx + \left(x + x^2y\right)dy = 0$ is -

A. $\frac{1}{xy} + \log|y| = c$

B. $-\frac{1}{xy}+\log|y|=c$

C. $\frac{1}{xy}+2\log|y|=c$

D. $\log|y|=cx$

Answer: B

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80. The solution of the differential equation $e^{\frac{dy}{dx}}=x+1$, when $y(0)=3$, is -

A. $y=x\log x-x+2$

B. $y=(x+1)\log|x+1|-x+3$

C. $y=(x+1)\log|x+1|+x+3$

D. $y=x\log x+x+3$

Answer: B

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81. The point on the curve $y^2 = x$, the tangent at which makes an angle 45° with the x- axis is-

A. $(0, 0)$

B. $\left(\frac{1}{4}, \frac{1}{2}\right)$

C. $\left(\frac{1}{2}, \frac{1}{4}\right)$

D. $(2, 4)$

Answer: B

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82. If p_1 and p_2 be the lengths of the perpendiculars from the origin upon the tangent and normal respectively to the curve $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$ at the point (x_1, y_1), then-

A. $p_1^2 + 4p_2^2 = a^2$

B. $p_1^2 + 4p_2^2 = 2a^2$

C. $4p_1^2 + p_2^2 = 2a^2$

D. $4p_1^2 + p_2^2 = a^2$

Answer: D

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83. Find the area of the region included between the parabola $y^2 = x$ and the line $x + y = 2$.

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84. If the straight line joining the point (0, 3) and (5, -2) is a tangent to the curve $y(x+1) = c$, then the value of c will be-

A. 3

B. -3

C. 4

D. -4

Answer: C

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85. The equation of the normal to the hyperbola $x = a\sec\theta, y = b\tan\theta$ at the point $(a\sec\theta, b\tan\theta)$ is-

A. $ax\cos\theta + by\cot\theta = a^2 + b^2$

B. $ax\cos\theta + by\tan\theta = a^2 + b^2$

C. $ax\sin\theta - by\cot\theta = a^2 - b^2$

D. $ax\cos\theta - by\tan\theta = a^2 - b^2$

Answer: A

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86. If the straight line $lx + my = 1$ is a normal to the parabola $y^2 = 4ax$, then-

A. $al^2 + 2lm = m^2$

B. $al^3 - 2alm = m^2$

C. $al^3 + 2alm^2 = m^2$

D. $al^2 + 2aml = m^2$

Answer: C

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87. The area (in square unit) of the region $\left\{(x, y): x^2 + y^2 \leq 1 \leq x + y\right\}$ is-

A. $\frac{\pi}{4}$

B. $\frac{\pi}{2}$

C. $\frac{\pi^2}{4}$

D. $\frac{\pi}{4} - \frac{1}{2}$

Answer: D

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88. The area (in square unit) bounded by the curve $y = \sec x$, the x-axis and the lines $x = 0$ and $x = \frac{\pi}{4}$ is-

A. $\log\left(\sqrt{2} - 1\right)$

B. $\log\left(\sqrt{2} + 1\right)$

C. $\frac{1}{2}\log 2$

D. $\sqrt{2}$

Answer: B

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89. The angle between the parabolas $y^2 = x$ and $x^2 = y$ at the origin is-

A. $2\tan^{-1}\frac{3}{4}$

B. $\tan^{-1}\frac{4}{3}$

C. $\frac{\pi}{2}$

D. $\frac{\pi}{4}$

Answer: C

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90. The area (in square unit) of the smaller segment cut off from the circle $x^2 + y^2 = 9$ by the line $x = 1$ is-

A. $\frac{1}{2}\left(9\sec^{-1}3 - \sqrt{8}\right)$

B. $9\sec^{-1}3 - \sqrt{8}$

C. $\sqrt{8} - 9\sec^{-1}3$

D. $9\sec^{-1}3 + \sqrt{8}$

Answer: B

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91. The optimal value of the objective function in a LPP is attained at points-

A. given by intersection of inequations with coordinate axes,

B. given by intersection of constraints with y-axis,

C. given by intersection of constraints with x-axis,

D. given by corner points of solution region.

Answer: D

View Text Solution

92. If the tangent at any point P to the parabola $y^2 = 4ax$ meets the directrix at the point K, then the angle which KP subtends at its focus is-

A. 90°

B. 60°

C. 45°

D. 30°

Answer: A

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93. The point (or points) on the curve $y^3 + 3x^2 = 12y$ where tangent is vertical is/ are-

A. $\left(\pm\frac{4}{\sqrt{3}}, 2\right)$

B. $(0, 0)$

C. $\left(\pm\sqrt{\frac{11}{3}}, 1\right)$

D. $\left(\pm\frac{4}{\sqrt{3}}, -2\right)$

Answer: A

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94. Tangents are drawn to the ellipse $5x^2 + 9y^2 = 45$ at the four ends of two latera recta. The area (in square unit) of the quadrilateral so formed is-

A. $\frac{81}{4}$

B. $\frac{27}{4}$

C. 27

D. $\frac{27}{2}$

Answer: C

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95. The normal to the parabola $y^2 = 8x$ at the point (2, 4) meets the parabola again at the point-

A. $(-18, -12)$

B. $(-18, 12)$

C. $(18, 12)$

D. $(18, -12)$

Answer: D

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96. A tangent is drawn at the point $\left(3\sqrt{3}\cos\theta, \sin\theta\right)\left(0 < \theta < \frac{\pi}{2}\right)$ to the ellipse $x^2 + 27y^2 = 27$, then the least value of the sum of the intercepts on the coordinate axes by this tangent is attained when the value of θ is-

A. $\frac{\pi}{3}$

B. $\frac{\pi}{6}$

C. $\frac{\pi}{4}$

D. $\frac{\pi}{8}$

Answer: B

97. A cone of height h is inscribed in a sphere of radius R , if the volume of the inscribed cone is maximum, then the value of h : R will be-

A. $\frac{\sqrt{3}}{1}$

B. $\frac{4}{3}$

C. $\frac{2}{3}$

D. $\frac{3}{2}$

Answer: B

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98. If $f(x) = \int_{x^2}^{x^2+1} e^{-t^2} dt$, then the interval in which f(x) is increasing, is-

A. $(-\infty, 0)$

B. $(0, \infty)$

C. $[-2, 2]$

D. $[3, 5]$

Answer: A

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99. The minimum value of $f(x) = 2x^2 + x - 1$ is-

A. $-\frac{1}{4}$

B. $\frac{3}{4}$

C. $\frac{9}{4}$

D. $-\frac{9}{8}$

Answer: D

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100. The point on the curve $xy^2 = 1$ that is nearest to the origin is-

A. $(1, 1)$

B. $\left(4, \frac{1}{2}\right)$

C. $\left(2^{-\frac{1}{3}}, 2^{\frac{1}{6}}\right)$

D. $\left(\frac{1}{4}, 2\right)$

Answer: C

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101. The number of values of x for which $f(x) = \cos x + \cos\sqrt{2}x$ attains its maximum value is-

A. 1

B. 0

C. 2

D. infinite

Answer: A

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102. The function $f(x) = 2x^3 - 15x^2 + 36x + 1$ is increasing in the interval-

A. $x \leq 1$ or $x \geq 3$

B. $x < 2$ or $x > 3$

C. $x \geq 2$ or $x \leq 3$

D. none of these

Answer: b

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103. The coordinates of the point for minimum value of $Z = 7x - 8y$, subject to the conditions $x + y \leq 20, y \geq 5$ and $x \geq 0$ are-

A. $(20, 0)$

B. $(0, 20)$

C. $(15, 5)$

D. $(0, 5)$

Answer: B

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104. If M and m are the maximum and minimum values respectively of the function $f(x) = x + \frac{1}{x}$, then the value of M - m is-

A. 0

B. 2

C. 4

D. -4

Answer: D

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105. The interval in which the function $f(x) = 2x^2 - \log|x|(x \neq 0)$ is increasing, is-

A. $0 < x < \frac{1}{2}$

B. $x < -\frac{1}{2}$

C. $-\frac{1}{2} < x < 0$ or, $x > \frac{1}{2}$

D. none of these

Answer: C

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106. The sides of an equilateral triangle are increasing at the rate of $2cm/s.$, then the rate at which the area (in cm^2/s) increases when the side is 10 cm , is-

A. $\sqrt{3}$

B. $10\sqrt{3}$

C. 10

D. $10\sqrt{2}$

Answer: B

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107. Air is being pumped into a spherical balloon at the rate of 30 cm^3/s. Then the rate (in cm/s) at which the radius increases when it reaches the value 15 cm , is-

A. $\frac{1}{30\pi}$

B. $\frac{1}{15\pi}$

C. $\frac{1}{20}$

D. $\frac{1}{25}$

Answer: A

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108. If the curves xy = a and $x = y^2$ intersect at right angles, then-

A. $16a^2 = 1$

B. $8a^2 + 1 = 0$

C. $8a^2 = 1$

D. $16a^2 + 1 = 0$

Answer: C

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109. A curve having the condition that the slope of tangent at some point is two times the slope of the straight line joining the same point to the origin of coordinates is a/an-

A. circle

B. parabola

C. ellipse

D. hyperbola

Answer: B

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110. An edge of a variable cube is increasing at the rate of 2 cm/s. When the edge of a cube is 8 cm long, then its volume will increase at the rate of-

A. $128 cm^3/s$

B. $192 cm^3/s$

C. $384 cm^3/s$

D. none of these

Answer: C

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Question Paper 5

1. Two mappings $f: R \rightarrow R$ and $g: R \rightarrow R$ are defined as follows:

$f(x) = \begin{cases} 0 & \text{when x is rational} \\ 1 & \text{when x is irrational} \end{cases}$ and

$g(x) = \begin{cases} -1 & \text{wnen x is rational} \\ 0 & \text{when x is irrational} \end{cases}$ then the value of

$[(gof)(e) + (fog)(\pi)]$ is -

A. 0

B. -1

C. 1

D. 2

Answer: B

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2. Let S be the set of real numbers. Then the relation $R = \{(a, b) : 1 + ab > 0\}$ on S is -

A. symmetric and transitive but not reflexive

B. reflexive and transitive but not symmetric

C. reflexive and symmetric but not transitive

D. reflexive, transitive and symmetric

Answer: C

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3. If R denotes the set of all real numbers then the mapping $f: R \rightarrow R$ defined by $f(x) = |x|$ is -

A. one-one only

B. onto only

C. both one-one and onto

D. neither one-one not onto

Answer: D

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4. If $\hat{a}$ and $\hat{b}$ are two unit vectors inclined at an angle θ, then the value of $\left|\hat{a} - \hat{b}\right|$ is -

A. $2\sin\frac{\theta}{2}$

B. $2\cos\frac{\theta}{2}$

C. $2\sin\theta$

D. $2\cos\theta$

Answer: A

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5. The value of p for which the vectors $60\hat{i} + 3\hat{j}, 40\hat{i} - 8\hat{j}$ and $p\hat{i} - 52\hat{j}$ are collinear is -

A. -32

B. 32

C. -40

D. 40

Answer: C

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6. The range of the function $f(x) = \sin\left(\sin^{-1}x + \cos^{-1}x\right)(|x| \le 1)$ is-

A. $\{0\}$

B. $\{1\}$

C. $\{-1\}$

D. $\{x: -1 \le x \le 1\}$

Answer: B

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7. The vector equation of the line passing through the points (2, -3, 1) and (-4, 3, 6) is -

A. $\vec{r} = -4\hat{i} + 3\hat{j} + 6\hat{k} + \lambda\left(2\hat{i} - 3\hat{j} + \hat{k}\right)$

B. $\vec{r} = 2\hat{i} - 3\hat{j} + \hat{k} + \lambda\left(-4\hat{i} + 3\hat{j} + 6\hat{k}\right)$

C. $\vec{r} = -6\hat{i} + 6\hat{j} + 5\hat{k} + \lambda\left(2\hat{i} - 6\hat{j} - 5\hat{k}\right)$

D. $\vec{r} = 2\hat{i} - 3\hat{j} + \hat{k} + \lambda\left(-6\hat{i} + 6\hat{j} + 5\hat{k}\right)$

Answer: D

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8. If $f(x) = \frac{3x + 2}{5x - 3}\left(x \neq \frac{3}{5}\right)$, then which one of the following is correct ?

A. $f^{-1}(x) = f(x)$

B. $f^{-1}(x) = -f(x)$

C. $(fof)(x) = -x$

D. $f^{-1}(x) = \frac{1}{19}f(x)$

Answer: A

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9. Let $f(x) = \sin x + \cos x$ and $g(x) = x^2 - 1$, then $g\{f(x)\}$ is invertible if -

A. $-\frac{\pi}{2} \leq x \leq 0$

B. $-\frac{\pi}{2} \leq x \leq \pi$

C. $0 \leq x \leq \frac{\pi}{2}$

D. $-\frac{\pi}{4} \leq x \leq \frac{\pi}{4}$

Answer: D

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10. ABCD is a quadrilateral,AB and CD are parallel, P and Q are the midpoints of the sides BC and AD respectively. They, the value of $\overline{AB} + \overline{DC}$ is -

A. $\overline{QP}$

B. $5\overline{QP}$

C. $2\overline{QP}$

D. $4\overline{QP}$

Answer: C

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11. If $\sin^{-1}\frac{5}{x} + \sin^{-1}\frac{12}{x} = \frac{\pi}{2}$, then the value of x is -

A. ± 13

B. 13

C. $\frac{13}{7}$

D. $\pm\frac{13}{7}$

Answer: B

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12. The chance of throwing a total of 7 or 12 with two dice is -

A. $\frac{2}{9}$

B. $\frac{5}{9}$

C. $\frac{5}{36}$

D. $\frac{7}{36}$

Answer: D

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13. Five horses are in a race. Mr. A selects two of the horses at random and bets on them. The probability that Mr. A selected the winning horse is -

A. $\frac{4}{5}$

B. $\frac{2}{5}$

C. $\frac{3}{5}$

D. $\frac{1}{5}$

Answer: B

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14. For three events A, B and C, if $P(B) = \frac{3}{4}$, $P\left(A^c \cap B \cap C^c\right) = \frac{1}{3}$ and $P\left(A \cap B \cap C^c\right) = \frac{1}{3}$, then the value of $P(B \cap C)$ is -

A. $\frac{1}{12}$

B. $\frac{5}{12}$

C. $\frac{1}{4}$

D. $\frac{23}{36}$

Answer: A

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15. In tossing a fair coin twice, let A and B denote the events of occurrence of head on first toss and second toss respectively , then the value of $P(A \cup B)$ is -

A. $\frac{1}{4}$

B. $\frac{1}{2}$

C. $\frac{3}{4}$

D. $\frac{1}{3}$

Answer: C

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16. A bag X contains 2 white and 3 black balls and another bag Y contains 4 white and 2 black balls. One bag is selected at random and a ball is drawn from it. Then the probability for the ball chosen be white is -

A. $\frac{2}{15}$

B. $\frac{7}{15}$

C. $\frac{14}{15}$

D. $\frac{8}{15}$

Answer: D

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17. A five digit number of formed by writing the digits 1, 2, 3, 4, 5 in a random order without repeatation. Then the probability that the number is divisible by 4, is -

A. $\frac{3}{5}$

B. $\frac{5}{18}$

C. $\frac{1}{5}$

D. $\frac{5}{6}$

Answer: C

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18. The value of the determinant $\begin{vmatrix} b^2c^2 & bc & b+c \\ c^2a^2 & ca & c+a \\ a^2b^2 & ab & a+b \end{vmatrix}$ is -

A. $abc\left(a^2+b^2+c^2\right)$

B. 0

C. $abc(bc+ca+ab)$

D. $(a+b+c)\left(a^2+b^2+c^2\right)(ab+bc+ca)$

Answer: B

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19. If $\begin{vmatrix} \cos(A+B) & -\sin(A+B) & \cos 2B \\ \sin A & \cos A & \sin B \\ -\cos A & \sin A & \cos B \end{vmatrix} = 0$ then the value of B is -

A. $(2n+1)\frac{\pi}{2}$

B. $n\pi$

C. $(2n+1)\pi$

D. $2n\pi$

Answer: A

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20. If $\begin{vmatrix} x & -3i & 1 \\ y & 1 & i \\ 0 & 2i & -i \end{vmatrix} = 6 + 11i$, then the values of x and y are -

A. $x = -3, y = 4$

B. $x = 3, y = 4$

C. $x = 3, y = -4$

D. $x = -3, y = 0$

Answer: A

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21. If $1, \omega, \omega^2$ are the cube roots of unity, then the value of

$$\begin{vmatrix} 1 & \omega^n & \omega^{2n} \\ \omega^n & \omega^{2n} & 1 \\ \omega^{2n} & 1 & \omega^n \end{vmatrix}$$ is equal to -

A. ω^2

B. 0

C. 1

D. ω

Answer: B

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22. If $\begin{vmatrix} x+1 & 1 & 1 \\ 2 & x+2 & 2 \\ 3 & 3 & x+3 \end{vmatrix} = 0$, then the value of x is -

A. 0, 6

B. 0, -6

C. 0, 2

D. 2, -1

Answer: B

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23. If $A = \begin{bmatrix} -i & 0 \\ 0 & i \end{bmatrix}$ then $A^T A$ is equal to -

A. $\begin{bmatrix} -5 & -2 \\ -3 & 1 \end{bmatrix}$

B. $\frac{1}{11}\begin{bmatrix} -5 & -2 \\ -3 & 1 \end{bmatrix}$

C. $\frac{1}{11}\begin{bmatrix} 5 & 2 \\ 3 & -1 \end{bmatrix}$

D. $\begin{bmatrix} 5 & 2 \\ 3 & -1 \end{bmatrix}$

Answer: C

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24. If $A = \begin{bmatrix} -1 & 2 \\ 2 & -1 \end{bmatrix}$, $B = \begin{bmatrix} 5 \\ 7 \end{bmatrix}$ and $AX = B$ then X is equal to -

A. [19, 17]

B. $\frac{1}{3}\begin{bmatrix} 19 \\ 17 \end{bmatrix}$

C. $\frac{1}{3}[19, 17]$

D. $\begin{bmatrix} 19 \\ 17 \end{bmatrix}$

Answer: B

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25. If $i = \sqrt{-1}, P = \begin{bmatrix} i & 0 & -i \\ 0 & -i & i \\ -i & i & 0 \end{bmatrix}$ and $Q = \begin{bmatrix} -i & i \\ 0 & 0 \\ i & -i \end{bmatrix}$ then PQ is equal to -

A. $\begin{bmatrix} 2 & -2 \\ -1 & 1 \\ -1 & 1 \end{bmatrix}$

B. $\begin{bmatrix} -2 & 2 \\ 1 & -1 \\ 1 & -1 \end{bmatrix}$

C. $\begin{bmatrix} 2 & -2 \\ -1 & 1 \end{bmatrix}$

D. $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

Answer: A

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26. If $A \neq 0$ and $B \neq 0$ are two 2×2 matrices such that AB = 0, then which of the following is correct ?

