

MATHEMATICS

1) $\int e^x \left(\frac{1-x}{1+x^2} \right)^2 \cdot dx = \text{_____} + C$

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

(B) $\frac{e^x}{1+x^2}$

(C) $\frac{e^x}{(1+x^2)^2}$

(D) $\frac{e^x}{1+x}$

2) $\int \frac{e^{2025+x} - e^{2025-x}}{e^{2026+x} + e^{2026-x}} \cdot dx = \text{_____} + C$

(A) $\log|e^x + e^{-x}|$

(B) $e \log|e^x + e^{-x}|$

(C) $\frac{1}{e} \log|e^x + e^{-x}|$

(D) $-\frac{1}{e} \log|e^x + e^{-x}|$

3) Area lying in the first quadrant and bounded by ellipse $4x^2 + 9y^2 = 144$ is _____.

(A) 12π

(B) 24π

(C) 8π

(D) 6π

(Space for Rough Work)

- 4) The area bounded by the curve $y = x|x|$, X-axis and the ordinates $x = -1$ and $x = 1$ is _____.

(A) $\frac{1}{3}$

(B) 0

☒ (C) $\frac{2}{3}$

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

- 5) The order and the degree of the differential equation

$$\sqrt{1 + \left(\frac{d^2y}{dx^2}\right)^2} = \sqrt[3]{x + \left(\frac{dy}{dx}\right)^3} \text{ is respectively } \underline{\hspace{2cm}} \text{ and } \underline{\hspace{2cm}}$$

(A) 3, 2

(B) 2, 3

(C) 1, 6

☒ (D) 2, 6

- 6) The number of arbitrary constants in the particular solution of a differential equation of third order are

(A) 2

(B) 3

(C) 1

☒ (D) 0

(Space for Rough Work)

- 7) The general solution of the differential equation $\frac{dy}{dx} = e^{x+y}$ is _____.
(A) $e^x + e^y = C$ (B) $e^x + e^{-y} = C$
(C) $e^{-x} + e^y = C$ (D) $e^{-x} + e^{-y} = C$
- 8) If two vectors $\vec{a}$ and $\vec{b}$ are such that $|\vec{a}|=2$, $|\vec{b}|=3$ and $\vec{a} \cdot \vec{b} = 4$ then $|\vec{a} - \vec{b}| =$ _____.
(A) 5 (B) $\sqrt{5}$
(C) 13 (D) $\sqrt{17}$
- 9) The area of the triangle with vertices A(1, 1, 2), B(2, 3, 5) and C(1, 5, 5) is _____.
(A) $\sqrt{61}$ (B) $\sqrt{43}$
(C) $\frac{\sqrt{43}}{2}$ (D) $\frac{\sqrt{61}}{2}$
- 10) The value of $\hat{i} \cdot (\hat{k} \times \hat{j}) + \hat{j} \cdot (\hat{k} \times \hat{i}) + \hat{k} \cdot (\hat{j} \times \hat{i})$ is _____.
(A) -1 (B) 0
(C) 1 (D) 3

(Space for Rough Work)

11) The angle between the pair of lines given by

$$\vec{r} = 3\hat{i} + 2\hat{j} - 4\hat{k} + \lambda(\hat{i} + 2\hat{j} + 2\hat{k}) \quad \text{and} \quad \vec{r} = 5\hat{i} - 2\hat{j} + \mu(3\hat{i} + 2\hat{j} + 6\hat{k}) \quad \text{is}$$

_____.

(A) $\cos^{-1}\left(-\frac{19}{21}\right)$

(B) $\cos^{-1}\left(\frac{19}{21}\right)$

(C) $\sin^{-1}\left(\frac{19}{21}\right)$

(D) $\cos^{-1}\left(\frac{\sqrt{19}}{21}\right)$

12) If the lines $\frac{1-x}{3} = \frac{7y-14}{2p} = \frac{3-z}{-2}$ and $\frac{7-7x}{3p} = \frac{y-5}{1} = \frac{6-z}{5}$ are perpendicular, then the value of p is _____.

