

MATHEMATICS

1) $\int \frac{x^5 + 1}{x + 1} dx = \underline{\hspace{2cm}} + C$

(A) $\sum_{n=1}^4 \left((-1)^{n+1} \cdot \frac{x^n}{n} \right)$

(B) $\sum_{n=1}^5 \left((-1)^{n+1} \cdot \frac{x^n}{n} \right)$

(C) $\sum_{n=1}^4 \left((-1)^n \cdot \frac{x^n}{n} \right)$

(D) $\sum_{n=1}^5 \left((-1)^n \cdot \frac{x^n}{n} \right)$

2) $\int_{-1}^1 \cot^{-1} x \, dx = \underline{\hspace{2cm}}$

(A) 0

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

(C) π

(D) 2π

$\int_0^1 \cot^{-1} x \, dx$

$\int_0^1 \tan^{-1}(\pi - x) \, dx$

$\int_0^1 \tan \pi - \int_0^1$

0

3) $\int \tan\left(\frac{\pi}{4} - x\right) \cdot (2 + 2\sin 2x) dx = \underline{\hspace{2cm}} + C.$

(A) $\sin 2x$

(B) $-\sin 2x$

(C) $2\sin 2x$

(D) $-2\sin 2x$

4) $\int_0^1 \frac{dx}{(3x+2)+\sqrt{3x+2}} = \underline{\hspace{2cm}}$

(A) $-\frac{2}{3} \log \left| \frac{\sqrt{5}+1}{\sqrt{2}+1} \right|$

(B) $\frac{2}{3} \log \left| \frac{\sqrt{5}+1}{\sqrt{2}+1} \right|$

(C) $2 \log |\sqrt{5}+1|$

(D) $\frac{2}{3} \log |\sqrt{5}+1|$

5) If $\int \frac{\cos 3x}{\sin x} dx = p \cos 2x + q \log |\sin x| + C$, then $p + q = \underline{\hspace{2cm}}$

(A) 0

(B) $\frac{3}{2}$

(C) 2

(D) $\frac{1}{2}$

6) $\int e^x (2021 + \tan x + \tan^2 x) dx = \underline{\hspace{2cm}} + C.$

(A) $(2021 + \tan x)e^x$

(B) $(2020 + \tan x)e^x$

(C) $(2020 + \tan x)$

(D) $(2000 + \tan x)e^x$

7) If area bounded by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is $\frac{\pi}{6}$, then equation of ellipse is _____

(A) $\frac{x^2}{4} + \frac{y^2}{9} = 1$

(B) $4x^2 + 9y^2 = 1$

(C) $\frac{x^2}{36} + y^2 = 1$

(D) $x^2 + y^2 = 36$

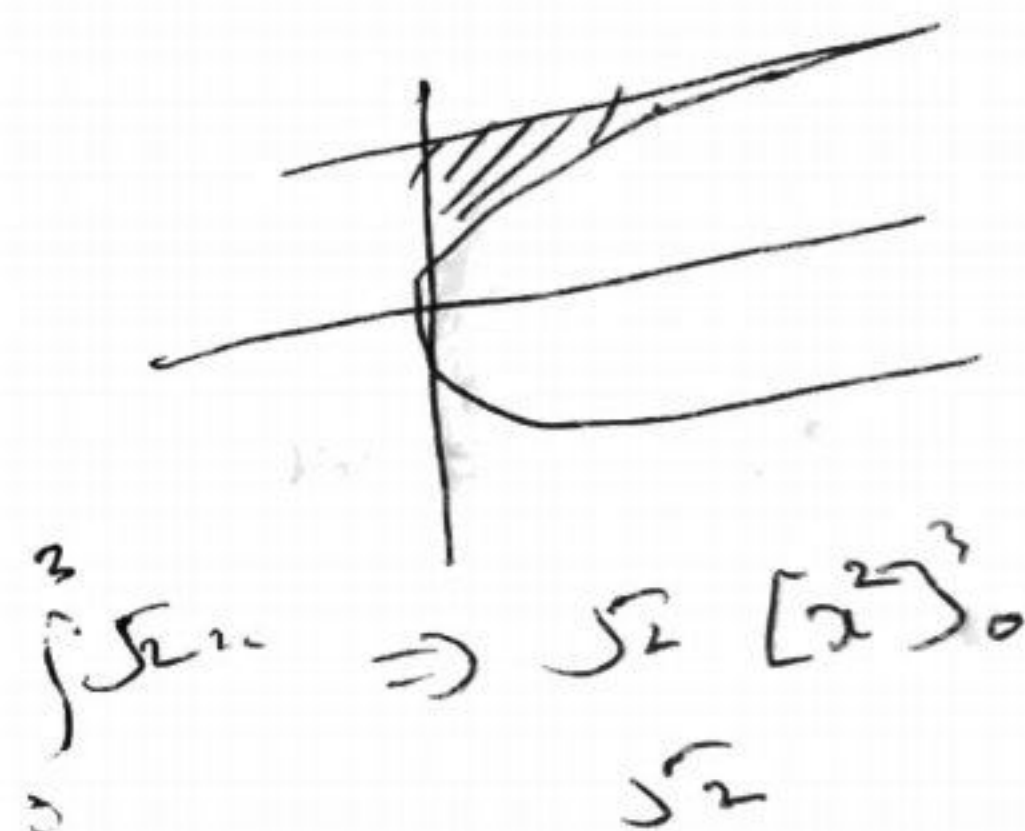
8) Area of the region bounded by the curve $y^2 = 4x$, Y-axis and the line $y = 3$ is _____