A. det A = 0 or det B = 0

B. det A = 0 and det B = 0

C. det A = det $B \neq 0$

D. none of these

Answer: B

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27. The value of $\begin{vmatrix} \log_3 512 & \log_4 3 \\ \log_3 8 & \log_4 9 \end{vmatrix} \times \begin{vmatrix} \log_2 3 & \log_8 3 \\ \log_3 4 & \log_3 4 \end{vmatrix}$ is -

A. 7

B. 17

C. 13

D. 10

Answer: D

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28. It is known that a lot of 10 articles contains 3 defectives. A sample of 4 articles is drawn at random from the lot. If X be the random variable of defective articles in the sample, then the value of $P(0 < X < 2)$ is -

A. $\frac{1}{2}$

B. $\frac{2}{3}$

C. $\frac{1}{2}$

D. $\frac{1}{3}$

Answer: C

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29. If the mean and variance of a binomial distribution are $\frac{4}{3}$ and $\frac{8}{9}$ respectively, then the value $P(X \geq 1)$ is -

A. $\frac{16}{81}$

B. $\frac{65}{81}$

C. $\frac{32}{81}$

D. none of these

Answer: B

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30. If the function f(x) is defined by $f(x) = a + bx$ and $f^r = fff....$ (repeated r times), then $f^r(x)$ is equal to -

A. $a\left(b^r - 1\right) + b^r x$

B. $ar + bx^r$

C. $a \cdot \frac{b^r - 1}{b - 1} + b^r x$

D. $(a + x)b^r$

Answer: C

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31. The range of the function $^{7-x}P_{x-3}$ is -

A. {1, 2, 3, 4, 5}

B. {1, 2, 3, 4}

C. {1, 2}

D. {1, 2, 3}

Answer: D

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32. The domain of definition of the function $f(x) = \dfrac{\sin^{-1}(x-3)}{\sqrt{9-x^2}}$ is -

A. $2 \leq x < 3$

B. $1 \leq x \leq 2$

C. $1 \leq x < 2$

D. $2 \leq x \leq 3$

Answer: A

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33. The acute angle between the z-axis and the straight line joining the points (3, 2, 3) and (-3, -1, 5) is -

A. $\cos^{-1}\frac{2}{7}$

B. $\cos^{-1}\frac{6}{7}$

C. $\cos^{-1}\frac{3}{7}$

D. none of these

Answer: A

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34. Let $\vec{a} = \hat{i} + \hat{j} + 2\hat{k}, \vec{b} = 2\hat{i} + 2\hat{j}, \vec{c} = 3\hat{i} + 5\hat{j} - 2\hat{k}$ and $\vec{d} = -\hat{j} + \hat{k}$, then the ratio of the modulis of the vectors $\vec{b} - \vec{a}$ and $\vec{d} - \vec{c}$ is -

A. $2:3$

B. $3:1$

C. $1:3$

D. $3:2$

Answer: C

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35. If $\vec{r}_1 = \hat{i} + 2\hat{j} - 2\hat{k}$ and $\vec{r}_2 = 3\hat{j} - 4\hat{k}$, then the angle between $\vec{r}_1$ and $\vec{r}_2$ is -

A. $\cos^{-1}\frac{4}{5}$

B. $\cos^{-1}\frac{14}{15}$

C. $\cos^{-1}\frac{5}{13}$

D. $\cos^{-1}\frac{12}{13}$

Answer: B

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36. A unit vector which is perpendicular to both the vectors $\vec{a} = \hat{i} - \hat{j} - \hat{k}$ and $\vec{b} = \hat{i} + \hat{j} + \hat{k}$ is -

A. $\hat{i} + \hat{k}$

B. $\frac{1}{\sqrt{2}}\left(\hat{j} - \hat{k}\right)$

C. $\frac{1}{\sqrt{2}}\left(\hat{i} + \hat{j}\right)$

D. $\frac{1}{\sqrt{2}}\left(-\hat{j} + \hat{k}\right)$

Answer: D

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37. If $\left|\vec{a}\right| = 7, \left|\vec{b}\right| = \sqrt{26}$ and $\left|\vec{a} \times \vec{b}\right| = 35$, then the value of $\vec{a} \cdot \vec{b}$ is -

A. $\sqrt{26}$

B. 13

C. 7

D. $2\sqrt{13}$

Answer: C

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38. The equation of any plane parallel to y -axis is -

A. $y = b$

B. $x = a, z = c$

C. $ax + by + d = 0$

D. $ax + cz + d = 0$

Answer: D

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39. If $\left|\vec{b}\right| = 4$ and $\left(\vec{a} + \vec{b}\right) \cdot \left(\vec{a} - \vec{b}\right) = 9$, then the value $\left|\vec{a}\right|$ is -

A. 5

B. $2\sqrt{6}$

C. $3\sqrt{2}$

D. none of these

Answer: A

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40. If the line $\vec{r} = \left(2\hat{i} - \hat{j} + 3\hat{k}\right) + \lambda\left(2\hat{i} + \hat{j} + 2\hat{k}\right)$ is parallel to the plane $\vec{r} \cdot \left(3\hat{i} - 2\hat{j} + p\hat{k}\right) = 4$ then the value of p is -

A. 2

B. -2

C. 3

D. -3

Answer: B

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41. If the equation $ax^4 + bx^3 + cx^2 + kx = 0$ has a root $\alpha > 0$, then the equation $4ax^3 + 3bx^2 + 2cx + k = 0$ has -

A. one negative and two positive roots

B. at least one root in $(0, \alpha)$

C. no root in $(0, \alpha)$

D. none of these

Answer: B

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42. The chord of the curve $ax^2 + bx + c = 0$, joining the points x=p and x=q on the curve is parallel to the tangent to the curve at x=c where -

A. $c = \frac{a+b}{2}$

B. $c = \frac{p+q}{2}$

C. $c = \frac{a-b}{2}$

D. $c = \frac{p-q}{2}$

Answer: B

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43. The value of $\lim_{x \to 0} \frac{10^x - 2^x - 5^x + 1}{x\log(1+x)}$ is -

A. $\log_e 5 \log_e 10$

B. 0

C. 1

D. $\log_e 5 \log_e 2$

Answer: D

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44. If $f(x) = \log_x(\log_e x)$, then the value of $f'(e)$ is -

A. 0

B. e

C. $\frac{1}{e}$

D. $\frac{1}{e^2}$

Answer: C

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45. If $y=\left(\cos^{-1}x\right)^2$, then the value of $\left(1-x^2\right)y_2-xy_1$ is -

A. 4

B. 2

C. y

D. 2y

Answer: B

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46. If $y=\sin\left(x^2\right), z=e^{y^2}$ and $t=\sqrt{z}$, then the value of $\frac{dt}{dx}$ is -

A. $\frac{xyz}{t}$

B. $\frac{2xyz}{t}$

C. $\frac{2xyz}{t}\cos\left(x^2\right)$

D. $-\frac{xyz}{t}\cos\left(x^2\right)$

Answer: C

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47. If $y = a^x b^{2x-1}$, then the value of $\frac{d^2y}{dx^2}$ is -

A. $y\left(\log ab^2\right)^2$

B. $y\log\left(ab^2\right)$

C. $y\left(\log a^2 b\right)^2$

D. $y^2\log\left(ab^2\right)$

Answer: A

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48. If $y = \sqrt{\sin x + \sqrt{\sin x + \sqrt{\sin x + \ldots\infty}}}$, then the value of $\frac{dy}{dx}$ is -

A. $-\frac{\cos x}{2y - 1}$

B. $\frac{\sin x}{1 - 2y}$

C. $-\frac{\sin x}{1 - 2y}$

D. $\frac{\cos x}{2y - 1}$

Answer: D

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49. If $y = \log_a x + \log_x a + \log_x x + \log_a a$, then the value of $\frac{dy}{dx}$ is -

A. $\frac{\log a}{x} + \frac{x}{\log a}$

B. $\dfrac{1}{x\log a} - \dfrac{\log a}{x(\log x)^2}$

C. $\dfrac{1}{x\log a}$

D. $\dfrac{1}{x} + x\log a$

Answer: B

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50. If $f(x) = \begin{cases} \dfrac{\left(4^x - 1\right)^3}{\sin\frac{x}{a}\log\left(1 + \frac{x^2}{3}\right)} & \text{when } x \neq 0 \\ 9\left(\log_e 4\right)^3 & \text{when } x = 0 \end{cases}$ is a continuous function at x=0, then the value of a is -

A. 1

B. 2

C. $-\frac{1}{2}$

D. 3

Answer: D

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51. If $(x+y)^{m+n}=x^m y^n$, then the value of $\frac{dy}{dx}$ is -

A. $\frac{x}{y}$

B. xy

C. $\frac{y}{x}$

D. $-\frac{x}{y}$

Answer: C

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52. If $x + y = e^{x-y}$ then the value of $\frac{d^2y}{dx^2}$ is -

A. $\frac{4(x+y)}{(x+y+1)^3}$

B. $\frac{2(x+y)}{(x+y+1)^3}$

C. $\frac{4(x+y)}{(x+y+1)^2}$

D. $\frac{2(x+y)}{(x+y+1)^2}$

Answer: A

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53. If $x = 2\cos\theta - \cos 2\theta$ and $y = 2\sin\theta - \sin 2\theta$, then the value of $\frac{d^2y}{dx^2}$ at $\theta = \frac{\pi}{2}$ is -

A. -2

B. $-\frac{3}{2}$

C. $\frac{3}{2}$

D. 0

Answer: B

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54. Let $f(x)$ be differentiable for all x. If f(1)=-2 and $f'(x) \geq 2$ for $x \in [1, 6]$ then -

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55. The value of the integral $\int_{\pi}^{10\pi} |\sin x| dx$ is equal to -

A. 20

B. 8

C. 10

D. 18

Answer: D

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56. The value of the integral $\int \frac{dx}{x^2 + 4x + 13}$ is -

A. $\frac{1}{3}\tan^{-1}\left(\frac{x+2}{3}\right) + c$

B. $\log\left(x^2 + 4x + 13\right) + c$

C. $\frac{1}{6}\log\left|\frac{x+5}{x-1}\right| + c$

D. $\frac{x+2}{\left(x^2 + 4x + 13\right)^2} + c$

Answer: A

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57. The value of $\int_{-\frac{1}{2}}^{\frac{1}{2}} \cos x \log\left(\frac{1-x}{1+x}\right) dx$ is -

A. $2\sqrt{e}$

B. 1

C. $\sqrt{e}$

D. 0

Answer: D

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58. The value of the integral $\int_0^{\frac{\pi}{2}} |\sin x - \cos x| dx$ is -

A. 0

B. $2\left(\sqrt{2} - 1\right)$

C. $2\sqrt{2}$

D. $2\left(\sqrt{2} + 1\right)$

Answer: B

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59. The value of $\int_0^3 \frac{3x + 1}{x^2 + 9} dx$ is equal to -

A. $\log\left(2\sqrt{2}\right) + \frac{\pi}{12}$

B. $\log\left(2\sqrt{2}\right) + \frac{\pi}{2}$

C. $\log\left(2\sqrt{2}\right)+\frac{\pi}{6}$

D. $\log\left(2\sqrt{2}\right)+\frac{\pi}{3}$

Answer: A

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60. The value of $\int e^{x}\left(\frac{2+\sin 2x}{1+\cos 2x}\right)dx$ is equal to -

A. $e^{x}\sec^{2}\frac{x}{2}+c$

B. $e^{x}\sec\frac{x}{2}+c$

C. $e^{x}\tan\frac{x}{2}+c$

D. $e^{x}\tan x+c$

Answer: D

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61. The value of $\int_0^1 \tan^{-1}\left(\frac{1}{x^2 - x + 1}\right)dx$ is equal to -

A. log2

B. $\frac{\pi}{4} + \log 2$

C. $\frac{\pi}{2} + \log 2$

D. $\frac{\pi}{2} - \log 2$

Answer: D

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62. The value of $\int \frac{a^{\frac{x}{2}}}{\sqrt{a^{-x} - a^x}}dx$ is equal to -

A. $\frac{1}{\log a}\sin^{-1}\left(a^x\right) + c$

B. $\frac{1}{\log a}\tan^{-1}\left(a^{x}\right) + c$

C. $\log\left(a^{x} - 1\right) + c$

D. $\sin^{-1}\left(a^{x}\right) + c$

Answer: A

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63. The value of $\int_{a}^{b}\frac{x}{|x|}dx, a < b < 0$, is equal to -

A. $-(|a| + b|b|)$

B. $|b| - |a|$

C. $|a| - |b|$

D. $|a| + |b|$

Answer: B

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64. If $g(x) = \frac{1}{2}[f(x) - f(-x)]$ defined over $-3 \leq x \leq 3$ and $f(x) = 2x^2 - 4x + 1$, then the value of $\int_{-3}^{3} g(x)dx$ is -

A. 4

B. -4

C. 0

D. 8

Answer: C

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65. If $I_n = \int_0^{\frac{\pi}{4}} \tan^n x dx$, then the value of $\left(I_8 + I_6\right)$ is -

A. $\frac{1}{7}$

B. $\frac{1}{6}$

C. $\frac{1}{5}$

D. $\frac{1}{8}$

Answer: A

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66. The value of $\lim_{n \to \infty} \sum_{r=1}^{n} \frac{1}{n} e^{\frac{r}{n}}$ is -

A. $1 - e$

B. $e - 1$

C. e

D. $e + 1$

Answer: B

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67. $\int_0^1 \sqrt{\frac{1-x}{1+x}}dx$ is equal to -

A. $\frac{\pi}{2}+1$

B. $\frac{\pi}{2}-1$

C. π

D. 1

Answer: B

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68. If $\int \frac{\sin x dx}{\sin(x - a)} = Ax + B\log|\sin(x - a)| + c$, then the value of (A, B) is -

A. $(\cos a, \sin a)$

B. $(- \sin a, \cos a)$

C. $(\sin a, \cos a)$

D. $(- \cos a, \sin a)$

Answer: A

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69. The value of $\int_{-2}^{3}\left|1 - x^2\right|dx$ is equal to -

A. $\frac{7}{3}$

B. $\frac{14}{3}$

C. $\frac{1}{3}$

D. $\frac{28}{3}$

Answer: D

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70. If $\int_0^{t^2} xf(x)dx = \frac{2}{5}t^5, t > 0$, then the value of $f\left(\frac{4}{25}\right)$ is -

A. $\frac{5}{2}$

B. $-\frac{2}{5}$

C. $\frac{2}{5}$

D. 1

Answer: C

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71. If $P = \int_0^{3\pi} f\left(\cos^2 x\right) dx$ and $Q = \int_0^{\pi} f\left(\cos^2 x\right) dx$, then -

A. $P = 5Q$

B. $P = 3Q$

C. $P = 2Q$

D. $P = Q$

Answer: B

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72. The order and degree of differential equation $\left(1 + 3\frac{dy}{dx}\right)^{\frac{4}{3}} = 4\frac{d^3y}{dx^3}$ are respectively -

A. 2, 2

B. 3, 1

C. 3, 3

D. 1, 4

Answer: C

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73. The solution of the differential equation $\frac{dy}{dx} + P(x)y = 0$ is -

A. $y = ce^{-\int P(x)dx}$

B. $y = ce^{\int P(x)dx}$

C. $y^{-1} = ce^{-\int P(x)dx}$

D. $y^{-1} = ce^{\int P(x)dx}$

Answer: A

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74. The solution of the equation $\frac{dy}{dx} + y = e^{-x}, y(0) = 0$ is -

A. $y = e^{-x}(x - 1)$

B. $y = xe^{x}$

C. $y = xe^{-x} + 1$

D. $y = xe^{-x}$

Answer: D

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75. The differential equation of the family of curves $y^2 = 4a(x + a)$ is -

A. $2y\frac{dy}{dx} = \frac{d^2y}{dx^2}$

B. $\left(2x + y\frac{dy}{dx}\right)\frac{dy}{dx} = y$

C. $y\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 = 0$

D. $y^2\frac{dy}{dx} + 4y + 1 = 0$

Answer: B

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76. The differential equation $\cot y dx = x dy$ has a solution of the form -

A. $|y| = |\cos x|$

B. $|x| = |\sin y|$

C. $|x| = |\sec y|$

D. $|y| = |\sin x|$

Answer: C

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77. The integrating factor of the differential equation $3\frac{dy}{dx} + \frac{3y}{x} = 2x^4y^4$ is -

A. $\frac{1}{x^3}$

B. $\frac{1}{x^2}$

C. $\frac{1}{x^4}$

D. x^3

Answer: A

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78. The degree of the differential equation $\left(\frac{d^3y}{dx^3}\right)^{\frac{2}{3}} - 3\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 4y = 0$ is -

A. 3

B. 6

C. $\frac{2}{3}$

D. 2

Answer: D

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79. The differential equation of all non-horizontal lines in a plane is -

A. $\frac{dx}{dy} = 0$

B. $\frac{dy}{dx} = 0$

C. $\frac{d^2y}{dx^2} = 0$

D. $\frac{d^2x}{dy^2} = 0$

Answer: D

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80. The differential equation obtained by eliminating. constants A and B from $Ax^2 + By^2 = 1$ is -

A. $x + yy' = 0$

B. $(y')^2 + yy'' + 1 = 0$

C. $xyy'' + x(y')^2 = yy'$

D. $yy'' + (y')^2 = yy'$

Answer: C

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81. The equation of a tangent to the hyperbola $x^2 - 2y^2 = 2$ parallel to the line $2x - 2y + 5 = 0$ is-

A. $y = 2x + 1$

B. $y = 2x - 1$

C. $y = x \pm 1$

D. $x + y + 1 = 0$

Answer: C

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82. The area (in square unit) surrounded by the curve $|x| + |y| = 1$ is-

A. 5

B. 4

C. 3

D. 2

Answer: D

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83. The slope of the normal to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ at the point $(a\sec\theta, b\tan\theta)$ is-

A. $\frac{b}{a}\sin\theta$

B. $-\frac{a}{b}\sin\theta$

C. $\frac{a}{b}\sin\theta$

D. $-\frac{b}{a}\sin\theta$

Answer: B

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84. If the straight line $y = x\sin\alpha + a\sec\alpha$ is a tangent to the circle $x^2 + y^2 = a^2$ then-

A. $\cos 2\alpha = 1$

B. $\sin^2\alpha = 1$

C. $\sin 2\alpha = 1$

D. $\tan^2\alpha = 2$

Answer: A

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85. The angle between the pair of tangents drawn to the ellipse $3x^2 + 2y^2 = 5$ from the point (1, 2) is-

A. $\tan^{-1}\left(\frac{12}{5}\right)$

B. $\tan^{-1}\left(\frac{12}{\sqrt{5}}\right)$

C. $\tan^{-1}\left(\frac{6}{\sqrt{5}}\right)$

D. $\tan^{-1}\left(\frac{6}{5}\right)$

Answer: B

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86. The angle of intersection of the cuves $y = x^2$ and $6y = 7 - x^3$ at (1, 1) is-

A. $\frac{\pi}{4}$

B. $\frac{\pi}{3}$

C. $\frac{\pi}{6}$

D. $\frac{\pi}{2}$

Answer: D

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87. If the tangent at the point p on the circle $x^2 + y^2 + 6x + 6y - 2 = 0$ meets the straight line $5x - 2y + 6 = 0$ at the point Q on the y-axis, then the length of PQ is-

A. 4 units

B. $2\sqrt{5}$ units

C. 5 units

D. $3\sqrt{5}$ units

Answer: C

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88. The equation of the common tangent to the curves $y^2 = 8x$ and $xy = -1$ is-

A. $3y = 9x + 2$

B. $y = x + 2$

C. $y = 2x + 1$

D. $2y = x + 8$

Answer: B

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89. Area (in square unit) bounded by the curve $y = \sqrt{x}$, the straight line $x = 2y + 3$ in first quadrant and x- axis is-

A. 9

B. $2\sqrt{3}$

C. 18

D. $\frac{35}{3}$

Answer: A

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90. The area bounded by the coordinate axes and the curve $\sqrt{x} + \sqrt{y} = 1$ is equal to-

A. $\frac{1}{6}$

B. $\frac{1}{3}$

C. $\frac{1}{2}$

D. 1

Answer: A

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91. The normal to the curve $x = a(1 + \cos\theta), y = a\sin\theta$ at the point θ always passes throught the fixed point-

A. $(0, 0)$

B. $(0, a)$

C. (a, a)

D. $(a, 0)$

Answer: D

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92. If the area bounded by the parabola $y = ax^2$ and $x = ay^2, a > 0$ is 1 square unit , then the value of a is-

A. 1

B. $\frac{1}{\sqrt{3}}$

C. $\frac{1}{3}$

D. $\frac{1}{\sqrt{2}}$

Answer: B

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93. The locus of the middle point of the intercept of the tangent drawn from an external point to the ellipse $x^2 + 2y^2 = 2$ between the coordinate axes is-

A. $\frac{1}{x^2} + \frac{1}{2y^2} = 1$

B. $\frac{1}{4x^2} + \frac{1}{2y^2} = 1$

C. $\frac{1}{2x^2} + \frac{1}{4y^2} = 1$

D. $\frac{1}{2x^2} + \frac{1}{y^2} = 1$

Answer: C

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94. Which one of the following definite integrals represents the area included between the parabola $4y = 3x^2$ and the straight line $2y = 3x + 12$?