(A) $\frac{35}{11}$

(B) $\frac{11}{70}$

(C) $\frac{70}{11}$

(D) $-\frac{70}{11}$

13) The vector equation of the line passing through the point $(1, 2, -4)$ and perpendicular to the two lines $\frac{x-8}{3} = \frac{y+19}{-16} = \frac{z-10}{7}$ and

$$\frac{x-15}{3} = \frac{y-29}{8} = \frac{z-5}{-5} \quad \text{is} \quad \underline{\hspace{2cm}}.$$

(A) $\vec{r} = \hat{i} + 2\hat{j} - 4\hat{k} + \lambda(2\hat{i} + 3\hat{j} - 6\hat{k})$

(B) $\vec{r} = \hat{i} + 2\hat{j} - 4\hat{k} + \lambda(2\hat{i} - 3\hat{j} + 6\hat{k})$

(C) $\vec{r} = \hat{i} + 2\hat{j} - 4\hat{k} + \lambda(2\hat{i} + 3\hat{j} + 6\hat{k})$

(D) $\vec{r} = \hat{i} + 2\hat{j} - 4\hat{k} + \lambda(2\hat{i} - 3\hat{j} - 6\hat{k})$

(Space for Rough Work)

- 14) The coordinates of the corner points of the bounded feasible region are $(0, 10)$, $(5, 5)$, $(15, 15)$, $(0, 20)$. The minimum of the objective function $z = 3x + 9y$ is ____.
- (A) 90 (B) 180
(C) 30 (D) 60
- 15) For linear programming problem, the objective function is $z = px + qy$, $p, q > 0$. If at the corner points $(0, 10)$ and $(5, 5)$ the value of z are 90 and 60 respectively, then relation between p and q is ____.
- (A) $q = 3p$ (B) $p = 3q$
(C) $q = 2p$ (D) $p = 2q$
- 16) Let A and B be two events such that $P(A) = \frac{5}{11}$, $P(B) = \frac{2}{11}$ and $P(A \cup B) = \frac{3}{11}$ then $P(A' | B') =$ ____.
- (A) $\frac{1}{2}$ (B) $\frac{8}{9}$
(C) $\frac{3}{5}$ (D) $\frac{2}{9}$
- 17) If A and B are any two events such that $P(A) + P(B) - P(A \text{ and } B) = P(A)$ then ____.
- (A) $P(A | B) = 1$ (B) $P(B | A) = 1$
(C) $P(B | A) = 0$ (D) $P(A | B) = 0$

(Space for Rough Work)

- 18) Three cards are drawn successively, without replacement from a pack of 52 well shuffled cards. The probability that first two cards are kings and the third card drawn is an ace is _____.

(A) $\frac{3}{5525}$

(B) $\frac{1}{135200}$

(C) $\frac{2}{5525}$

(D) $\frac{3}{135200}$

- 19) Let R be the relation in the set N given by $R = \{(a, b) : a = b - 2, b < 6\}$ then _____.

(A) $(8, 3) \in R$

(B) $(6, 8) \in R$

(C) $(8, 7) \in R$

(D) $(2, 4) \in R$

- 20) Let $f: N \rightarrow N$ be defined by $f(n) = \begin{cases} \frac{n+1}{2} & \text{if } n \text{ is odd} \\ \frac{n}{2} & \text{if } n \text{ is even} \end{cases}$, for all $n \in N$ then f is _____.

(A) One - one but not onto

~~(B)~~ One - one and onto

~~(C)~~ Many - one and onto

(D) Neither one - one nor onto

(Space for Rough Work)

21) If $\cos^{-1}x = y$ then _____.

(A) $-\frac{\pi}{2} \leq y \leq \frac{\pi}{2}$

☒ (B) $0 \leq y \leq \pi$

(C) $0 < y < \pi$

(D) $-\frac{\pi}{2} < y < \frac{\pi}{2}$

22) $\sin^{-1}\left(\sin \frac{3\pi}{5}\right) =$ _____

☒ (A) $\frac{2\pi}{5}$

(B) $\frac{\pi}{5}$

☒ (C) $\frac{3\pi}{5}$

(D) $\frac{4\pi}{5}$

23) $\tan^{-1}\left[2 \cos\left(2 \sin^{-1} \frac{1}{2}\right)\right] =$ _____.

(A) $-\frac{\pi}{4}$

☒ (B) $\frac{\pi}{4}$

(C) $\frac{3\pi}{4}$

(D) $-\frac{3\pi}{4}$

(Space for Rough Work)

24) If $A = \begin{bmatrix} a & b \\ c & -a \end{bmatrix}$ is such that $A^2 = I$, then

(A) $1 - a^2 + bc = 0$

(B) $1 + a^2 + bc = 0$

☒ (C) $1 - a^2 - bc = 0$

(D) $1 + a^2 - bc = 0$

25) If A and B are Skew Symmetric matrices of same order, then $AB - BA$ is a _____.

(A) Symmetric matrix

☒ (B) Skew Symmetric matrix

(C) Zero matrix

(D) Identity matrix

26) If $A = \begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix}$, then $A^2 + I =$ _____.