(A) 2

(B) $\frac{9}{3}$

(C) $\frac{9}{4}$

~~(D) $\frac{9}{2}$~~



9) Area of the region bounded by the curve $y^2 = x$ and the lines $x = 1$, $x = 4$ and X-axis in the first quadrant is _____

~~(A) $\frac{14}{3}$~~

(B) $\frac{7}{3}$

(C) $\frac{28}{3}$

(D) 14



10) 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) $e^x - e^y = C$~~

$$\frac{dy}{dx} = e^x \cdot e^{-y}$$

$$e^y dy = e^x dx$$

$$e^y - e^{-y} = C$$

11) The number of arbitrary constants in the particular solution of a differential equation of order 4 are : _____

~~(A) 4~~

(B) 2

(C) 3

(D) 0

12) Order and degree of the differential equation $e^{\frac{d^2y}{dx^2}} = x$ are _____ respectively.

~~(A) 2 and not defined~~

(B) 1 and 2

(C) 2 and 1

(D) 1 and not defined

13) If $\vec{c}$ is the unit vector in the direction of sum of the vectors $\vec{a} = 2\hat{i} + 2\hat{j} - 5\hat{k}$ and $\vec{b} = 2\hat{i} + \hat{j} + 3\hat{k}$, then $|\vec{c}| =$ _____

~~(A) $\frac{4}{\sqrt{29}}\hat{i} + \frac{3}{\sqrt{29}}\hat{j} - \frac{2}{\sqrt{29}}\hat{k}$~~

(B) 1

(C) 0

(D) -1

14) Let the vector $\vec{a}$ and $\vec{b}$ be such that $|\vec{a}| = 3$ and $|\vec{b}| = \frac{\sqrt{2}}{3}$, then $\vec{a} \times \vec{b}$ is unit vector, if the angle between $\vec{a}$ and $\vec{b}$ is _____

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

(B) $\frac{\pi}{3}$

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

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

15) The area of parallelogram whose adjacent sides are determined by the vectors $\vec{a} = \hat{i} - \hat{j} + 3\hat{k}$ and $\vec{b} = 2\hat{i} - 7\hat{j} + \hat{k}$ is _____

(A) $15\sqrt{2}$

(B) 15

(C) $\frac{15}{\sqrt{2}}$

~~(D)~~ $\frac{15}{2}$

$$\begin{vmatrix} 1 & -1 & 3 \\ 2 & -7 & 1 \end{vmatrix}$$

$$(-1+21) - (1-6) + (-7)$$

$$(20) + 5 - 5$$

16) The distance of a point $(2, 5, -3)$ from the plane $6x - 3y + 2z - 4 = 0$ is _____

~~(A)~~ $\frac{13}{\sqrt{7}}$

(B) $\frac{5}{7}$

(C) $\frac{5}{\sqrt{7}}$

(D) $\frac{13}{7}$

17) The coordinates of the foot of the perpendicular drawn from the origin to the plane $2x - 3y + 4z - 12 = 0$ is _____