A. $\int_{-2}^{4} \frac{3x^2}{4} dx$

B. $\int_{0}^{4} \left(\frac{3x + 12}{2} - \frac{3x^2}{4} \right) dx$

C. $\int_{-2}^{4} \left(\frac{3x + 12}{2} - \frac{3x^2}{4} \right) dx$

D. $\int_{-2}^{2} \left(\frac{3x + 12}{2} - \frac{3x^2}{4} \right) dx$

Answer: C

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95. A normal to the parabola $y^2 = 5x$ makes an angle $45°$ with the x-axis. Find the equation of the normal and the cooridnates of its foot.

A. $\left(\frac{5}{4}, -\frac{5}{2}\right)$

B. $\left(\frac{5}{2}, -\frac{5}{4}\right)$

C. $\left(\frac{5}{4}, \frac{5}{2}\right)$

D. $\left(\frac{5}{2}, \frac{5}{4}\right)$

Answer: A

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96. If the tangents to the graph of the function $y = f(x)$ make angle $\frac{\pi}{4}$ and $\frac{\pi}{3}$ with the x- axis at the point $x = 2$ and $x = 4$ respectively, then the value of $\int_2^4 f'(x) f''(x) dx$ is-

A. $f(4)$

B. $f(2)$

C. 0

D. 1

Answer: D

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97. The maximum value of xy when $x + 2y = 8$ is

A. 20

B. 16

C. 8

D. 24

Answer: C

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98. The function $f(x) = \tan^{-1}(\sin x + \cos x), x > 0$ is always an increasing function on the interval-

A. $(0, \pi)$

B. $\left(0, \frac{\pi}{2}\right)$

C. $\left(0, \frac{\pi}{4}\right)$

D. $\left(0, \frac{3\pi}{4}\right)$

Answer: C

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99. The points of extrema of the function $f(x) = \int_0^x \frac{\sin t}{t} dt$ in the domain $x > 0$ are-

A. $(2n + 1)\frac{\pi}{2}, n = 1, 2, 3, \ldots$

B. $(4n + 1)\frac{\pi}{2}, n = 1, 2, 3, \ldots$

C. $(2n + 1)\frac{\pi}{4}, n = 1, 2, 3, \ldots$

D. $n\pi, n = 1, 2, 3, \ldots$

Answer: D

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100. The minimum value of the function $f(x) = \sin x + \cos x$ is-

A. $-\sqrt{2}$

B. $-2\sqrt{2}$

C. -1

D. $\sqrt{2}$

Answer: A

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101. The perimeter of a sector is p , then the area of the sector is maximum when its radius is-

A. p

B. $\frac{p}{4}$

C. $\frac{p}{3}$

D. $\frac{p}{2}$

Answer: B

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102. The value of $a(a \geq 3)$ for which the sum of the cubes of the roots of $x^2 - (a - 2)x + (a - 3) = 0$, assumes the least value is-

A. 3

B. 4

C. 5

D. none of these

Answer: D

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103. If $f(x) = x^3 + \frac{1}{x^3}(x \neq 0)$, then its greatest value is-

A. 2

B. 1

C. 3

D. none of these

Answer: D

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104. The nearest point on the line $3x - 4y = 25$ from the origin is

A. (3, -4)

B. (-1, -7)

C. (-5, 8)

D. (3, 4)

Answer: A

105. If the slope of the tangent at (x, y) to a curve passing through the point $(2, 1)$ is $\frac{x^2 + y^2}{2xy}$, then the equation of the curve is-

A. $x^2 - y^2 = 3y$

B. $x\left(x^2 - y^2\right) = 6$

C. $2\left(x^2 - y^2\right) = 3x$

D. $x\left(x^2 + y^2\right) = 6$

Answer: C

106. An open box, with a square base, is to be made out of a given quantity of metal sheet of area A^2 , then the maximum volume of the box is-

A. $\frac{A^3}{3\sqrt{3}}$

B. $\frac{2A^3}{3\sqrt{3}}$

C. $\frac{A^3}{6\sqrt{3}}$

D. $\frac{A^3}{2\sqrt{3}}$

Answer: C

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107. If the radius of a sphere is measured as 5 m with an error of 0.02 m, then the approximate error in calculating its volume is-

A. π

B. 2π

C. 4π

D. 5π

Answer: B

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108. If the volume of a sphere increases at a constant rate, then the rate at which its radius increases, is-

A. inversely proportional to the surface area of the sphere ,

B. a constant ,

C. proportional to the radius ,

D. inversely proportional to the radius.

Answer: A

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109. Let A(0, 75), B(90, 0) , C(60, 40) and D(45, 25) be the corner points of the bounded feasible region of a LPP . If the objective function is $Z = 3x + 4y$, then Z is maximum at corner point-

A. B

B. D

C. A

D. C

Answer: D

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110. If $f(x) = 2x^2 + 10x - 7$, then the approximate value of $f(2.05)$ is-

A. 24.08

B. 28.9

C. 21.9

D. 21.08

Answer: C

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Question Paper 6

1. The value of the determinant $\begin{vmatrix} 441 & 442 & 443 \\ 445 & 446 & 447 \\ 449 & 450 & 451 \end{vmatrix}$ is -

A. $441 \times 446 \times 451$

B. 1

C. -1

D. 0

Answer: D

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2. In complex plane z_1, z_2 and z_3 be three collinear complex numbers, then the value of $\begin{vmatrix} z_1 & \bar{z}_1 & 1 \\ z_2 & \bar{z}_2 & 1 \\ z_3 & \bar{z}_3 & 1 \end{vmatrix}$ is -

A. 1

B. -1

C. 0

D. 2

Answer: C

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3. The solution of the equation

$$\begin{vmatrix} \cos\theta & \sin\theta & \cos\theta \\ -\sin\theta & \cos\theta & \sin\theta \\ -\cos\theta & -\sin\theta & \cos\theta \end{vmatrix} = 0 \text{ is -}$$

A. $(2n+1)\frac{\pi}{2}$

B. $n\pi$

C. $n\pi + (-1)^n\frac{\pi}{4}$

D. $1n\pi \pm \frac{\pi}{4}$

Answer: A

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4. If $\begin{vmatrix} a+a_1x & 1+b_1x & 1+c_1x \\ 1+a_2x & 1+b_2x & 1+c_2x \\ 1+a_3x & 1+b_3x & 1+c_3x \end{vmatrix} = A_0 + A_1x + A_2x^2 + A_3x^3,$ then the value of A_1 is -

A. $a_1a_2a_3 + b_1b_2b_3 + c_1c_2c_3$

B. 0

C. 1

D. -1

Answer: B

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5. The roots of the equation $\begin{vmatrix} 1 & 4 & 20 \\ 1 & -2 & 5 \\ 1 & 2x & 5x^2 \end{vmatrix} = 0$ are -

A. $-1, \ -2$

B. $-1, 2$

C. $1, \ -2$

D. $1, 2$

Answer: B

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6. Let $\vec{a}$ and $\vec{b}$ are non-collinear vectors and

$\vec{p} = (x+4y)\vec{a} + (2x+y+1)\vec{b},$

$\vec{q} = (-2x + y + 2)\vec{a} + (2x - 3y - 1)\vec{b}$

if $3\vec{p} = 2\vec{q}$, then the values of x and y are -

A. $x = 2, y = -1$

B. $x = -2, y = 1$

C. $x = 1, y = 2$

D. $x = -2, y = -1$

Answer: A

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7. The position vectors of the points A, B, C and D are $\hat{i} + 3\hat{j} - \hat{k}$, $-\hat{i} - \hat{j} + \hat{k}$, $2\hat{i} - 3\hat{j} + 3\hat{k}$ and $-3\hat{i} + 2\hat{j} + \hat{k}$ respectively. Then, the ratio of the moduli of the vectors $\overrightarrow{AB}$ and $\overrightarrow{CD}$ is -

A. $2 : 1$

B. $3:2$

C. $1:2$

D. $2:3$

Answer: D

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8. A function $f: R \rightarrow R$ is defined by $f(x) = (x - 1)(x - 2)$. Which one of the following is correct in respect of the function?

A. it is one-one but not onto

B. it is onto but not one-one

C. it is neither one-one nor onto

D. it is both one-one and onto

Answer: C

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9. If $f(x) = ax + b$ and $g(x) = cx + d$ are such that $(fog)(x) = (gof)(x)$, then which one of the following is correct ?

A. $f(b) = g(a)$

B. $f(c) = g(d)$

C. $f(d) = g(b)$

D. $f(a) = g(c)$

Answer: C

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10. Let $f(x) = [x]$ where [x] denotes the greatest integer in x. Which one of the following is correct ?

A. both domain and range of f(x) are sets of real numbers,

B. domain of f(x) is the set of real numbers and its range is the set of integers,

C. both domain and range of f(x) are sets of integers,

D. none of these

Answer: B

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11. The value of $\left(\sin^{-1}\frac{4}{5} + 2\tan^{-1}\frac{1}{3}\right)$ is -

A. $\frac{\pi}{2}$

B. $\frac{\pi}{3}$

C. $\frac{2\pi}{3}$

D. $\frac{3\pi}{4}$

Answer: A

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12. If $\sin\left[\sin^{-1}\frac{1}{5}+\cos^{-1}x\right]=1$, then the value of x is -

A. $\frac{2}{5}$

B. 1

C. $\frac{1}{3}$

D. $\frac{1}{5}$

Answer: D

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13. If $f(x) = \sin^2 x$ and and composite function $g\{f(x)\} = |\sin x|$, then the function g(x) is equal to -

A. $\sqrt{x + 1}$

B. $\sqrt{x}$

C. $-\sqrt{x}$

D. $\sqrt{x - 1}$

Answer: B

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14. If $f(2x + 3) = \sin x + 2^x$, then the value of $f(4m - 2n + 3)$ is -

A. $\sin(m - 2n) + 2^{2m - n}$

B. $\sin(2m - n) + 2^{\frac{m - n}{2}}$

C. $\sin(m - 2n) + 2^{\frac{m - n}{2}}$

D. $\sin(2m - n) + 2^{2m - n}$

Answer: D

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15. If $l(x)$ is the integer not less than x and g(x) is the greatest integer not greater than x, then $\lim_{x \to \pi + e}[l(x) + g(x)]$ is equal to -

A. 10

B. 11

C. 9

D. 12

Answer: B

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16. It is known that the probability of a male birth is $\frac{1}{2}$, then the probability of a least one boy and one girl in a family of 6 children is -

A. $\frac{31}{32}$

B. $\frac{63}{64}$

C. $\frac{57}{64}$

D. none of these

Answer: A

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17. Let X represent the difference between the number of heads and the number of tails obtained when an unbiased coin is tossed 7 times. Then, the possible values of X are -

A. 0, 2, 4, 6

B. 0, 1, 2, 3, 4

C. 1, 3, 5, 7

D. none of these

Answer: C

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18. If A is a square matrix of order 3×3 and k a scalar, then adj(kA) is equal to which of the following ?

A. k adj A

B. k^2 adj A

C. k^3 adj A

D. 2k adj A

Answer: B

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19. If $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$ and its inverse $B = \left[b_{ij}\right]$, then the element b_{23} of matrix B is -

A. -1

B. 1

C. -2

D. 2

Answer: A

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20. The inverse of the matrix $\begin{bmatrix} \cos 2\theta & -\sin 2\theta \\ \sin 2\theta & \cos 2\theta \end{bmatrix}$ is -

A. $\begin{bmatrix} \cos 2\theta & \sin 2\theta \\ \sin 2\theta & \cos 2\theta \end{bmatrix}$

B. $\begin{bmatrix} \cos 2\theta & \sin 2\theta \\ \sin 2\theta & -\cos 2\theta \end{bmatrix}$

C. $\begin{bmatrix} \cos 2\theta & -\sin 2\theta \\ \sin 2\theta & \cos 2\theta \end{bmatrix}$

D. $\begin{bmatrix} \cos 2\theta & \sin 2\theta \\ -\sin 2\theta & \cos 2\theta \end{bmatrix}$

Answer: D

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21. If $\begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix} = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 3 & 4 & 5 \end{bmatrix} \begin{bmatrix} -1 & -2 \\ -2 & 0 \\ 0 & -4 \end{bmatrix} \begin{bmatrix} -4 & -5 & -6 \\ 0 & 0 & 1 \end{bmatrix}$, then the value of a_{22} is -

A. 40

B. -40

C. -20

D. 20

Answer: A

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22. If $2X + \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} = \begin{bmatrix} 3 & 8 \\ 7 & 2 \end{bmatrix}$, then the matrix X is equal to -

A. $\begin{bmatrix} 2 & 6 \\ 4 & -2 \end{bmatrix}$

B. $\begin{bmatrix} 1 & -3 \\ 2 & -1 \end{bmatrix}$

C. $\begin{bmatrix} 1 & 3 \\ 2 & -1 \end{bmatrix}$

D. $\begin{bmatrix} 2 & -6 \\ 4 & -2 \end{bmatrix}$

Answer: C

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23. If $A = \begin{bmatrix} \alpha & 2 \\ 2 & \alpha \end{bmatrix}$ and $|A^3| = 125$, then the value of α is -

A. ± 2

B. ± 3

C. ± 5

D. 0

Answer: B

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24. From a set of 100 cards numbered 1 to 100, one card is drawn at random. The probability that the number obtained on the card is divisible by 6 or 8 but not by 24 is -

A. $\frac{6}{25}$

B. $\frac{1}{5}$

C. $\frac{2}{5}$

D. $\frac{8}{25}$

Answer: B

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25. Two persons A and B take turns in throwing a pair of dice. The first person to throw 9 from both will get the prize. If A throws first then the probability of B winning the prize is -

A. $\frac{8}{17}$

B. $\frac{9}{17}$

C. $\frac{4}{9}$

D. $\frac{5}{9}$

Answer: A

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26. A fair coin is tossed n times. The probability of getting head at least once is greater than 0.8. Then the least value of n is -

A. 5

B. 4

C. 3

D. 6

Answer: C

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27. A card is drawn from an ordinary pack of 52 cards and a gambler bets that either a spade or an ace is going to appear. Then the odds against his winning the prize are -

A. $3:10$

B. $10:3$

C. $4:9$

D. $9:4$

Answer: D

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28. Out of 30 consecutive natural numbers, 2 are chosen at random. The probability that their sum is odd is -

A. $\frac{14}{29}$

B. $\frac{15}{29}$

C. $\frac{12}{29}$

D. $\frac{10}{29}$

Answer: B

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29. A relation R is defined on the set of integers Z as follows:

$R\{(x, y) : x, y \in Z \text{ and } x - y \text{ is odd}\}$

Then the relation R on Z is -

A. reflexive

B. symmetric

C. an equivalence relation

D. transitive

Answer: C

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30. The projection of the vector $\vec{\alpha} = 2\hat{i} + 3\hat{j} + 2\hat{k}$ on the vector $\vec{\beta} = \hat{i} + 2\hat{j} + \hat{k}$ is -

A. $\frac{5\sqrt{6}}{3}$

B. $\frac{5}{2}\sqrt{6}$

C. $\frac{4}{3}\sqrt{5}$

D. none of these

Answer: A

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31. If the position vectors of the points A, B, C, D are $\hat{i} + \hat{j} + \hat{k}, 2\hat{i} + 5\hat{j}, 3\hat{i} + 2\hat{j} - 3\hat{k}$ and $\hat{i} - 6\hat{j} - \hat{k}$ respectively, then the angle between the vectors $\overrightarrow{AB}$ and $\overrightarrow{CD}$ is -

A. $\frac{\pi}{3}$

B. π

C. $\frac{\pi}{4}$

D. $\frac{2\pi}{3}$

Answer: B

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32. Let OP = 21 where O is the origin, if the direction radios of OP are proportional to 6, -2, 3, then the coordinates of P are -

A. (6 , -2, -3)

B. (-6, 2, 3)

C. (12, -4, -6)

D. (18, -6, 9)

Answer: D

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33. The vector equation of the line passing through the point (3, -1, 2) and parallel to the vector $2\hat{i} - 3\hat{j} + 4\hat{k}$ is -

A. $\vec{r} = 2\hat{i} - 3\hat{j} + 4\hat{k} + \lambda\left(3\hat{i} - \hat{j} + 2\hat{k}\right)$

B. $\vec{r} = -3\hat{i} + \hat{j} - 2\hat{k} + \lambda\left(2\hat{i} - 3\hat{j} + 4\hat{k}\right)$

C. $r = 3\hat{i} - \hat{j} + 2\hat{k} + \lambda\left(\hat{i} + 2\hat{j} - 2\hat{k}\right)$

D. $\vec{r} = 3\hat{i} - \hat{j} + 2\hat{k} + \lambda\left(2\hat{i} - 3\hat{j} + 4\hat{k}\right)$ where λ is a scalar

Answer: D

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34. The angle between the pair of lines $\frac{x-2}{1} = \frac{y+3}{-2} = \frac{z-4}{2}$ and $\frac{x+1}{-6} = \frac{y-2}{-3} = \frac{z+5}{2}$ is -