☒ (A) $A - I$

(B) $A - 2I$

(C) $A + I$

(D) $I - A$

27) If area of triangle is 35 sq. units with vertices $(2, -6)$, $(5, 4)$ and $(k, 4)$. Then k is _____.

(A) -2

(B) 12

(C) $-12, -2$

☒ (D) $12, -2$

(Space for Rough Work)

28) If $A = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & -3 \end{bmatrix}$, then $A^2 + B^2 =$ _____

(A) $\begin{bmatrix} 5 & 0 & 0 \\ 0 & 13 & 0 \\ 0 & 0 & 25 \end{bmatrix}$

(B) $\begin{bmatrix} 5 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 7 \end{bmatrix}$

(C) $\begin{bmatrix} 3 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

(D) $\begin{bmatrix} 3 & 0 & 0 \\ 0 & 5 & 0 \\ 0 & 0 & 7 \end{bmatrix}$

29) If inverse matrix of $A = \begin{bmatrix} 2 & 3 \\ 1 & -4 \end{bmatrix}$ is $A^{-1} = \begin{bmatrix} a & \frac{3}{11} \\ \frac{1}{11} & b \end{bmatrix}$, then $a + b =$ _____.

(A) $-\frac{2}{11}$

(B) $\frac{2}{11}$

(C) $\frac{6}{11}$

(D) $-\frac{6}{11}$

(Space for Rough Work)

30) If function f is continuous at point $x = \pi$ and $f(x) = \begin{cases} kx + 1 & ; x \leq \pi \\ \cos x & ; x > \pi \end{cases}$, then the value of k is _____.

(A) $\frac{1}{\pi}$

(B) $\frac{2}{\pi}$

☒ (C) $-\frac{2}{\pi}$

(D) 0

31) If $x = at^2$, $y = 2at$ then $\frac{d^2y}{dx^2} =$ _____

☒ (A) $-\frac{a}{xy}$

(B) $\frac{a}{xy}$

(C) $\frac{ax}{y}$

(D) $-\frac{ax}{y}$

32) If $y = \log_{2026}(\log_{2025} x)$ then $\frac{dy}{dx} =$ _____.

(A) $\frac{1}{2025x \log x}$

(B) $\frac{1}{x \log x \log 2025}$

☒ (C) $\frac{1}{x \log x \log 2026}$

(D) $\frac{1}{2026x \log x}$

(Space for Rough Work)

33) If $e^y(x+1) = 1$ then $\frac{d^2y}{dx^2} - \left(\frac{dy}{dx}\right)^2 = \underline{\hspace{2cm}}$.

(A) $-\frac{1}{x+1}$

(B) e^y

(C) $\frac{1}{x+1}$

☒ (D) 0

34) The total revenue in Rupees received from the sale of x units of a product is given by $R(x) = 3x^2 + 36x + 5$. The marginal revenue, when $x = 15$ is _____.

(A) 96

(B) 116

(C) 90

☒ (D) 126

35) The maximum value of the function $f(x) = -|x+1| + 3$, $x \in \mathbb{R}$ is _____.

(A) -2

☒ (B) 2

☒ (C) 3

(D) 4

36) The interval in which $y = x^2 \cdot e^{-x}$ is decreasing is _____.

(A) $(-2, 0)$

(B) $(-\infty, \infty)$

☒ (C) $(2, \infty)$

(D) $(0, 2)$

(Space for Rough Work)

37) $\int \sec^2 x \cdot \operatorname{cosec}^2 x \cdot dx = \text{_____} + C$

☒ (A) $\tan x - \cot x$

(C) $\tan x \cdot \cot x$

☒ (B) $\tan x + \cot x$

(D) $\tan x - \cot 2x$

38) $\int \frac{dx}{\sqrt{9x - 4x^2}} = \text{_____} + C$

☒ (A) $\frac{1}{2} \sin^{-1} \left(\frac{8x-9}{9} \right)$

(C) $\frac{1}{3} \sin^{-1} \left(\frac{9x-8}{8} \right)$

(B) $\frac{1}{9} \sin^{-1} \left(\frac{9x-8}{8} \right)$

(D) $\frac{1}{2} \sin^{-1} \left(\frac{9x-8}{9} \right)$

39) $\int_0^{\pi} \left(\sin^2 \frac{x}{2} - \cos^2 \frac{x}{2} \right) dx = \text{_____}$

(A) 1

(C) -1

☒ (B) 0

(D) 2

40) $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{dx}{1 + \sqrt{\cot x}} = \text{_____}$

☒ (A) $\frac{\pi}{12}$

(C) 0

(B) $\frac{\pi}{6}$

(D) 1

(Space for Rough Work)