(A) $\left(\frac{12}{29}, -\frac{18}{29}, \frac{24}{29}\right)$

(B) $\left(\frac{24}{29}, -\frac{36}{29}, \frac{48}{29}\right)$

(C) $\left(\frac{24}{\sqrt{29}}, -\frac{36}{\sqrt{29}}, \frac{48}{\sqrt{29}}\right)$

~~(D)~~ $\left(\frac{12}{\sqrt{29}}, -\frac{18}{\sqrt{29}}, \frac{24}{\sqrt{29}}\right)$

18) If $2x + 3y - z + 7 = 0$ and $x - 2y + kz + 2 = 0$ are two perpendicular planes, then $k =$ _____

(A) 4

(B) 8

(C) -4

(D) -8

19) Minimise : $Z = 2x + 3y$, subject to constraints $2x + 4y \leq 12$, $x + y \leq 3$, $x \geq 0$ and $y \geq 0$.

(A) 12

(B) 9

(C) 0

(D) 6

(Space for Rough Work)

20) If $P(A) = \frac{6}{11}$, $P(B) = \frac{5}{11}$ and $P(A \cup B) = \frac{7}{11}$, then $P(A/B) =$ _____

100% ~~(A)~~ $\frac{4}{5}$

(C) $\frac{4}{11}$

(B) $\frac{2}{3}$

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

$$P(A/B) = \frac{P(A \cap B)}{P(B)} = \frac{4/11}{5/11}$$

21) For two mutually exclusive events A and B if $P(A) = \frac{1}{2}$, $P(A \cup B) = \frac{3}{5}$ and $P(B') = p$, then $p =$ _____

(A) $\frac{1}{5}$

(C) $\frac{2}{5}$

~~(B)~~ $\frac{9}{10}$

(D) $\frac{1}{10}$

$$\frac{1/2}{3/5} = \frac{5}{6}$$

$$P(A/B) = P(A)$$

22) If A and B are two events such that $P(A) \neq 0$ and $P(B/A) = 1$, then _____

(A) $B \subset A$

(C) $A = \emptyset$

(B) $B = \emptyset$

~~(D)~~ $A \subset B$

23) Let R be the relation in the set $\{x : x \in \mathbb{N}, x \leq 4\}$ given by $R = \{(1, 1), (2, 2), (3, 3)\}$ then, R is _____.

(A) reflexive and symmetric but not transitive

(B) symmetric and transitive but not reflexive

~~(C)~~ reflexive and transitive but not symmetric

(D) an equivalence relation

Not
Sure

24) Function $f : \mathbb{R} \rightarrow \mathbb{R}$ defined as $f(x) = x^3$, f is _____.

(A) one-one and onto

(B) one-one but not onto

(C) many-one and onto

(D) neither one-one nor onto

25) If $f(x) = \frac{1+x}{1-x}$; $x \neq 1$, then $f(x) \cdot f(y) =$ _____.

(A) $f\left(\frac{x+y}{1-xy}\right)$

(B) $f(x \cdot y)$

(C) $f\left(\frac{x+y}{1+xy}\right)$

(D) $f\left(\frac{1}{1+xy}\right)$

26) $\cos^2(\sin^{-1} x) + \sin^2(\cos^{-1} x) =$ _____; $0 < x < 1$.

(A) $2\sqrt{1-x^2}$

(B) $2(x^2 - 1)$

(C) 0

(D) $2(1-x^2)$

(Space for Rough Work)

27) Solution set of $\tan^{-1} 2x + \tan^{-1} 3x = \frac{\pi}{4}$ is _____.

(A) $\left\{\frac{1}{6}, -1\right\}$

(B) $\{0, 1\}$

(C) $\left\{\frac{1}{6}, 1\right\}$

~~(D)~~ $\left\{\frac{1}{6}\right\}$

$$\frac{2x + 3x}{1 - 6x} = \frac{\pi}{4}$$

$$5x = 1 - 6x$$

$$11x = 1$$

$$x = \frac{1}{11}$$

28) If $AB = \begin{bmatrix} -6 & 26 \\ -1 & 19 \end{bmatrix}$ and $11B^{-1} = \begin{bmatrix} 5 & -3 \\ 2 & 1 \end{bmatrix}$, then $A =$ _____.