A. $\cos^{-1}\frac{1}{7}$

B. $\cos^{-1}\frac{4}{21}$

C. $\cos^{-1}\frac{2}{3}$

D. $\cos^{-1}\frac{8}{21}$

Answer: B

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35. The cartesian equation of a straight line is $\frac{x-3}{4} = \frac{y+2}{5} = \frac{z-4}{3}$, its vector form will be -

A. $\vec{r} = 4\hat{i} + 5\hat{j} + 3\hat{k} + \lambda\left(3\hat{i} - 2\hat{j} + 4\hat{k}\right)$

B. $\vec{r} = -3\hat{i} + 2\hat{j} - 4\hat{k} + \lambda\left(4\hat{i} + 5\hat{j} + 3\hat{k}\right)$

C. $\vec{r} = 3\hat{i} - 2\hat{j} + 4\hat{k} + \lambda\left(4\hat{i} + 5\hat{j} + 3\hat{k}\right)$

D. none of these

Answer: C

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36. Three vectors $\vec{a}, \vec{b}, \vec{c}$ are such that $\left|\vec{a}\right| = 3, \left|\vec{b}\right| = 2, \left|\vec{c}\right| = 6$, if each vector is perpendicular to the sum of the other two vectors, then the value of $\left|\vec{a} + \vec{b} + \vec{c}\right|$ is -

A. $4\sqrt{3}$

B. $5\sqrt{2}$

C. 14

D. 7

Answer: D

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37. The value of $\hat{i}\cdot\left(\hat{k}\times\hat{j}\right)+\hat{j}\cdot\left(\hat{i}\times\hat{k}\right)+\hat{k}\cdot\left(\hat{j}\times\hat{i}\right)$ is -

A. -3

B. -1

C. 1

D. 3

Answer: A

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38. The angle between the planes $x - 2y + 2z = 5$ and $2x - 3y + 6z = 11$ is -

A. $\cos^{-1}\frac{5}{21}$

B. $\cos^{-1}\frac{20}{21}$

C. $\cos^{-1}\frac{4}{21}$

D. $\cos^{-1}\frac{4}{7}$

Answer: B

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39. If $\left|\vec{a} \times \vec{b}\right| = 3$ and $\vec{a} \cdot \vec{b} = 4$, then the value of $\left|\vec{a}\right|^2\left|\vec{b}\right|^2$ is -

A. 49

B. 12

C. 25

D. 7

Answer: C

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40. If the equation of a straight line is $6x - 2 = 3y + 1 = 2z - 2$, then direction cosines of the line are -

A. $\frac{1}{\sqrt{14}}, \frac{2}{\sqrt{14}}, \frac{3}{\sqrt{14}}$

B. $\frac{6}{7}, \frac{3}{7}, \frac{2}{7}$

C. $-\frac{2}{3}, \frac{1}{3}, -\frac{2}{3}$

D. none of these

Answer: A

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41. If $y = \sin\left(\frac{\pi}{6}e^{xy}\right)$, then the value of $\frac{dy}{dx}$ at $x = 0$ is -

A. $\frac{\sqrt{3}}{24}$

B. $\frac{\sqrt{3}\pi}{24}$

C. $\frac{\sqrt{3}}{12}$

D. $\frac{\sqrt{3}\pi}{12}$

Answer: B

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42. In the mean value theorem $f(a + h) = f(a) + hf'(a + \theta h)(0 < \theta < 1)$, if $f(x) = \sqrt{x}, a = 1, h = 3,$

then the value of θ is -

A. $\frac{5}{12}$

B. $\frac{1}{2}$

C. $\frac{1}{3}$

D. $\frac{2}{3}$

Answer: A

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43. If $y = \log\left(\tan\frac{x}{2}\right) + \sin^{-1}(\cos x)$, then the value of $\frac{dy}{dx}$ is -

A. $\sec x + 1$

B. $\operatorname{cosec} x + 1$

C. $\operatorname{cosec} x - 1$

D. $\sec x - 1$

Answer: C

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44. Let $f(x) = 4x^3 + x^2 - 4x - 1$. The equation f(x)=0 has roots 1 and $\left(-\frac{1}{4}\right)$. Find the root of f'(x)=0 mentioned in Rolle's theorem.

A. $\frac{1}{3}$

B. $\frac{2}{5}$

C. $\frac{3}{4}$

D. $\frac{1}{2}$

Answer: D

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45. At $x = 0$ the function $f(x) = x^3 + 1$ has -

A. a maximum value

B. a minimum value

C. a point of inflection

D. none of the above

Answer: c

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46. If $y = \dfrac{1}{1 + x + x^2 + x^3}$, then the value of $\dfrac{d^2y}{dx^2}$ at $x = 0$ is -

A. 0

B. 1

C. -1

D. 2

Answer: A

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47. If $y = \sin x \log\left(\tan\frac{x}{2}\right)$ then the value of $\frac{d^2y}{dx^2} + y$ is -

A. $-\cot x$

B. $\tan x$

C. $\cot x$

D. $-\tan x$

Answer: C

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48. If t is a parameter and $x = t^2 + 2t, y = t^3 - 3t$, then the value of $\frac{d^2y}{dx^2}$ at $t = 1$ is -

A. $-\frac{3}{8}$

B. $\frac{3}{8}$

C. $-\frac{3}{4}$

D. $\frac{3}{4}$

Answer: B

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49. $\frac{d}{dx}\left[\sin^2\cot^{-1}\left(\sqrt{\frac{1 - x}{1 + x}}\right)\right]$ is equal to -

A. $-\frac{1}{2}$

B. -1

C. 1

D. $\frac{1}{2}$

Answer: D

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50. If $x = \sin^{-1}\left(3t - 4t^3\right)$ and $y = \cos^{-1}\sqrt{1 - t^2}$ then $\frac{dy}{dx} =$

A. $\frac{1}{3}$

B. $\frac{1}{2}$

C. 2

D. $\frac{3}{2}$

Answer: A

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51. The derivative of $\sin^2 x$ w.r.t. $\cos^2 x$ is -

A. $\tan^2 x$

B. $\tan x$

C. $-\tan x$

D. none of these

Answer: D

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52. If $y = \operatorname{cosec}^{-1}\left(\frac{x+1}{x-1}\right) + \cos^{-1}\left(\frac{x-1}{x+1}\right)$, then $\frac{dy}{dx}$ is equal to -

A. 1

B. π

C. 0

D. $\frac{\pi}{2}$

Answer: C

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53. If $y = \tan^{-1}\left(\frac{\sqrt{1+x^2}-1}{x}\right)$ and $z = \tan^{-1}\left(\frac{2x}{1-x^2}\right)$, then $\frac{dy}{dz}$ is equal to -

A. $\frac{1}{8}$

B. $\frac{1}{4}$

C. $\frac{1}{2}$

D. 1

Answer: B

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54. If $f(x) = \frac{1}{1 - x}$, then the derivative of the composite function f[f{f(x)}]` is equal to

A. 1

B. $\frac{1}{2}$

C. 0

D. 2

Answer: A

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55. The value of $\left[\sum_{n=1}^{10}\int_{-2n-1}^{-2n}\sin^{27}x\,dx+\sum_{n=1}^{10}\int_{2n}^{2n+1}\sin^{27}x\,dx\right]$ is equal to -

A. 0

B. 54

C. $(27)^2$

D. -54

Answer: A

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56. The value of the integral $\int x^3\log x\,dx$ is equal to -

A. $\frac{1}{8}\left(x^4\log x-4x^4\right)+c$

B. $\frac{1}{16}\left(4x^4\log x - x^4\right) + c$

C. $\frac{1}{16}\left(4x^4\log x + x^4\right) + c$

D. $\frac{1}{4}x^4\log x - x^4 + c$

Answer: B

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57. The value of $\int_{-\frac{1}{2}}^{\frac{1}{2}}\left\{[x] + \log\left(\frac{1 + x}{1 - x}\right)\right\}dx$ is equal to -

A. 0

B. 1

C. $-\frac{1}{2}$

D. $2\log\frac{1}{2}$

Answer: C

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58. If $I_n = \int (\log x)^n dx$, then the value of $\left(I_n + nI_{n-1}\right)$ is -

A. $(\log x)^{n-1} + c$

B. $n(\log x)^n + c$

C. $(x\log x)^n + c$

D. $x(\log x)^n + c$

Answer: D

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59. The value of $\int_0^\infty \frac{xdx}{(1+x)\left(1+x^2\right)}$ is equal to -

A. $\frac{\pi}{2}$

B. 0

C. $\frac{\pi}{4}$

D. 1

Answer: C

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60. The value of $\int \frac{e^x dx}{(e^x+2)(e^x+1)}$ is equal to -

A. $\log \frac{e^x+1}{e^x+2}+c$

B. $\log \frac{e^x+2}{e^x+1}+c$

C. $\frac{e^x+1}{e^x+2}+c$

D. $\frac{e^x+2}{e^x+1}+c$

Answer: A

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61. The value of $\int \frac{dx}{\cos x - \sin x}$ is equal to -

A. $\frac{1}{\sqrt{2}}\log\left|\tan\left(\frac{x}{2} - \frac{3\pi}{8}\right)\right| + c$

B. $\frac{1}{\sqrt{2}}\log\left|\cot\frac{x}{2}\right| + c$

C. $\frac{1}{\sqrt{2}}\log\left|\tan\left(\frac{x}{2} + \frac{3\pi}{8}\right)\right| + c$

D. $\frac{1}{\sqrt{2}}\log\left|\tan\left(\frac{x}{2} - \frac{\pi}{8}\right)\right| + c$

Answer: C

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62. The value of $\int_0^{\frac{\pi}{2}} \frac{(\sin x + \cos x)^2}{\sqrt{1 + \sin 2x}} dx$ is equal to -

A. 1

B. 2

C. 0

D. 3

Answer: B

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63. If $\int_0^{\pi} x f(\sin x) dx = A \int_0^{\frac{\pi}{2}} f(\sin x) dx$, then the value of A is -

A. $\frac{\pi}{4}$

B. $\frac{\pi}{2}$

C. π

D. 2π

Answer: C

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64. The value of $\int \frac{\left(x - x^3\right)^{\frac{1}{3}}}{x^4} dx$ is equal to -

A. $-\frac{3}{8}\left(\frac{1}{x^2} - 1\right)^{\frac{4}{3}} + c$

B. $\frac{3}{8}\left(\frac{1}{x^2} - 1\right)^{\frac{4}{3}} + c$

C. $\frac{1}{8}\left(1 - \frac{1}{x^2}\right)^{\frac{4}{3}} + c$

D. $\frac{1}{x^2}\left(x - x^3\right)^{\frac{4}{3}} + c$

Answer: A

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65. The value of $\int e^{x\log a} \cdot e^x dx$ is equal to -

A. $(ae)^x + c$

B. $\dfrac{e^x}{1 + \log a} + c$

C. $\dfrac{e^x}{\log a} + c$

D. $\dfrac{(ae)^x}{\log(ae)} + c$

Answer: D

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66. The value of $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} x^3 \sin^4 x dx$ is equal to -

A. $\frac{\pi}{4}$

B. 0

C. $\frac{\pi}{3}$

D. $\frac{\pi}{2}$

Answer: B

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67. If $f(x) = \cos x - \cos^2 x + \cos^3 x - \ldots \infty$, then the value of $\int f(x) dx$ is equal to -

A. $x - \tan\frac{x}{2} + c$

B. $\frac{1}{2}\left(x - \tan\frac{x}{2}\right) + c$

C. $x + \tan\frac{x}{2} + c$

D. $x - \frac{1}{2}\tan\frac{x}{2} + c$

Answer: A

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68. The value of $\int_0^1 \frac{xdx}{\left(x+\sqrt{1-x^2}\right)\sqrt{1-x^2}}$ is equal to -

A. 0

B. 1

C. $\frac{\pi}{4}$

D. $\frac{\pi}{2}$

Answer: C

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69. The value of $\int_0^{2a} \frac{f(x)}{f(x) + f(2a - x)} dx$ is equal to -

A. f(a)

B. f(0)

C. 2a

D. a

Answer: D

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70. The value of $\int \left\{ \frac{\log x - 1}{1 + (\log x)^2} \right\}^2 dx$ is equal to -

A. $\frac{xe^x}{1 + x^2} + c$

B. $\frac{x}{1 + (\log x)^2} + c$

C. $\frac{\log x}{1+(\log x)^2}+c$

D. $\frac{x}{x^2+1}+c$

Answer: B

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71. The value of $\int_{\pi}^{2\pi}[2\cos x]dx$ is equal to -

A. $-\frac{\pi}{2}$

B. $\frac{\pi}{2}$

C. π

D. $\frac{3\pi}{2}$

Answer: A

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72. The order and degree of the differential equation $\left[1+\left(\frac{dy}{dx}\right)^2\right]^{\frac{3}{2}}=\frac{d^2y}{dx^2}$ are respectively -

A. $(2, 3)$

B. $\left(\frac{3}{2}, 2\right)$

C. $(2, 2)$

D. $(3, 4)$

Answer: C

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73. The differential equation of the system of circles touching the y-axis at the origin, is -

A. $x^2 + y^2 - 2xy\frac{dy}{dx} = 0$

B. $x^2 + y^2 + 2xy\frac{dy}{dx} = 0$

C. $x^2 - y^2 - 2xy\frac{dy}{dx} = 0$

D. $x^2 - y^2 + 2xy\frac{dy}{dx} = 0$

Answer: D

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74. The integrating factor of the differential equation $\cos x\frac{dy}{dx} + y\sin x = 1$ is -

A. cosx

B. secx

C. tanx

D. cotx

Answer: B

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75. The general solution of $y^2dx + \left(x^2 - xy + y^2\right)dy = 0$ is -

A. $\tan^{-1}\left(\frac{x}{y}\right) + \log|y| + c = 0$

B. $2\tan^{-1}\left(\frac{x}{y}\right) + \log|x| + c = 0$

C. $\log\left(y + \sqrt{x^2 + y^2}\right) + \log|y| + c = 0$

D. $\log\left(x + \sqrt{x^2 + y^2}\right) + \log|x| = c$

Answer: A

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76. The general solution of the linear differential equation $\cos^2 x \dfrac{dy}{dx} + y = \tan x$ is -

A. $y = \tan x + ce^{\tan x}$

B. $y = \tan x + 1 + ce^{\tan x}$

C. $y = \tan x - 1 + ce^{-\tan x}$

D. $y = \tan x + 1 + ce^{-\tan x}$

Answer: C

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77. The value of $\lim_{x \to \infty} \sqrt{x}\left(\sqrt{x+2} - \sqrt{x}\right)$ is -

A. 2

B. -1

C. $\frac{1}{2}$

D. 1

Answer: D

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78. The differential equation obtained by eliminating constants A and B from $y = Ae^{2x} + Be^{-\frac{x}{2}}$ is -

A. $2\frac{d^2y}{dx^2} - 3\frac{dy}{dx} - 2y = 0$

B. $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = 0$

C. $2\frac{d^2y}{dx^2} + 3\frac{dy}{dx} - 2y = 0$

D. $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = 0$

Answer: A

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79. Solution of the differential equation $\tan y \frac{dy}{dx} = \sin(x + y) + \sin(x - y)$ is -

A. $\sec y - 2\cos x = c$

B. $\sec y + 2\cos x = c$

C. $\cos y - 2\sin x = c$

D. $\sec y + 2\sin x = c$

Answer: B

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80. If $f(x) = \begin{cases} \dfrac{\sin 5x}{x^2+2x} & \text{when } x \neq 0 \\ k + \dfrac{1}{2} & \text{when } x = 0 \end{cases}$ is continuous at x=0, then the value of k is-

A. $\frac{3}{2}$

B. -2

C. 1

D. 2

Answer: D

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81. The equation of the tangent to the parabola $y^2 = 4x + 5$ which is parallel to the line $y = 2x + 7$ is-

A. $y = 2x - 3$

B. $y = 2x + 3$

C. $y = 2x - 5$

D. $y = 2x + 5$

Answer: B

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82. The slope of the normal to the curve $y = \dfrac{2x}{1 + x^2}$ at y=1 is-

A. 1

B. 0

C. 2

D. ∞

Answer: D

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83. A function $y = f(x)$ is defined as follows :

$$y = f(x) = \begin{cases} x^2 \text{ when } 0 \le x \le 1 \\ \sqrt{x} \text{ when } x \ge 1 \end{cases}$$

Then the area (in square unit) above the x- axis included between the curve y= f(x) and the line x = 4 is-

A. $\frac{15}{3}$

B. 4

C. 5

D. 6

Answer: C

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84. The coordinates of the point on the parabola $x = 3y^2 + 4y + 2$ at which the slope of the normal is 8, are-

A. (6, -2)

B. (2, 0)

C. (1, -1)

D. (9, 1)

Answer: A

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85. The area (in square unit) of the region bounded by the curve $9x^2 + 4y^2 = 36$ is-

A. 36π

B. 9π

C. 6π

D. 4π

Answer: C

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86. If θ is the acute angle of intersection at a real point of intersection of the circle $x^2 + y^2 = 5$ and the parabola $y^2 = 4x$, then the value of $\tan\theta$ is-

A. 1

B. $\sqrt{3}$

C. $\frac{1}{\sqrt{3}}$

D. 3

Answer: D

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87. The area (in square unit) of the triangle bounded by the lines $y = 2, x + y = 0$ and $x - y = 0$ is-

A. 4

B. 8

C. 12

D. 16

Answer: B

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88. If the tangent to the curve $y^2 = x^3$ at the point $\left(m^2, m^3\right)$ is also the normal to the curve at $\left(M^2, M^3\right)$, then the value of mM is-

A. $-\frac{4}{9}$

B. $-\frac{1}{3}$

C. $-\frac{2}{9}$

D. $-\frac{1}{9}$

Answer: A

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89. If A is the area of the region bounded by the curve $y = \sqrt{3x + 4}$, x- axis and the lines $x = -1$ and x=4 and B is the area bounded by the curve $y^2 = 3x + 4$ and the lines x=-1 and x=4 ,

then the value of A : B is-

A. $1:1$

B. $2:1$

C. $2:3$

D. $3:2$

Answer: A

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90. The locus of a point $P(\alpha, \beta)$ moving under the condition that the line $y = \alpha x + \beta$ is a tangent to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ is a/an-

A. parabola

B. hyperbola

C. circle

D. ellipse

Answer: B

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91. The curves $y = \sin x$ and $y = \cos x$ intersect infinitely many times giving bounded regions of equal areas. The area (in square unit) of one such region is-

A. $4\sqrt{2}$

B. $3\sqrt{2}$

C. $\sqrt{2}$

D. $2\sqrt{2}$

Answer: D

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92. From a point (d, 0) three normals are drawn to the parabola $y^2 = x$, then

A. 30°

B. 45°

C. 90°

D. 60°

Answer: C

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93. The condition that the line $ax + by + c = 0$ is a tangent to the parabola $y^2 = 4ax$ is-

A. $a = b$

B. $b^2 = c$

C. $b^2 = a$

D. $a^2 = b$

Answer: B

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94. The normal to the curve $x = a(\cos\theta + \theta\sin\theta)$, $y = a(\sin\theta - \theta\cos\theta)$ at any point θ is such that-

A. it passes through the origin

B. it passes through (a, -a)

C. it is at a constant distance from the origin

D. it makes angle $\left(\frac{\pi}{4} + \theta\right)$ with the x- axis

Answer: C

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95. If the tangent to the parabola $y = x^2 + 6$ at the point (1, 7) also touches the circle $x^2 + y^2 + 16x + 12y + c = 0$, then the coordinates of the point of contact are-

A. (-1, -2)

B. (2, 3)

C. (6, -7)

D. (-6, -7)

Answer: D

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96. The parabolas $y^2 = 4x$ and $x^2 = 4y$ divide the square region bounded by the line x = 4 , y = 4 and the coordinate axes into three parts. If S_1, S_2, S_3 are respectively the areas of these three parts numbered from top to bottom then $S_1 : S_2 : S_3$ is-

A. $1:1:1$

B. $2:1:2$

C. $1:2:1$

D. $1:2:3$

Answer: A

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97. The greatest value of the function $f(x) = x^2 \log \frac{1}{x}$ is-

A. $\frac{1}{e}$

B. $\frac{1}{2e}$

C. e

D. 2e

Answer: B

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98. If $f(x) = x^3 - 6x^2 + 9x + 3$ be a decreasing function, then x lies in-

A. (1, 3)

B. $(-\infty, -1) \cup (3, \infty)$

C. $(3, \infty)$

D. none of these

Answer: A

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99. The minimum value of the function $f(\theta) = 6\cos\theta + 8\sin\theta + 11$ is-

A. 2

B. $\frac{1}{2}$

C. 1

D. 0

Answer: C

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100. The abscissa of the point on the parabola $y^2 = 2px$ which is nearest to the point (a, 0) is-

A. $a + p$

B. $-(a + p)$

C. $p - a$

D. $a - p$

Answer: D

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101. The value of a for which the function $(a + 2)x^3 - 3ax^2 + 9ax - 1$ decreases monotonically throughout for all real values of x , are-

A. $a < -2$

B. $a > -2$

C. $-3 < a < 0$

D. $a \leq -3$

Answer: D

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102. A minimum value of the function $f(x) = \int_0^x te^{-t^2}dt$ is-

A. 0

B. 1

C. 2

D. -2

Answer: A

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103. If $f(x) = x^3 + ax^2 + bx + c$ is an increasing function for all real values of x then-

A. $a^2 > 3b$

B. $a^2 < 3b$

C. $b^2 > 3a$

D. $b^2 < 3a$

Answer: B

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104. The area (in square unit) in the first quadrant bounded by the parabolas $y^2 = 4x, y^2 = 16x$ and the straight line $x = 9$ is-

A. 9

B. 18

C. 36

D. 72

Answer: C

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105. The slope of the tangent at (x, y) to a curve passing through $\left(1, \frac{\pi}{4}\right)$ is given by $\frac{y}{x} - \cos^2\left(\frac{y}{x}\right)$, then the equation of the curve is-

A. $y = \tan^{-1}\left[\log\left(\frac{e}{x}\right)\right]$

B. $y = x\tan^{-1}\left[\log\left(\frac{x}{e}\right)\right]$

C. $y = x\tan^{-1}\left[\log\left(\frac{e}{x}\right)\right]$

D. $y = \tan^{-1}\left[\log\left(\frac{x}{e}\right)\right]$

Answer: C

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106. The time rate of change of the radius of a sphere is $\frac{1}{2\pi}$. When its radius is 5 cm , then the rate of change of the area of the surface (in square cm) of the sphere with time will be-

A. 25

B. 15

C. 24

D. 20

Answer: D

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107. The rate at which microbe multiply is proportional to the instantaneous number present . If the original number doubles in 2 hours, then they will triple in-

A. $4 \cdot \frac{\log 2}{\log 3}$ hours

B. $2 \cdot \frac{\log 3}{\log 2}$ hours

C. $5 \cdot \frac{\log 2}{\log 3}$ hours

D. $\frac{\log 3}{\log 2}$ hours

Answer: B

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108. A spherical iron ball of radius 10 cm is coated with layer of ice of uniform thickness that melts at a rate of 50 $cm^3/\min$. When the thickness of ice is 5 cm, then the rate at which the thickness of ice (in cm/ min unit) decreases, is-

A. $\frac{1}{18\pi}$

B. $\frac{1}{36\pi}$

C. $\frac{5}{6\pi}$

D. $\frac{1}{54\pi}$

Answer: A

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109. The length of a longest interval in which the function $f(x) = 3\sin x - 4\sin^3 x$ is increasing, is-

A. $\frac{\pi}{2}$

B. $\frac{\pi}{3}$

C. π

D. $\frac{3\pi}{2}$

Answer: B

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110. The vertex of the parabola $x^2 - 6x + 4y + 1 = 0$ is

A. $(2, 3)$

B. $(3, 2)$

C. $(3, 1)$

D. none of these

Answer: B

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Question Paper 7

1. The inverse of the matrix $\begin{bmatrix} 1 & 0 & 0 \\ a & 1 & 0 \\ b & c & 1 \end{bmatrix}$ is -

A. $\begin{bmatrix} 1 & 0 & 0 \\ -a & 1 & 0 \\ ac-b & -c & 1 \end{bmatrix}$

B. $\begin{bmatrix} 1 & 0 & 0 \\ -a & 1 & 0 \\ -b & -c & 1 \end{bmatrix}$

C. $\begin{bmatrix} 1 & -a & ac-b \\ 0 & 1 & -c \\ 0 & 0 & 1 \end{bmatrix}$

D. $\begin{bmatrix} 1 & 0 & 0 \\ -a & 1 & 0 \\ ac & b & 1 \end{bmatrix}$

Answer: A

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2. If $A = |a_{ij}|$ and A_{ij} denotes the cofactor of a_{ij}, then which of the following is not equal to zero ?

A. $a_{31}A_{11} + a_{32}A_{12} + a_{33}A_{13}$

B. $a_{11}A_{31} + a_{12}A_{32} + a_{13}A_{33}$

C. $A_{21}A_{21} + a_{22}A_{22} + a_{23}A_{23}$

D. $a_{31}A_{21} + a_{32}A_{22} + a_{33}A_{23}$

Answer: C

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3. The minors of (-4) and 9 and the cofactors of (-4) and 9 in matrix $\begin{bmatrix} -1 & -2 & 3 \\ -4 & -5 & -6 \\ -7 & 8 & 9 \end{bmatrix}$ are respectively -

A. $42, 3, -42, 3$

B. $-42, -3, 42, -3$

C. $42, 3, -42, -3$

D. $42, 3, 42, 3$

Answer: B

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4. If $\begin{vmatrix} 0 & x-a & x-b \\ x+a & 0 & x-c \\ x+b & x+c & 0 \end{vmatrix} = 0$ then the value of x is -

A. $a+b+c$

B. $a+bc$

C. $b+ca$

D. 0

Answer: D

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5. If the system of equations $x+y+z=6, x+2y+kz=0$ and $x+2y+3z=10$ has no solution, then the value of k is -

A. 5

B. 4

C. 3

D. 2

Answer: C

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6. If $A = \begin{bmatrix} -i & 0 \\ 0 & i \end{bmatrix}$ then $A^T A$ is equal to -

A. A

B. $-A$

C. I

D. $-I$

Answer: D

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7. If $A = \begin{bmatrix} 0 & 3 \\ 4 & 5 \end{bmatrix}$ and $kA = \begin{bmatrix} 0 & 4a \\ 3b & 60 \end{bmatrix}$, then the values of k, a and b are respectively -

A. 12, 9, 16

B. 9, 12, 16

C. 12, 9, 12

D. 16, 12, 9

Answer: A

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8. The value of the determinant $\begin{vmatrix} 1 & a & a^2 - bc \\ 1 & b & b^2 - ca \\ 1 & c & c^2 - ab \end{vmatrix}$ is -

A. abc

B. $(a + b + c)(bc + ca + ab)$

C. 0

D. $(a - b)(b - c)(c - a)$

Answer: C

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9. If the matrix A stisfies the equation $\begin{bmatrix} 1 & 3 \\ 0 & 1 \end{bmatrix} \cdot A = \begin{bmatrix} 1 & 1 \\ 0 & -1 \end{bmatrix}$, then which one of the following represents A ?

A. $\begin{bmatrix} 1 & 4 \\ -1 & 0 \end{bmatrix}$

B. $\begin{bmatrix} 1 & 4 \\ 0 & -1 \end{bmatrix}$

C. $\begin{bmatrix} 1 & -4 \\ 1 & 0 \end{bmatrix}$

D. $\begin{bmatrix} 1 & -2 \\ 0 & -1 \end{bmatrix}$

Answer: B

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10. For any matrix A, if A^{-1} exists then which of the following is not true ?

A. $(A^{-1})^{-1} = A$

B. $(A^T)^{-1} = (A^{-1})^T$

C. $(A^2)^{-1} = (A^{-1})^2$

D. $\left|A^{-1}\right| = |A|^{-1}$

Answer: C

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11. If $a_1, a_2, a_3 \ldots, a_n$ are in G.P., then the value of the determinant

$$D = \begin{vmatrix} \log a_n & \log a_{n+1} & \log a_{n+2} \\ \log a_{n+3} & \log a_{n+4} & \log a_{n+5} \\ \log a_{n+6} & \log a_{n+7} & \log a_{n+8} \end{vmatrix}$$ is -

A. 0

B. 2

C. 1

D. 3

Answer: A

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12. The value of the determinant $\begin{vmatrix} (10)! & (11)! & (12)! \\ (11)! & (12)! & (13)! \\ (12)! & (13)! & (14)! \end{vmatrix}$ is -

A. 2(10!)(11!)

B. 2(10!)(13!)

C. 2(11!)(12!)(13!)

D. 2(10!)(11!)(12!)

Answer: D

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13. If C is the midpoint of AB and P is any point outside AB, then which one of the following is correct ?

A. $\overrightarrow{PA} + \overrightarrow{PB} + 2\overrightarrow{PC} = \vec{0}$

B. $\overrightarrow{PA} + \overrightarrow{PB} = 2\overrightarrow{PC}$

C. $\overrightarrow{PA} + \overrightarrow{PB} = \overrightarrow{PC}$

D. $\overrightarrow{PA} + \overrightarrow{PB} + \overrightarrow{PC} = \vec{0}$

Answer: B

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14. The position vectors of the points A, B, C are $\left(\hat{i} - 3\hat{j} - 5\hat{k}\right)$, $\left(2\hat{i} - \hat{j} + \hat{k}\right)$ and $\left(3\hat{i} - 4\hat{j} - 4\hat{k}\right)$ respectively. Then A, B, C form a/an -

A. equilateral triangle

B. isosceles triangle

C. right angled triangle

D. right angled isosceles triangle

Answer: C

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15. If N be the set of natural numbers and and $N_a = \{an : n \in N\}$ then $N_5 \cap N_7$ is -

A. N_{35}

B. N_{12}

C. N

D. N_7

Answer: A

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16. If the function $f: R \rightarrow R$ is defined by $f(x) = x^2 - 6x - 14$, then $f^{-1}(2)$ is equal to -

A. {2, 8}

B. {-2, 8}

C. {-2, -8}

D. {2, -8}

Answer: B

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17. Let $f : R \rightarrow R$ be defined by $f(x) = x^2$ and $g : R \rightarrow R$ be defined by $g(x) = x + 5$. Then , $(gof)(x)$ is equal to -

A. $x + 5$

B. $(x + 5)^2$

C. $x^2 + 25$

D. $x^2 + 5$

Answer: D

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18. If $f : R \rightarrow S$ is defined by $f(x) = \sin x - \sqrt{3}\cos x + 1$ is onto, then the interval of S is -

A. [-1, 3]

B. [0, 1]

C. [-1, 1]

D. [0, 3]

Answer: A

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19. If $\frac{x^3}{(2x - 1)(x + 2)(x - 3)} = A + \frac{B}{2x - 1} + \frac{C}{x + 2} + \frac{D}{x - 3}$, then the value of A is-

A. 1

B. 2

C. $\frac{1}{2}$

D. $\frac{1}{3}$

Answer: C

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20. The value of $\left[\tan^{-1}\frac{m}{n} - \tan^{-1}\left(\frac{m-n}{m+n}\right)\right]$ is -

A. $\frac{\pi}{2}$

B. $\frac{\pi}{4}$

C. $-\frac{\pi}{4}$

D. $-\frac{\pi}{2}$

Answer: B

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21. If $\sin^{-1}x + \sin^{-1}y + \sin^{-1}z = \frac{3\pi}{2}$, then then the value of $(x + y + z)$ is -

A. $\frac{1}{3}$

B. $-\frac{1}{3}$

C. -3

D. 3

Answer: D

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22. A real valued function f(x) stisfies the functional relation $f(x - y) = f(x)f(y) - f(a - x)f(a + y)$ where a is a given constant and f(0)=1. Then, $f(2a - x)$ is equal to -

A. $f(a) + f(a - x)$

B. $f(-x)$

C. $-f(x)$

D. $f(x)$

Answer: C

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23. The probability of having a king and a queen when two cards are drawn at random from a pack of 52 cards is -

A. $\frac{8}{663}$

B. $\frac{16}{283}$

C. $\frac{16}{663}$

D. $\frac{8}{283}$

Answer: A

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24. A, B, C are mutually exclusive events such that $P(A)=\frac{3x+1}{3}, P(B)=\frac{1-x}{4}$ and $P(C)=\frac{1-2x}{2}$, then the set of possible values of x are in the interval -

A. $\left[\frac{1}{3}, \frac{1}{2}\right]$

B. $[0, 1]$

C. $\left[\frac{1}{3}, \frac{2}{3}\right]$

D. $\left[\frac{1}{3}, \frac{13}{3}\right]$

Answer: A

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25. The chance of throwing a total of 7 or 12 with two dice is -

A. $\frac{2}{9}$

B. $\frac{7}{36}$

C. $\frac{5}{36}$

D. $\frac{5}{9}$

Answer: B

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26. If A and B are two events, then the probability that one and only one event occurs is -

A. $P\left(A^c\right) + P\left(B^c\right) + 2P\left(A^c \cap B^c\right)$

B. $P\left(A^c\right) + P(B) - 2P\left(A^c \cap B^c\right)$

C. $P(A) + P(B) - 2P\left(A^c \cap B^c\right)$

D. $P(A) + P(B) - 2P(A \cap B)$

Answer: D

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27. If A and B are two events and $P(A \cup B) = \frac{5}{6}, P(A \cap B) = \frac{1}{3}$ and $P\left(B^c\right) = \frac{1}{2}$ then A and B are -

A. dependent

B. independent

C. mutually exclusive

D. none of these

Answer: B

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28. If two fair coins are tossed together 5 times, then the probability of getting 5 heads and 5 tails is -

A. $\frac{63}{256}$

B. $\frac{9}{128}$

C. $\frac{189}{512}$

D. $\frac{63}{512}$

Answer: A

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29. If n and p are two parameters of Binomial Distribution and its variance is σ^2 then -

A. $\sigma^2 > 4n$

B. $\sigma^2 \geq 4n$

C. $4\sigma^2 \leq n$

D. none of these

Answer: C

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30. 5 unbiased coins are tossed at random. The probability of getting at least two tails is -

A. $\frac{31}{32}$

B. $\frac{27}{32}$

C. $\frac{13}{16}$

D. $\frac{1}{2}$

Answer: C

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31. Roots of the equation $3x^2 - 6x + 4 = 0$ are α and β then find the value of $\alpha^3 + \beta^3$

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32. The angle between the normals to the planes $x - y + 2z = 8$ and $2x + y + z = 12$ is -

A. $\frac{\pi}{6}$

B. $\frac{\pi}{3}$

C. $\frac{\pi}{4}$

D. $\frac{2\pi}{3}$

Answer: B

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33. The acute angle between the normals to the planes the points (3, 2, 3) and (-3, -1, 5) is -

A. $\cos^{-1}\frac{3}{7}$

B. $\cos^{-1}\frac{2}{7}$

C. $\cos^{-1}\frac{6}{7}$

D. $\frac{\pi}{3}$

Answer: B

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34. If the lines $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4}$ and $\frac{x-4}{5}=\frac{y-1}{2}=\frac{z-0}{1}$ intersect, then the coordinates of their point of intersection are -

A. (-1, 2, 1)

B. (-1, 1, 1)

C. (-1, -1, -1)

D. (-1, -1, 2)

Answer: C

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35. The equation of the line passing through the point (2, -3, 1) and parallel to the line $\frac{3x-2}{3}=\frac{2y+1}{4}=\frac{3-z}{2}$ is -

A. $\frac{x-2}{3}=\frac{y+3}{4}=\frac{z-1}{-2}$

B. $\frac{x-2}{1} = \frac{y+3}{2} = \frac{z-1}{2}$

C. $\frac{x+2}{1} = \frac{y-3}{2} = \frac{z+1}{-2}$

D. $\frac{x-2}{1} = \frac{y+3}{2} = \frac{z-1}{-2}$

Answer: D

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36. If the straight line joining the points (4, -3, 2) and (3, -1, 5) is perpendicular to the straight line joining the points (m, -2, 1) and (7, 3, -2), then the value of m is -

A. -6

B. 12

C. -12

D. 6

Answer: D

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37. If $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}$ and $\vec{b} = -2\hat{i} + \hat{j} - 2\hat{k}$, then the value of $\left|\vec{a} \times \vec{b}\right|$ is -

A. $\sqrt{26}$

B. $3\sqrt{6}$

C. $5\sqrt{3}$

D. $4\sqrt{6}$

Answer: A

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38. A unit vector perpendicular to both the vectors $\hat{i} + \hat{j}$ and $\hat{j} + \hat{k}$ is -

A. $\dfrac{\hat{i} + \hat{j} + \hat{k}}{\sqrt{3}}$

B. $\dfrac{\hat{i} - \hat{j} + \hat{k}}{\sqrt{3}}$

C. $\dfrac{\hat{i} - \hat{j} - \hat{k}}{\sqrt{3}}$

D. $\dfrac{-\hat{i} - \hat{j} + \hat{k}}{\sqrt{3}}$

Answer: B

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39. If the vectors $\vec{\alpha} = \hat{i} + 3\hat{j} + \hat{k}, \vec{\beta} = 2\hat{i} - \hat{j} - \hat{k}$ and $\vec{\gamma} = \gamma\hat{i} + 7\hat{j} + 3\hat{k}$ are coplanar, then the value of λ is -

A. -2

B. -1

C. 0

D. 2

Answer: C

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40. If $\left|\vec{a} \times \vec{b}\right|^2 + \left(\vec{a} \cdot \vec{b}\right)^2 = 196$ and $\left|\vec{b}\right| = 2$, then the value of $\left|\vec{a}\right|$ is -

A. 7

B. 6

C. 5

D. 4

Answer: A

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41. If $e^y + xy = e^2$ then the value of $\frac{d^2y}{dx^2}$ at x=0 is -