(A) $\begin{bmatrix} -2 & 4 \\ 3 & -2 \end{bmatrix}$

(B) $\begin{bmatrix} 2 & 4 \\ 3 & 2 \end{bmatrix}$

(C) $\begin{bmatrix} 2 & -4 \\ -3 & 2 \end{bmatrix}$

(D) $\begin{bmatrix} -2 & 4 \\ 3 & 2 \end{bmatrix}$

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

~~(A)~~ $\frac{1}{25} I_3$

(B) $-\frac{1}{5} I_3$

(C) $\frac{1}{5} I_3$

(D) $-\frac{1}{25} I_3$

(Space for Rough Work)

$$\begin{bmatrix} 5 & 0 & 0 \\ 0 & 5 & 0 \\ 0 & 0 & 5 \end{bmatrix}$$

30) If $A = \begin{bmatrix} 1 & 5 \\ 6 & 7 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$, then which one of the following is incorrect.

(A) $(AB)' = A'B'$

(B) $A \cdot \text{adj } A = |A| I$

(C) $(A+B)' = B' + A'$

(D) $(AB)^{-1} = B^{-1} \cdot A^{-1}$

31) $A(1, 3)$, $B(0, 0)$ and $C(k, 0)$ are vertices of ΔABC . If area of ΔABC is 3 units, then k is _____.

(A) 2

(B) 0

~~(C)~~ -2

(D) ± 2

$$\begin{vmatrix} 1 & 3 & 1 \\ 0 & 0 & 1 \\ k & 0 & 1 \end{vmatrix} = 3$$

32) If $2 \begin{vmatrix} \sin(A+B) & \cos(A+B) \\ \cos(A-B) & \sin(A-B) \end{vmatrix} + \sqrt{3} = 0$, then $A =$ _____.

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

(B) $\frac{\pi}{3}$

(C) $\frac{\pi}{12}$

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

$$\begin{aligned} -3k &= 3 \\ k &= -1 \end{aligned}$$

33) For $\begin{vmatrix} 2 & 3 & 5 \\ 1 & 0 & 7 \\ -1 & -2 & 4 \end{vmatrix}$, the sum of minor and cofactor of 7 = _____.

(A) 0

~~(B)~~ 2

(C) -2

(D) -1

34) $\frac{d}{dx}(\operatorname{cosec}^{-1} e^x) = \underline{\hspace{2cm}}.$

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

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

(C) $\sin^{-1}(e^x)$

(D) $\frac{-e^x}{\sqrt{e^{2x}-1}}$

35) If $f(x) = 4x^3 + 3x^2 + 3x + 4$; $x \neq 0$, then $\frac{d}{dx} \left(x^3 \cdot f\left(\frac{1}{x}\right) \right) = \underline{\hspace{2cm}}.$

(A) $24x^5 + 15x^4 + 12x^3 + 12x^2$

(B) $\frac{12}{x^2} + \frac{6}{x} + 3$

(C) $\frac{x^2}{12} + \frac{x}{6} + \frac{1}{3}$

(D) $12x^2 + 6x + 3$

36) $\frac{d}{dx} \left[\log\left(\frac{1}{x}\right) + \log\left(\frac{1}{x^2}\right) + \log\left(\frac{1}{x^3}\right) \right] = \underline{\hspace{2cm}}; x > 1.$

(A) $-\frac{6}{x}$

(B) $6x$

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

(D) $-6x$

37) If $x+1 = e^{-y}$, then $\frac{d^2y}{dx^2} =$ _____.

(A) $\left(\frac{dy}{dx}\right)^3$

(B) $\frac{dy}{dx}$

(C) $\left(\frac{dy}{dx}\right)^2$

(D) $-\frac{dy}{dx}$

38) The slope of normal to the curve $y = 2x^2 + 3\sin x$ at $x = 0$ is _____.

(A) 3

(B) -3

~~(C) $\frac{1}{3}$~~

(D) $-\frac{1}{3}$

39) The point on the curve $x^2 = 2y$ which is nearest to the point $(0, 5)$ is _____.

(A) $(2\sqrt{2}, 4)$

~~(B) $(0, 0)$~~

(C) $(2\sqrt{2}, 0)$

(D) $(2, 2)$

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

(A) $(-\infty, \infty)$

(B) $(2, \infty)$

(C) $(-2, 0)$

~~(D) $(0, 2)$~~