A. 0

B. 1

C. $\frac{1}{e^2}$

D. $\frac{1}{e}$

Answer: A

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42. Derivative of $\sin^{-1}x$ w.r.t. $\cos^{-1}\sqrt{1-x^2}$ is -

A. $\frac{1}{1 - x^2}$

B. $\cos^{-1}x$

C. 1

D. none of these

Answer: C

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43. If $x = a(\theta + \sin\theta), y = a(1 - \cos\theta)$, then the value of $\frac{dy}{dx}$ is -

A. $\tan\theta$

B. $\tan\frac{\theta}{2}$

C. $\cot\theta$

D. $\cot\frac{\theta}{2}$

Answer: B

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44. The equation $ax^2 + bx + c = 0$ has one real root between 0 and k. If $4a + 3b + 3c = 0$, then the value of k is -

A. $\frac{1}{2}$

B. $\frac{1}{3}$

C. 1

D. 2

Answer: D

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45. If $\lim_{x \to \infty}\left[\frac{x^3+1}{x^2+1} - (ax+b)\right] = 2$, then the values of a and b are -

A. $a = 1, b = 1$

B. $a = 1, b = -1$

C. $a = 1, b = 2$

D. $a = 1, b = -2$

Answer: D

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46. Let f(x) be continuous in $(-\infty, \infty)$ and f'(x) exists in $(-\infty, \infty)$. If $f(3) = -6$ and $f'(x) \geq 6$ for all $x \in [3, 6]$ then -

A. $f(6) \geq 24$

B. $f(6) \geq 12$

C. $f(6) \leq 24$

D. $f(6) \leq 12$

Answer: B

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47. The value of $\lim_{x \to 0}(1 - 3x)^{\frac{3}{x}}$ is equal to -

A. e^{a}

B. 1

C. e^{-a}

D. e^{2a}

Answer: A

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48. If $y = 2\sin^{-1}\left(\frac{x-2}{\sqrt{6}}\right) - \sqrt{2+4x-x^2}$ then prove that $\frac{dy}{dx}$ at x=2 is $\frac{2}{\sqrt{6}}$

A. $-\frac{2}{\sqrt{6}}$

B. $\frac{1}{\sqrt{6}}$

C. $\frac{2}{\sqrt{6}}$

D. $\frac{1}{2}\sqrt{6}$

Answer: C

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49. If $f(x) = \tan^{-1}\left(\frac{3x - x^3}{1 - 3x^2}\right)$ and $\phi(x) = \cos^{-1}\left(\frac{1 - x^2}{1 + x^2}\right)$, then the value of $\lim_{x \to a}\frac{f(x) - f(a)}{\phi(x) - \phi(a)}\left(0 < a < \frac{1}{2}\right)$ is -

A. $\frac{3}{2\left(1 + a^2\right)}$

B. $-\frac{3}{2\left(1 + a^2\right)}$

C. $\frac{3}{2}$

D. $-\frac{3}{2}$

Answer: D

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50. If $y = \sec\left(\tan^{-1}x\right)$, then $\frac{dy}{dx}$ is equal to -

A. $\dfrac{x}{\sqrt{1+x^2}}$

B. $-\dfrac{x}{\sqrt{1+x^2}}$

C. $\dfrac{x}{\sqrt{1-x^2}}$

D. none of these

Answer: A

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51. If $y = e^{x + e^{x + e^{x + \dots \infty}}}$, then the value of $\dfrac{dy}{dx}$ is -

A. $\dfrac{y}{y+1}$

B. $\dfrac{y}{1-y}$

C. $\dfrac{1+y}{1-y}$

D. none of these

Answer: B

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52. If $y = \frac{x\sin^{-1}x}{\sqrt{1-x^2}} + \log\sqrt{1-x^2}$, then the value of $\frac{d^2y}{dx^2}$ at x=0 is -

A. 0

B. $\frac{1}{2}$

C. 1

D. 2

Answer: C

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53. For $|x| < 1$, let $y = 1 + x + x^2 + \ldots\infty$, then the value of $\frac{dy}{dx} - y$ is equal to -

A. $\frac{x}{y}$

B. $\frac{x^2}{y^2}$

C. $\frac{x}{y^2}$

D. xy^2

Answer: D

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54. Observe the following statements :

(i) $f(x) = ax^{41} + bx^{-40} \Rightarrow \frac{f''(x)}{f(x)} = 1640x^{-2}$

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

Which of the following is correct ?

A. (i) is true, but (ii) is false,

B. both (i) and (ii) are true,

C. neither (i) nor (ii) is true,

D. (i) is false, but (ii) is true.

Answer: A

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55. If $f(y) = e^y, g(y) = y, y > 0$ and $F(t) = \int_0^t f(t-y)g(y)dy$, then -

A. $F(t) = te^{-t}$

B. $F(t) = 1 - e^{-t}(t+1)$

C. $F(t) = e^{t} - (t + 1)$

D. $F(t) = te^{t}$

Answer: C

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56. If $m, n \in R$, then the value of $I(m, n) = \int_0^1 t^m (1 + t)^n dt$ is -

A. $\frac{n}{1 + m} I\begin{bmatrix} m + 1 \\ n - 1 \end{bmatrix}$

B. $\frac{2^n}{1 + m} - \frac{n}{m + 1} I\begin{bmatrix} m + 1 \\ n - 1 \end{bmatrix}$

C. $\frac{m}{n + 1} I\begin{bmatrix} m + 1 \\ n - 1 \end{bmatrix}$

D. $\frac{2^n}{1 + m} - \frac{m}{n + 1} I\begin{bmatrix} m + 1 \\ n - 1 \end{bmatrix}$

Answer: B

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57. The value of $\int_{-2}^{2}\left[p\log\left(\frac{1+x}{1-x}\right)+q\log\left(\frac{1-x}{1+x}\right)^{-2}+r\right]dx$ depends on -

A. the value of p

B. the value of q

C. the values of p and q

D. the value of r

Answer: D

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58. The value of $\int\frac{f'(x)}{f(x)\log\{f(x)\}}dx$ is equal to -

A. $\log[\log\{f(x)\}] + c$

B. $\frac{f(x)}{\log\{f(x)\}} + c$

C. $f(x)\log\{f(x)\} + c$

D. $\frac{1}{\log[\log\{f(x)\}]} + c$

Answer: A

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59. The value of $\int e^{-\log x}dx$ is -

A. $\frac{1}{x} + c$

B. $-\frac{1}{x} + c$

C. $\log|x| + c$

D. $\log x + c$

Answer: C

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60. If

$f(x)=\dfrac{e^x}{1+e^x}, I_1=\int_{f(-a)}^{f(a)} xg\{x(1-x)\}dx$ and $I_2=\int_{f(-a)}^{f(a)} g\{x(1-x)\}dx$

, then the value of $\dfrac{I_2}{I_1}$ is -

A. -1

B. 2

C. -3

D. 1

Answer: B

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61. The value of $\int \sqrt{x} e^{\sqrt{x}} dx$ is -

A. $2\sqrt{x} - e^{\sqrt{x}} - 4\sqrt{x} e^{\sqrt{x}} + c$

B. $\left(1 - 4\sqrt{x}\right) e^{\sqrt{x}} + c$

C. $\left(2x + 4\sqrt{x} + 4\right) e^{\sqrt{x}} + c$

D. $\left(2x - 4\sqrt{x} + 4\right) e^{\sqrt{x}} + c$

Answer: D

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62. The value of $\int_{-1}^{1} |1 - x| dx$ is equal to -

A. 2

B. -2

C. 0

D. 4

Answer: A

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63. The value of $\int_0^{\frac{\pi}{8}} \cos^3 4\theta d\theta$ is equal to -

A. $\frac{2}{3}$

B. $\frac{1}{4}$

C. $\frac{1}{3}$

D. $\frac{1}{6}$

Answer: D

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64. The value of $\int \frac{dx}{\sin x \cos x}$ is equal to -

A. $\log|\sin x| + c$

B. $\log|\tan x| + c$

C. $\log|\cos x| + c$

D. $\log|\cot x| + c$

Answer: B

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65. If $\int \frac{e^x(1 + \sin x)}{1 + \cos x} dx = e^x f(x) + c$, then the value of f(x) is -

A. $\sin\frac{x}{2}$

B. $\cos\frac{x}{2}$

C. $\tan\frac{x}{2}$

D. $\cot\frac{x}{2}$

Answer: C

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66. The value of $\int_0^{\pi}\frac{\cos x dx}{x^4+(\pi-x)^4}$ is equal to -

A. 0

B. π

C. $\frac{\pi}{2}$

D. $\frac{\pi}{4}$

Answer: A

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67. The value of $\int \frac{(e^x - e^{-x})dx}{(e^x + e^{-x})\log(e^x + e^{-x})}$ is equal to -

A. $2\log(e^x + e^{-x}) + c$

B. $2\log(e^x - e^{-x}) + c$

C. $2\log[\log(e^x + e^{-x})] + c$

D. $\log[\log(e^x + e^{-x})] + c$

Answer: D

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68. The value of $\lim n \to \infty \sum_{r=1}^{n} \frac{r}{n^2}\sec^2\frac{r^2}{n^2}$ is equal to -

A. tan 1

B. $\frac{1}{2}\tan 1$

C. sec 1

D. $\frac{1}{2}\sec 1$

Answer: B

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69. Let $f : R \to R$ be a differentiable function and $f(1) = 4$ and $f'(1) = 2$, then the value of $\lim_{x \to 1} \int_4^{f(x)} \frac{2t}{x - 1} dt$ is -

A. 4

B. 8

C. 16

D. 32

Answer: C

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70. The value of $\int_{-2}^{0}\left[x^3+3x^2+3x+3+(x+1)\cos(x+1)\right]dx$ is equal to -

A. 0

B. 2

C. 4

D. 6

Answer: C

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71. If $a > 0$, then the value of $\int_{-\pi}^{\pi}\frac{\cos^2 x}{1+a^x}dx$ is equal to -

A. $\frac{\pi}{2}$

B. $\frac{\pi}{a}$

C. $a\pi$

D. 2π

Answer: A

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72. The solution of the differential equation $(2y - 1)dx - (2x + 3)dy = 0$ is -

A. $\left|\frac{2x - 1}{2y + 3}\right| = c$

B. $\left|\frac{2y + 1}{2x - 3}\right| = c$

C. $\left|\frac{2x - 1}{2y - 1}\right| = c$

D. $\left|\frac{2x+3}{2y-1}\right| = c$

Answer: D

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73. The order and degree of the differential equation $\left(\frac{d^3y}{dx^3}\right)^2 - 3\frac{d^2y}{dx^2} + 2\left(\frac{dy}{dx}\right)^4 = y^4$ respectively are -

A. 2, 4

B. 3, 2

C. 1, 4

D. 3, 4

Answer: B

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74. The integrating factor of the linear differential equation $\cos^2 x \frac{dy}{dx} - y\tan 2x = \cos^4 x$ is -

A. $\left(1 - \tan^2 x\right)$

B. $\tan^2 x$

C. $\sec^{-2} x$

D. $-\text{cosec}^2 x$

Answer: A

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75. The general solution of the differential equation $(2x - y + 1)dx + (2y - x + 1)dy = 0$ is -

A. $x^2 + y^2 + xy - x + y = c$

B. $x^2 + y^2 - xy + x + y = c$

C. $x^2 - y^2 + 2xy - x + y = c$

D. $x^2 - y^2 - 2xy + x - y = c$

Answer: B

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76. Examine whether the function f given by $f(x) = x^2$ is continuous at x= 0.

A. (i), (ii) and (iii)

B. (i) and (iii)

C. (i) and (ii)

D. (ii) and (iii)

Answer: C

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77. If $f'\,'(x) = \dfrac{2x}{\left(1 + x^2\right)^2}$ where $f'(x) = 1, f(x) = 2$ when x=0, when the value of f(x) is -

A. $x + 1 + \tan^{-1}x$

B. $2(x + 1) - \tan^{-1}x$

C. $2(x + 1) + \tan^{-1}x$

D. $x + 1 - \tan^{-1}x$

Answer: B

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78. The points of discontinuity of the function $f(x) = \dfrac{2x^2 + 7}{x^3 + 3x^2 - x - 3}$ are -

A. x=1, x=-1 and x=-3

B. x=1 and x=-1

C. x=-1 and x=3

D. none of these

Answer: A

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79. Which one of the following equations represent the differential equation of circles, with centres on the x-axis and all passing through the origin ?

A. $2y\dfrac{dy}{dx} = x^2 + y^2$

B. $2xy\frac{dy}{dx} = x^2 - y^2$

C. $ydy + xdx = 0$

D. $2xy\frac{dy}{dx} = y^2 - x^2$

Answer: D

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80. The general solution of the differential equation $\frac{dy}{dx} + 1 = \text{cosec}(x + y)$ is -

A. $\cos(x + y) + c = 0$

B. $\sin(x + y) + x + c = 0$

C. $\cos(x + y) + x + c = 0$

D. $x - \sin(x + y) + c = 0$

Answer: C

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81. If the line $ax + by + c = 0$ is a normal to the curve $xy = 1$ at the point (1, 1), then -

A. $a = b$

B. $a = -b$

C. $a^2 = b$

D. $b^2 = a$

Answer: B

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82. Two equal parabolas have the same vertex and their axes are at right angles. Then the angle between the tangents to them at their point of intersection (other than vertex) is-

A. $\frac{\pi}{4}$

B. $\tan^{-1}2$

C. $\tan^{-1}\frac{3}{4}$

D. $\frac{\pi}{3}$

Answer: C

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83. If three normals are drawn from the point $(c, 0)$ to the parabola $y^2 = x$, then-

A. $c < \frac{1}{2}$

B. $c \geq 2$

C. $c < 2$

D. $c \geq \frac{1}{2}$

Answer: D

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84. If tangents are drawn from the origin to the curve $y = \sin x$, then their points of contact lie on-

A. $x^2y^2 = x^2 - y^2$

B. $x^2y^2 = y^2 - x^2$

C. $x^2y^2 = x^2 + y^2$

D. $x^2y^2 = 2\left(x^2 - y^2\right)$

Answer: A

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85. The line, among the following, that touches the parabola $y^2 = 4ax$ is-

A. $x + my + am^3 = 0$

B. $x - my + am^2 = 0$

C. $x + my - am^2 = 0$

D. $y + mx + am^2 = 0$

Answer: B

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86. If $y = 3x$ is a tangent to a circle with centre $(1, 1)$, then the other tangent drawn throught $(0, 0)$ to the circle is-

A. $3x + y = 0$

B. $2x + y = 0$

C. $y = 2x$

D. $x = 3y$

Answer: D

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87. From any point P(x, y) of the curve $y = x^m (m > 0, x > 0)$ perpendiculars PN and PM are dropped on the coordinate axes. Then the ratio of the area OMPO and the area of the rectangle ONPM (O represents the origin) is-

A. $\dfrac{1}{m+1}$

B. $\dfrac{1}{2(m+1)}$

C. $\dfrac{2}{m+1}$

D. $\dfrac{1}{3(m+1)}$

Answer: A

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88. The area enclosed between the curve $y = \log_e(x+e)$ and the coordinate axes (in square unit) is-

A. 3

B. 4

C. 1

D. 2

Answer: C

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89. Let $f(x)$ be non- negative continuous function such that the area bounded by the curve $y = f(x)$, x- axis and the ordinates $x = \frac{\pi}{4}$ and $x = \beta\left(\beta > \frac{\pi}{4}\right)$ is $\beta\sin\beta + \frac{\pi}{4}\cos\beta + \sqrt{2}\beta$. Then the value of $f\left(\frac{\pi}{2}\right)$ is-

A. $1 - \frac{\pi}{4} - \sqrt{2}$

B. $1 - \frac{\pi}{4} + \sqrt{2}$

C. $\frac{\pi}{4} + \sqrt{2} - 1$

D. $\frac{\pi}{4} - \sqrt{2} + 1$

Answer: B

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90. If the equation of the tangent to the circle $x^2 + y^2 - 2x + 6y - 6 = 0$ parallel to the line $3x - 4y + 7 = 0$ is $3x - 4y + k = 0$, then the value of k is-

A. $5, \ -35$

B. $-5, 35$

C. $7, \ -32$

D. $-7, 32$

Answer: A

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91. The locus of the point of intersection of a pair of perpendicular tangents to an ellipse is a/an-

A. parabola

B. ellipse

C. hyperbola

D. circle

Answer: D

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92. The straight line $x + y = \sqrt{2}p$ will touch the hyperbola $4x^2 - 9y^2 = 36$ if-

A. $p^2 = 2$

B. $2p^2 = 5$

C. $p^2 = 5$

D. $5p^2 = 2$

Answer: B

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93. If the focal chord of $y^2 = 16x$ is a tangent to the circle $(x - 6)^2 + y^2 = 2$, then the possible values of the slope of the chord are-

A. $-2, \frac{1}{2}$

B. $-\frac{1}{2}, 2$

C. $1, -1$

D. $\frac{1}{2}, 2$

Answer: C

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94. The area (in square unit) bounded by the curves $y = |x| - 1$ and $y = - |x| + 1$ is-

A. 1

B. 2

C. $2\sqrt{2}$

D. 4

Answer: B

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95. If the normal at the point $\left(bt_1^2, 2bt_1\right)$ to the parabola $y^2 = 4bx$ meets it again at the point $\left(bt_2^2, 2bt_2\right)$, then-

A. $t_2 = t_1 - \dfrac{2}{t_1}$

B. $t_2 = -t_1 + \dfrac{2}{t_1}$

C. $t_2 = t_1 + \dfrac{2}{t_1}$

D. $t_2 = -t_1 - \dfrac{2}{t_1}$

Answer: D

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96. The line $y = mx + c$ touches the hyperbola $b^2x^2 - a^2y^2 = a^2b^2$ if-

A. $c^2 = a^2m^2 - b^2$

B. $c^2 = a^2m^2 + b^2$

C. $c^2 = b^2m^2 - a^2$

D. $a^2 = b^2m^2 + c^2$

Answer: A

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97. The least value of the sum of any positive real number and its reciprocal is-

A. 1

B. -1

C. -2

D. 2

Answer: D

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98. The function $f(x) = x^{\frac{1}{x}}$ is-

A. increasing in $(1, \infty)$

B. decreasing in $(1, \infty)$

C. increasing in $(-\infty, e)$ and decreasing in (e, ∞)

D. decreasing in $(1, e)$ and increasing in (e, ∞)

Answer: C

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99. If the chord of contact of tangents from a point on the circle $x^2 + y^2 = a^2$ to the circle $x^2 + y^2 = b^2$ touches the circle $x^2 + y^2 = c^2$, then a, b, c are in-

A. A.P.

B. H.P.

C. G.P.

D. none of these

Answer: C

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100. The value of x for which the polynomial $2x^3 - 9x^2 + 12x + 4$ is a decreasing function of x, is-

A. $-1 < x < 1$

B. $1 < x < 2$

C. $0 < x < 2$

D. $1 < x < 3$

Answer: B

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101. The length of the rectangle of maximum area that can be inscribed in a semicircle of radius 1 unit, so that two vertices lie on the diameter, is-

A. $\sqrt{2}$ unit

B. 2 unit

C. $\frac{\sqrt{2}}{3}$ unit

D. $\sqrt{3}$ unit

Answer: A

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102. If the tangent at any point on the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ intersects the coordinate axes at P and Q , then the minimum value of the area (in square unit) of the triangle OPQ is (O being the origin)-

A. ab

B. $\frac{1}{2}\left(a^2 + b^2\right)$

C. 2ab

D. $a^2 + b^2$

Answer: A

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103. The minimum value of $4e^{2x} + 9e^{-2x}$ is-

A. 12

B. 11

C. 10

D. 14

Answer: A

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104. Suppose the function $f(x)$ is defined as follows :

$f(x) = x(x-1)(x-2)(x-3)...(x-100)$

Then which one of the following is correct ?

A. The function has 100 local maxima

B. The function has 50 local maxima

C. The function has 51 local maxima

D. Local maxima do not exist for this function

Answer: B

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105. The pressure p and the volume v of a gas are connected by the relation $pv^{1.4} = k$, where k is a constant. Then a decrease of 0.5% in the volume of the gas corresponds to an increase of pressure by-

A. 0.6%

B. 0.7%

C. 0.8%

D. 0.9%

Answer: B

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106. The population of a country doubles in 50 years. Assuming that the rate of increase of population is proportional to the number of inhabitants, in how many years would the population becomes three times ?

A. $50 \cdot \dfrac{\log 3}{\log 2}$

B. $50 \cdot \dfrac{\log 2}{\log 3}$

C. $50\log 6$

D. 75

Answer: A

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107. Let $y = f(x)$ be the function, which passes through (1, 2) and has slope $2x + 1$, then the area bounded between the curve $x = 1$ and x- axis (in square unit) is-

A. 6

B. $\frac{4}{3}$

C. $\frac{1}{6}$

D. $\frac{5}{6}$

Answer: C

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108. The radius of a cylinder is increasing at the rate of 3 m/s and its altitude is decreasing at the rate of 4m/s. The rate of change of volume $\left(m^3/s\right)$ when radius is 4 m and altitude 6 m is -

A. 144π

B. 80

C. -80π

D. 80π

Answer: D

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109. The function $f(x) = x^2 + 4x - 2$ has a minimum value at-

A. $x = 3$

B. $x = 2$

C. $x = -2$

D. $x = -3$

Answer: C

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110. The normal at any point to a curve always passes through a given point (a, b) , if the curve passes through the origin, then the curve is a/an -

A. circle

B. ellipse

C. parabola

D. hyperbola

Answer: A

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Question Paper 8

1. A fair coin is tossed 10 times. The probability of getting exactly 6 heads is -

A. $\frac{15}{64}$

B. $\frac{105}{512}$

C. $\frac{105}{1024}$

D. $\frac{21}{256}$

Answer: B

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2. A box contains 5 apples and 7 oranges and another box contains 4 apples and 8 oranges. One fruit is picked out from each box. Then the probability that the fruits are both apples or both oranges is -

A. $\frac{1}{6}$

B. $\frac{7}{18}$

C. $\frac{17}{36}$

D. $\frac{19}{36}$

Answer: D

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3. Three numbers are chosen at random from the first 20 natural numbers. The probability that their product is even, is -

A. $\frac{2}{19}$

B. $\frac{15}{19}$

C. $\frac{17}{19}$

D. $\frac{12}{19}$

Answer: C

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4. If $P(A \cup B) = 0.8$ and $P(A \cap B) = 0.3$ then the value of $\left[P(\bar{A}) + P(\bar{B})\right]$ is -

A. 0.9

B. 0.7

C. 1.1

D. 0.8

Answer: A

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5. 12 balls are kept in 3 different boxes, then the probability that the box will contain 3 balls is -

A. $\frac{1}{4}$

B. $\frac{2^9}{3^{12}}$

C. $\frac{{}^{12}C_3 \times 2^{12}}{3^{12}}$

D. $\frac{{}^{12}C_3 \times 2^9}{3^{12}}$

Answer: D

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6. Which one of the following is not true for any two events A and B ?

A. $P(A \cap B) \geq P(A) + P(B) - 1$

B. $P(A \cap B) \leq P(A)$

C. $P\left(A^c \cap B^c\right) = 1 - P(A \cap B)$

D. $P(A) \leq P(A \cup B)$

Answer: C

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7. The value of $\left(\sin^{-1}\frac{1}{2} + 2\cos^{-1}\frac{1}{2}\right)$ is -

A. $\frac{2\pi}{3}$

B. $\frac{5\pi}{6}$

C. $\frac{3\pi}{4}$

D. $\frac{\pi}{2}$

Answer: B

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8. If $\cos^{-1}x + \cos^{-1}y = \pi$, then the value of $\left(\sin^{-1}x + \sin^{-1}y\right)$ is -

A. 0

B. $\frac{\pi}{3}$

C. π

D. 2π

Answer: A

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9. If $2f\left(\frac{1}{x}\right) + f(x) = 3x$, then the value of f(2) is -

A. $\frac{1}{6}$

B. $\frac{1}{3}$

C. -1

D. $-\frac{1}{3}$

Answer: C

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10. If the position vectors of two given points A and B be $4\hat{i} + \hat{j} + 2\hat{k}$ and $2\hat{i} - 5\hat{j} - \hat{k}$ respectively, then a unit vector in the direction of $\overrightarrow{AB}$ is -

A. $\frac{1}{7}\left(2\hat{i} + 6\hat{j} - 3\hat{k}\right)$

B. $\frac{1}{7}\left(- 2\hat{i} - 6\hat{j} + 3\hat{k}\right)$

C. $\frac{1}{7}\left(2\hat{i} - 6\hat{j} + 3\hat{k}\right)$

D. $\frac{1}{7}\left(- 2\hat{i} - 6\hat{j} - 3\hat{k}\right)$

Answer: D

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11. If the points with position vectors $2\hat{i} + 6\hat{j}, \hat{i} + 2\hat{j}$ and $m\hat{i} + 10\hat{j}$ are collinear, then the value of m is -

A. -3

B. 3

C. 5

D. -5

Answer: B

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12. Let $R = \{(3, 3), (6, 6), (9, 9), (12, 12), (6, 12), (3, 9), (3, 12), (3, 6)\}$ be a relation on the set $A = \{3, 6, 9, 12\}$, then the relation is -

A. reflexive and transitive

B. reflexive only

C. an equivalence relation

D. reflexive and symmetric

Answer: A

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13. Let $f: R \rightarrow R$ be defined by $f(x) = x|x|$, then the function f is -

A. one-one only

B. onto only

C. neither one-one nor onto

D. one-one and onto

Answer: D

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14. If $f: R \to R, g: R \to R$ and $h: R \to R$ be defined respectively by $f(x) = \sin x, g(x) = 3x - 1$ and $h(x) = x^2 - 4$, then the value of $[ho(gof)]\left(\frac{\pi}{2}\right)$ is -

A. 1

B. -1

C. 0

D. 2

Answer: C

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15. Let R be the set of real numbers and $f: R \to R$ be defined by $f(x) = 2x^2 - 5x + 6$, then the value of $f^{-1}(2)$ is -

A. {2, -2}

B. $\left\{\sqrt{2},\ -\sqrt{2}\right\}$

C. ϕ

D. $\left\{\frac{5+\sqrt{17}}{4}, \frac{5-\sqrt{17}}{4}\right\}$

Answer: C

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16. If $f(x) = \frac{e^x - e^{-x}}{e^x + e^{-x}} + 2$, then the value of $f^{-1}(x)$ is -

A. $\frac{1}{2}\log_e \frac{x-1}{3-x}$

B. $\log_e \frac{3-x}{x-1}$

C. $\log_e \frac{x-1}{3-x}$

D. $\frac{1}{2}\log_e \frac{3-x}{x-1}$

Answer: A

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17. If I is the unit matrix of order 10×10, then the determinant of I is equal to -

A. 10

B. $\frac{1}{10}$

C. 9

D. 1

Answer: D

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18. If A and B are two square matrices of the same order, then $(A - B)^2$ is equal to -

A. $A^2 - 2AB + B^2$

B. $A^2 - AB - BA + B^2$

C. $A^2 - 2BA + B^2$

D. $A^2 + 2AB + B^2$

Answer: B

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19. The root of the equation $\begin{vmatrix} x & 3 & 7 \\ 2 & x & -2 \\ 7 & 8 & x \end{vmatrix} = 0$ are -

A. $-2, -7, 5$

B. $2, 5, -7$

C. $2, 5, 7$

D. $-2, -5, 7$

Answer: B

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20. The value of the determinant $\begin{vmatrix} 5^2 & 5^3 & 5^4 \\ 5^3 & 5^4 & 5^5 \\ 5^4 & 5^6 & 5^7 \end{vmatrix}$ is -

A. 5^{13}

B. 5^9

C. 0

D. 5^{11}

Answer: C

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21. If $A = \begin{vmatrix} -1 & 2 & 4 \\ 3 & 1 & 0 \\ -2 & 4 & 2 \end{vmatrix}$ and $B = \begin{vmatrix} -2 & 4 & 2 \\ 6 & 2 & 0 \\ -2 & 4 & 8 \end{vmatrix}$, then which one of the following is correct ?

A. $B = -A$

B. $B = 6A$

C. $B = 4A$

D. $B = -4A$

Answer: D

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22. For how many values of x in the closed interval [-4, -1], the matrix $\begin{bmatrix} 3 & -1+x & 2 \\ 3 & -1 & x+2 \\ x+3 & -1 & 2 \end{bmatrix}$ is singular ?

A. 0

B. 1

C. 2

D. 3

Answer: B

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23. $\begin{bmatrix} 7 & 1 & 2 \\ 9 & 2 & 1 \end{bmatrix} \times \begin{bmatrix} 3 \\ 4 \\ 5 \end{bmatrix} + 2\begin{bmatrix} 4 \\ 2 \end{bmatrix}$ is equal to the matrix-

A. $\begin{bmatrix} 43 \\ 44 \end{bmatrix}$

B. $\begin{bmatrix} 43 \\ 45 \end{bmatrix}$

C. $\begin{bmatrix} 45 \\ 44 \end{bmatrix}$

D. $\begin{bmatrix} 44 \\ 45 \end{bmatrix}$

Answer: A

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24. If $C = 2\cos\theta$, then the value of the determinant

$D = \begin{vmatrix} C & 1 & 0 \\ 1 & C & 1 \\ 6 & 1 & C \end{vmatrix}$ is -

A. $\dfrac{\sin 4\theta}{\sin\theta}$

B. $\dfrac{2\sin^2 2\theta}{\sin\theta}$

C. $4\cos^2\theta(2\cos\theta - 1)$

D. none of these

Answer: D

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25. If $A = \begin{bmatrix} 3 & 4 \\ 5 & 7 \end{bmatrix}$, then the value of A(adjA) is equal to -

A. I

B. |A|

C. $|A| \cdot I$

D. none of these

Answer: C

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26. The value of the determinant $\begin{vmatrix} \frac{1}{a} & 1 & bc \\ \frac{1}{b} & 1 & ca \\ \frac{1}{c} & 1 & ab \end{vmatrix}$ is -

A. 0

B. abc

C. $(a - b)(b - c)(c - a)$

D. $\frac{1}{abc}$

Answer: A

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27. If $\begin{bmatrix} x+y & 2x+z \\ x-y & 2z+w \end{bmatrix} = \begin{bmatrix} 4 & 7 \\ 0 & 10 \end{bmatrix}$ then the values of x, y, z and w are -

A. 2, 3, 1, 2

B. 2, 2, 3, 4

C. 3, 3, 0, 1

D. 2, 2, 4, 3

Answer: B

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28. The matrix $\begin{bmatrix} 2 & \lambda & -4 \\ -1 & 3 & 4 \\ 1 & -2 & -3 \end{bmatrix}$ is non-singular if -

A. $\lambda \neq 2$

B. $\lambda \neq 3$

C. $\lambda \neq -3$

D. $\lambda \neq -2$

Answer: D

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29. The domain of defination of the function $f(x) = \sqrt{\frac{\sqrt{x+1}}{\sqrt{x}}}$ is-

A. $(-1, \infty) - \{0\}$

B. $(-1, \infty)$

C. $(0, \infty)$

D. $[0, \infty)$

Answer: C

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30. The period of the function $\sin^4 x + \cos^4 x$ is -

A. $\frac{\pi}{2}$

B. π

C. 2π

D. $\frac{3\pi}{2}$

Answer: A

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31. The range of the function $f(x) = {}^{9-x}P_{x-1}$ is -

A. {2, 7, 24, 36, 60}

B. {1, 7, 24, 30, 60}

C. {1, 6, 24, 36, 64}

D. {2, 9, 16, 23, 30}

Answer: B

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32. Roots of the equation $3x^2 - 6x + 4 = 0$ are α and β then find the value of $\alpha^2\beta + \alpha\beta^2$

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33. On a multiple choice examination with 4 possible answers for each of 6 questions the probability that a student would get at least two correct answers just by guessing is -

A. $\frac{3367}{4096}$

B. $\frac{1319}{2048}$

C. $\frac{2187}{4096}$

D. $\frac{1909}{4096}$

Answer: D

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34. The distance of the point (3, -4, 2) from the plane $\vec{r} \cdot \left(3\hat{i} - 6\hat{j} + 2\hat{k}\right) = 9$ is -

A. $\frac{24}{7}$ unit

B. 4 unit

C. $\frac{29}{7}$ unit

D. $\frac{46}{7}$ unit

Answer: B

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35. The coordinates of the point where the line through the points (2, -3, 4) and (-5, 2, 3) intersects the yz plane are -

A. $\left(0, \frac{11}{7}, -\frac{26}{7}\right)$

B. $\left(0, -\frac{11}{7}, -\frac{26}{7}\right)$

C. $\left(0, -\frac{11}{7}, \frac{26}{7}\right)$

D. $\left(0, \frac{11}{7}, \frac{26}{7}\right)$

Answer: C

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36. The equation of the plane passing through the point (1, -2, 3) and perpendicular to each of the planes $3x - 4y + z = 7$ and $2x + 3y - 4z = 8$ is -

A. $13x + 14y + 17z = 36$

B. $3x + 14y + 17z = 26$

C. $13x + 14y - 7z + 36 = 0$

D. none of these

Answer: A

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37. The acute angle between the straight lines whose direction numbers are 1, 1, 2 and $\left(\sqrt{3} - 1\right), \left(- \sqrt{3}, - 1\right), 4$ is -

A. $\frac{\pi}{6}$

B. $\frac{\pi}{3}$

C. $\frac{\pi}{4}$

D. $\frac{5\pi}{12}$

Answer: B

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38. The vector equation of the plane passing through the point (1, -1, 2) and having 2, 3, 2 as direction numbers of the normal to the plane is -

A. $\vec{r} \cdot \left(2\hat{i} + 3\hat{j} + 2\hat{k}\right) + 4 = 0$

B. $\vec{r} \cdot \left(\hat{i} - \hat{j} + 2\hat{k}\right) + \left(\hat{i} - \hat{j} + \hat{k}\right) \cdot \left(2\hat{i} + 3\hat{j} + 2\hat{k}\right) = 0$

C. $\vec{r} \cdot \left(2\hat{i} + 3\hat{j} + 2\hat{k}\right) + 3 = 0$

D. $\vec{r} \cdot \left(2\hat{i} + 3\hat{j} + 2\hat{k}\right) = 3$

Answer: D

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39. If the vectors $\vec{a} = 3x\hat{i} + 4y\hat{j} - 12\hat{k}$ and $\vec{b} = 3x\hat{i} - 4y\hat{j} + 12\hat{k}$ are mutually perpendicular, then the locus of the point (x, y) is a/an -

A. ellipse

B. circle

C. parabola

D. hyperbola

Answer: D

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40. If $\vec{a}, \vec{b}, \vec{c}$ are three mutually perpendicular vectors and $\left|\vec{a}\right| = \left|\vec{b}\right| = \left|\vec{c}\right| = m$, then the value of $\left|\vec{a} + \vec{b} + \vec{c}\right|$ is -

A. 3m

B. 2m

C. $\sqrt{3}$ m

D. $\sqrt{2}$m

Answer: C

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41. Find the range of the function f(x) =$|x - 1| + |x - 2|$, $-1 \leq x \leq 3$

A. $a = -11, b = 6$

B. $a = -6, b = 11$

C. $a = -6, b = -11$

D. $a = 11, b = -6$

Answer: B

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42. In the mean value theorem $f(b) - f(a) = (b - a)f'(c)(a < c < b)$, if $a = \frac{\pi}{6}, b = \frac{5\pi}{6}$ and $f(x) = \log(\sin x)$, then the value of c is -

A. $\frac{\pi}{4}$

B. $\frac{\pi}{3}$

C. $\frac{\pi}{2}$

D. $\frac{2\pi}{3}$

Answer: C

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43. The value of $\lim_{x \to 0} \dfrac{27^x - 9^x - 3^x + 1}{\log_e\left(1 + \dfrac{x^2}{2}\right)}$ is equal to -

A. $4\left(\log_e 3\right)^2$

B. $2\left(\log_e 3\right)^2$

C. $8\left(\log_e 3\right)^2$

D. $\left(\log_e 3\right)^2$

Answer: A

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44. The value of $\lim_{x \to 0}(1 - 3x)^{\frac{3}{x}}$ is equal to -

A. e^6

B. e^{-6}

C. e^9

D. e^{-9}

Answer: D

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45. If $x\sqrt{1 - y^2} + y\sqrt{1 - x^2} = k$, then the value of $\frac{dy}{dx}$ at x=0 is -

A. $\sqrt{1 - k^2}$

B. $-\sqrt{1 - k^2}$

C. k

D. $-k$

Answer: B

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46. If $x = a\cot\theta$ and $y = \frac{1}{x^2 + a^2}$, then the value of $\frac{d^2y}{dx^2}$ at $\theta = \frac{\pi}{6}$ is

-

A. $\frac{1}{a^2}$

B. $-\frac{1}{4a^4}$

C. $\frac{2}{a^4}$

D. $-\frac{2}{a^4}$

Answer: A

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47. If $y = \left(\sin^{-1}x\right)^2 + \left(\cos^{-1}x\right)^2$, then which of the following is correct ?

A. $\left(1 - x^2\right)y_2 + xy_1 + 4 = 0$

B. $\left(1 + x^2\right)y_2 - xy_1 - 4 = 0$

C. $\left(1 - x^2\right)y_2 + (x - 2)y_1 = 2$

D. $\left(1 - x^2\right)y_2 - xy_1 + 4 = 0$

Answer: C

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48. If $y = e^{m\sin^{-1}x}$, then the value of $\left[\frac{d^2y}{dx^2}\right]_{x=0}$ is -

A. $m^2e^{m\pi}$

B. $-m^2 e^{m\pi}$

C. m^2

D. $-m^2$

Answer: C

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49. If $x\sqrt{1+y} + y\sqrt{1+x} = 0$ then the value of $\frac{dy}{dx}$ is -

A. $\frac{1}{1+x^2}$

B. $-\frac{1}{1+x^2}$

C. $\frac{1}{(1+x)^2}$

D. $-\frac{1}{(1+x)^2}$

Answer: D

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50. If $x^2 + y^2 = t + \frac{1}{t}$ and $x^4 + y^4 = t^2 + \frac{1}{t^2}$, then the value of $-x^3y\frac{dy}{dx}$ is -

A. 1

B. $\frac{1}{2}$

C. $\frac{1}{3}$

D. $\frac{1}{4}$

Answer: A

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51. If $\sin y = x\sin(a + y)$, then the value of $\frac{dy}{dx}$ is -

A. $\sin(a+y)$

B. $\dfrac{\sin^2(a+y)}{\sin a}$

C. $\dfrac{\sin^2(a+y)}{\cos a}$

D. $\dfrac{\sin^2(a+y)}{\sin y}$

Answer: B

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52. If $y=\tan^{-1}\dfrac{\sqrt{1+x^2}-\sqrt{1-x^2}}{\sqrt{1+x^2}+\sqrt{1-x^2}}$, then the value of $\dfrac{dy}{dx}$ is -

A. $\dfrac{x^2}{\sqrt{1-x^4}}$

B. $\dfrac{x^2}{\sqrt{1+x^4}}$

C. $\dfrac{x}{\sqrt{1-x^4}}$

D. $\frac{x}{\sqrt{1 - x^4}}$

Answer: C

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53. If the equation $a_n x^n + a_{n-1} x^{n-1} + \ldots + a_1 x = 0\left(a_1 \neq 0, n \geq 2\right)$, has a positive root α, then the equation $n a_n x^{n-1} + (n-1) a_{n-1} x^{n-2} + \ldots + a_1 = 0$ has a positive root, which is -

A. greater than or equal to α,

B. equal to α,

C. smaller than α,

D. greater than α.

Answer: C

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54. If $x\sin y + y\cos x = \pi$, then the value of $y''(0)$ is -

A. π

B. $-\pi$

C. 1

D. 0

Answer: A

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55. Let f(x) be a function satisfying $f'(x) = f(x)$ with $f(0) = 1$ and g(x) be a function that satisfies $f(x) + g(x) = x^2$. Then the value of the integral $\int_0^1 f(x)g(x)dx$ is equal to -

A. $e + \frac{e^2}{2} + \frac{5}{2}$

B. $e - \frac{e^2}{2} - \frac{5}{2}$

C. $e + \frac{e^2}{2} - \frac{5}{2}$

D. $e - \frac{e^2}{2} - \frac{3}{2}$

Answer: D

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56. The value of $\int \frac{dx}{x(x^7 + 1)}$ is equal to -

A. $\log\left|\frac{x^7}{x^7 + 1}\right| + c$

B. $\frac{1}{7}\log\left|\frac{x^7}{x^7 + 1}\right| + c$

C. $\log\left|\frac{x^7 + 1}{x^7}\right| + c$

D. $\frac{1}{7}\log\left|\frac{x^7+1}{x^7}\right|+c$

Answer: B

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57. If $f(x) = |x - 1|$, then the value of $\int_0^2 f(x)dx$ is -

A. 2

B. 0

C. 1

D. -2

Answer: C

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58. If $I_m = \int_1^x (\log x)^m dx$ satisfies the relation $I_m = x(\log x)^m - lI_{m-1}$, then which one of the following is correct ?

A. $l = m$

B. $l = m - 1$

C. $l = m + 1$

D. $l = m^2 + 1$

Answer: A

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59. If $\int_{-\frac{1}{2}}^{\frac{1}{2}} \cos x \log\left(\frac{1+x}{1-x}\right) dx = k\log 2$, then the value of k is -

A. $\frac{1}{2}$

B. 0

C. 1

D. -1

Answer: B

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60. The value of $\int \cos\left[2\cot^{-1}\sqrt{\frac{1-x}{1+x}}\right]dx$ is equal to -

A. $\frac{1}{2}x+c$

B. $\frac{1}{2}\sin\left[\cot^{-1}\sqrt{\frac{1-x}{1+x}}\right]+c$

C. $\frac{1}{2}x^2+c$

D. $-\frac{1}{2}x^2+c$

Answer: D

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61. If $\int_{\sin x}^{1} t^2 f(t) dt = 1 - \sin x$, then the value of $f\left(\frac{1}{\sqrt{3}}\right)$ is -

A. 3

B. $\sqrt{3}$

C. $\frac{1}{\sqrt{3}}$

D. $\frac{1}{3}$

Answer: A

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62. If $\int \frac{\cos 4x + 1}{\cot x - \tan x} dx = k \cos 4x + c$, then the value of k is -

A. $-\frac{1}{2}$

B. $-\frac{1}{4}$

C. $-\frac{1}{8}$

D. $\frac{1}{8}$

Answer: C

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63. The value of integral $\int \frac{dx}{\sin(x-a)\sin(x-b)}$ is -

A. $\frac{1}{\sin(a-b)}\log\left|\frac{\sin(x-a)}{\sin(x-b)}\right| + c$

B. $\frac{1}{\sin(b-a)}\log\left|\frac{\sin(x-a)}{\sin(x-b)}\right| + c$

C. $\frac{1}{\sin(a-b)}\log\left|\frac{\sin(x-b)}{\sin(x-a)}\right| + c$

D. $\frac{1}{\sin(b-a)}\log\left|\frac{\sin(x-b)}{\sin(x-a)}\right| + c$

Answer: A

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64. If an antiderivative of f(x) is e^x and that of g(x) is cosx, then the value of $\int f(x)\cos x dx + \int g(x)e^x dx$ is equal to -

A. $f(x)g(x) + c$

B. $e^x \cos x + c$

C. $f(x) + g(x) + c$

D. $e^x \cos x + f(x)g(x) + c$

Answer: B

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65. The value of $\int \sqrt{e^x - 1}dx$ is equal to -

A. $2\left[\sqrt{e^x - 1} + \tan^{-1}\sqrt{e^x - 1}\right] + c$

B. $\sqrt{e^x - 1} - \tan^{-1}\sqrt{e^x - 1} + c$

C. $\sqrt{e^x - 1} + \tan^{-1}\sqrt{e^x - 1} + c$

D. $2\left[\sqrt{e^x - 1} - \tan^{-1}\sqrt{e^x - 1}\right] + c$

Answer: D

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66. If $I_1 = \int \sin^{-1}x dx$ and $I_2 = \int \sin^{-1}\sqrt{1 - x^2}dx$ then -

A. $I_1 = I_2$

B. $I_2 = \frac{\pi}{2}I_1$

C. $I_1 + I_2 = \frac{\pi}{2}x$

D. $I_1 + I_2 = \frac{\pi}{2}$

Answer: C

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67. The value of $\int \cos^{-\frac{3}{7}} x \sin^{-\frac{11}{7}} x dx$ is equal to -

A. $-\frac{7}{4} \tan^{-\frac{4}{7}} x + c$

B. $\frac{4}{7} \tan^{\frac{4}{7}} x + c$

C. $\log\left|\sin^{\frac{4}{7}} x\right| + c$

D. $\log\left|\cos^{\frac{3}{7}} x\right| + c$

Answer: A

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68. The value of $\int_0^{\frac{\pi}{2}} \frac{2^{\sin x} dx}{2^{\sin x} + 2^{\cos x}}$ is equal to -

A. π

B. $\frac{\pi}{2}$

C. 2π

D. $\frac{\pi}{4}$

Answer: D

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69. The value of $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{dx}{1 + \sqrt{\tan x}}$ is equal to -

A. $\frac{\pi}{2}$

B. $\frac{\pi}{12}$

C. $\frac{\pi}{6}$

D. $\frac{\pi}{4}$

Answer: B

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70. The value of $\int_0^{\frac{\pi}{2}} \frac{\sin^4 x dx}{\sin^4 x + \cos^4 x}$ is equal to -

A. $\frac{\pi}{4}$

B. $\frac{\pi}{2}$

C. π

D. 2π

Answer: C

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71. State which of the following is correct :

If f(x) is a continuous function, then -

A. $\int_{-2}^{2} f(x)dx = \int_{0}^{2}[f(x) - f(-x)]dx$

B. $\int_{-3}^{5} 2f(x)dx = \int_{-6}^{10} f(x - 1)dx$

C. $\int_{-3}^{5} f(x)dx = \int_{-4}^{4} f(x - 1)dx$

D. $\int_{-3}^{5} f(x)dx = \int_{-2}^{6} f(x - 1)dx$

Answer: D

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72. The integrating factor of the linear differential equation $\left(1 - x^2\right)^2 \frac{dy}{dx} + \sqrt{1 - x^2} y = x + \sqrt{1 - x^2}$ is -

A. $\dfrac{x}{\sqrt{1-x^2}}$

B. $-\dfrac{x}{\sqrt{1-x^2}}$

C. $e^{\frac{x}{\sqrt{1-x^2}}}$

D. $e^{-\frac{x}{\sqrt{1-x^2}}}$

Answer: C

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73. Let $f(x) = \dfrac{1-\tan x}{4x-\pi}$ when $0 \leq x \leq \dfrac{\pi}{2}$ and $x \neq \dfrac{\pi}{4}$, if f(x) is continuous at $x = \dfrac{\pi}{4}$, then the value of $f\left(\dfrac{\pi}{4}\right)$ is -

A. $-\dfrac{1}{2}$

B. $\dfrac{1}{2}$

C. 1

D. -1

Answer: A

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74. The solution of the differential equation $(x+y)(dx-dy)=dx+dy$ is -

A. $\log|x+y|=y-x+c$

B. $\log|x+y|=x-y+c$

C. $\log|x+y|=x+y+c$

D. $\log|x+y|+x+y=c$

Answer: B

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75. The solution of the equation $dy = \cos x(2 - y\operatorname{cosec}x)dx$, where $y = \frac{3}{\sqrt{2}}$ when $x = \frac{\pi}{4}$ is -

A. $y = \sin x + \operatorname{cosec}x$

B. $y = \tan\frac{x}{2} + \cot\frac{x}{2}$

C. $y = \frac{1}{\sqrt{2}}\sec\frac{x}{2} + \sqrt{2}\cos\frac{x}{2}$

D. none of these

Answer: A

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76. The order of differential equations of all parabolas having directrix parallel to x-axis is -

A. 1

B. 2

C. 4

D. 3

Answer: D

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77. The general solution of equation $\frac{dy}{dx} + y = \sin x$ is -

A. $y = ce^{-2x} + \frac{1}{4}\sin x - \frac{1}{2}\cos x$

B. $y = ce^{-x}$

C. $y = ce^{-x} + \frac{1}{2}\sin x - \frac{1}{2}\cos x$

D. $y = ce^{-x} + \sin x$

Answer: C

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78. Solution of the differential equation $\frac{dy}{dx} + \sqrt{\frac{1-y^2}{1-x^2}} = 0$ is

A. $y\sqrt{1-y^2} + x\sqrt{1-x^2} = a$

B. $x\sqrt{1-y^2} + y\sqrt{1-x^2} = a$

C. $x\sqrt{1-y^2} - y\sqrt{1-x^2} = a$

D. $y\sqrt{1-y^2} - x\sqrt{1-x^2} = a$

Answer: B

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79. The degree of the differential equation $\left[1+\left(\frac{dy}{dx}\right)^2\right]^{\frac{3}{4}} = \left(\frac{d^2y}{dx^2}\right)^{\frac{1}{3}}$ is -

A. 4

B. $\frac{3}{4}$

C. 9

D. 6

Answer: A

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80. Given $f(0) = 0$ and $f(x) = \frac{1}{1 - e^{-\frac{1}{x}}}$ for $x \neq 0$. Then the function f(x) is -

A. both continuous and differentiable at x=0

B. continuous but not differentiable at x=0

C. continuous at x=0

D. not continuous at x=0

Answer: D

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81. If the line $y = 2x + k$ is a tangent to the curve $x^2 = 4y$, then the value of k is -

A. 4

B. $\frac{1}{2}$

C. -4

D. $-\frac{1}{2}$

Answer: C

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82. The are (in square unit) bounded by the parabola $x^2 = 16y$, y-axis and its latus rectum is -

A. $\frac{32}{3}$

B. $\frac{64}{3}$

C. $\frac{128}{3}$

D. $\frac{16}{3}$

Answer: B

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83. The tangent drawn at the point (0, 1) on the curve $y = e^{2x}$ meets the x-axis at the point -

A. (0, 0)

B. (2, 0)

C. $\left(\frac{1}{2}, 0\right)$

D. $\left(-\frac{1}{2}, 0\right)$

Answer: D

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84. The area (in square unit) bounded by the curve $f(x) = 4 - |x|$ and the x-axis is -

A. 16

B. 32

C. 12

D. 24

Answer: A

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85. If the area bounded by the parabola $y = x - x^2$ and the line $y = mx$ is $\frac{9}{2}$ square unit, then one value of m is -

A. 1

B. 2

C. 3

D. 4

Answer: D

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86. The point of intersection of the tangents to the parabola $y^2 = 4ax$ at the points t_1 and t_2 is -

A. $\{2at_1t_2, a(t_1 + t_2)\}$

B. $\{2at_1t_2, 2a(t_1 + t_2)\}$

C. $\{at_1t_2, a(t_1 + t_2)\}$

D. none of these

Answer: C

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87. The locus of the point of intersection of two perpendicular tangents to the ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$ is -

A. $x^2 + y^2 = 5$

B. $x^2 + y^2 = 13$

C. $x^2 + y^2 = 4$

D. $x^2 + y^2 = 9$

Answer: B

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88. If the area bounded by the parabola $y = 2 - x^2$ and the line $x + y = 0$ is A square unit, then the value of A is -

A. $\frac{9}{2}$

B. $\frac{2}{9}$

C. $\frac{1}{3}$

D. $\frac{7}{3}$

Answer: A

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89. The angle between the tangents drawn from the point (1, 4) to the parabola $y^2 = 4x$ is -

A. $\frac{\pi}{2}$

B. $\frac{\pi}{6}$

C. $\frac{\pi}{4}$

D. $\frac{\pi}{3}$

Answer: D

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90. The area (in square unit) of the region bounded by the curve $y = |x - 2|$, x-axis and the ordinates x=1, x=3 is -

A. 4

B. 3

C. 2

D. 1

Answer: D

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91. If the line $2x + \sqrt{6}y = 2$ is a tangent to the hyperbola $x^2 - 2y^2 = 4$, then the coordinates of the point of contact are -

A. $\left(4, -\sqrt{6}\right)$

B. $\left(7, -2\sqrt{6}\right)$

C. $(2, 3)$

D. $\left(\sqrt{6}, 1\right)$

Answer: A

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92. The equation of the normal to the curve $x^3 + y^3 = 8xy$ at the point where it meets the parabola $y^2 = 4x$ is -

A. $x + y = 0$

B. $x - y = 0$

C. $x - y + 4 = 0$

D. $x + y + 4 = 0$

Answer: B

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93. The curve $x = 1 - 3t^2, y = t - 3t^3$ is symmetrical with respect to -

A. both axes

B. y-axis

C. x-axis

D. none of these

Answer: C

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94. The equation of the curve in which the portion of the tangent between the coordinate axes is bisected at the point of contact is a/an-

A. ellipse

B. rectangular hyperbola

C. hyperbola

D. parabola

Answer: B

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95. The equation of the normal to the parabola $y^2 = 5x$. Which makes an angle of 45° with the x-axis is -

A. $x - y = 15$

B. $2(x - y) = 15$

C. $4(x - y) = 15$

D. $8(x - y) = 15$

Answer: C

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96. The maximum value of $Z = 3x + 4y$ subject to the constraints $x + y \leq 40, x + 2y \leq 60, x \geq 0$ and $y \geq 0$ is -

A. 140

B. 120

C. 100

D. 80

Answer: A

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97. The minimum value of $\frac{1}{2}(7 - \cos 2x)$ is -

A. $\frac{7}{2}$

B. 4

C. $\frac{5}{2}$

D. 3

Answer: D

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98. If $g(x) = \min\left(x, x^2\right)$ where x is a real number then -

A. g(x) is a decreasing function

B. g(x) is an increasing function

C. g(x) is a constant function

D. The function g(x) is neither decreasing nor increasing

Answer: B

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99. The value of a so that the sum of the squares of the roots of the equation $x^2 - (a - 2)x + 1 - a = 0$ assumes the least value is -

A. 3

B. 2

C. 1

D. -1

Answer: C

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100. Twenty metres are available to fence a land in the form of a circular sector. If the land should have the greatest possible surface area, then the the radius of the circle must be -

A. 5 m

B. 4 m

C. 6 m

D. 3 m

Answer: A

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101. Area (in square unit) of the greatest rectangle that can be inscribed in the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is -

A. $\sqrt{ab}$

B. $\frac{a}{b}$

C. ab

D. 2ab

Answer: D

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102. The point on the parabola $2y = x^2$, which is nearest to the point (0, 3) is -

A. $(\pm 4, 8)$

B. $\left(\pm 1, \frac{1}{2}\right)$

C. $(\pm 2, 2)$

D. $\left(\pm 3, \frac{9}{2}\right)$

Answer: C

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103. Let $f(x)$ be a differentiable function. If $h(x) = \frac{1}{3}\{f(x)\}^3 + \{f(x)\}^2 + f(x) + \frac{1}{3}$ then which one of the following is correct ?

A. h(x) increases as f(x) decreases

B. h(x) increases as f(x) increases

C. h(x) always increases whether f(x) increases or decreases

D. nothing definite can be said

Answer: B

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104. What is the value of b for which the function $f(x) = \sin x - bx + c$ is decreasing in the interval $(-\infty, \infty)$?

A. $b > 1$

B. $b \geq 1$

C. $b < 1$

D. $b \leq 1$

Answer: A

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105. The radius of a circular plate is increasing at the rate of 0.01 cm/s when the radius is 12 cm. Then the rate at which the area (in cm^2/s) increases is -

A. 0.25π

B. 0.60π

C. 1.2π

D. 0.24π

Answer: D

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106. A spherical balloon is being inflated at the rate of 35 cm^3 /min. Then the rate of increase of the surface area (in cm^2/min) of the balloon when its diameter is 14 cm, is -

A. 7

B. 10

C. 17.5

D. 28

Answer: B

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107. Electric current C, measured by a galvanometer, is given by the equation $C = k\tan\theta$, where k is constant. Then the percentage error in the current corresponding to an error 0.7 percent in the measurement of θ when $\theta = 45^\circ$ is -

A. 1.4

B. 2.8

C. 1.1

D. 2.2

Answer: C

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108. The value of Var (4x+3) is

A. 16 Var (x)

B. 4 Var (x)

C. 12 Var (x)

D. 16 Var (x)+9

Answer: A

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109. If the side of an equilateral triangle increases at the rate of $\sqrt{3}$ cm/s and its area at the rate of 12 cm^2/s, then the length (in cm) of a side of the triangle is -

A. 4

B. 6

C. 8

D. 16

Answer: C

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110. If $y = 3x^2 + 2$ and if x changes from 10 to 10.1, then the approximate change in y will be -

A. 4

B. 6

C. 5

D. 8

Answer: B

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