1) The tangent to the curve given by $x = e^{\theta} \cdot \cos\theta, y = e^{\theta} \cdot \sin\theta$ at $\theta = \frac{\pi}{4}$ makes an angle with X-axis is

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

B) 0

C) $\cdot \frac{\pi}{3}$

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

2) The minimum value of $f(x) = x\log x$ is

A) 0

B) $-\frac{1}{e}$

C) $\cdot \frac{1}{e}$

D) e

3) If $\int \frac{x^4+x^2+1}{x^2+1} dx = \frac{x^3}{3} + f(x) + \mathrm{C}$, then $f(1) =$

A) 0

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

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

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

4) $\int \frac{x+100}{(x+101)^2} e^x dx = - +.$

A) $\frac{1}{x+101} e^x$

B) $\frac{x}{x+101} e^x$

C) $\frac{1}{x+100} e^x$

D) $(x + 101)e^x$

5) $\int \frac{\sqrt{\cot x}}{\cos x \sin x} dx = \square + \mathrm{C}.$

A) $-2\sqrt{\cot x}$

B) $-2\sqrt{\tan x}$

C) $2\sqrt{\cot x}$

D) $\frac{1}{\sqrt{\cot x}}$

6) $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \log\left(\frac{2019-x}{2019+x}\right) dx =$

A) π

B) 0

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

D) 1

7) $\int_4^9 \frac{\sqrt{x}}{\left(30-x^{3/2}\right)^2} dx =$

A) $\frac{19}{66}$

B) $\frac{19}{33}$

C) $\frac{38}{99}$

D) $\frac{19}{99}$

8) If $f(a+b-x) = f(x)$ then $\int_a^b x \cdot f(x)dx$ is equal to

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

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

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

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

9) The area of the parabola $y^2 = 4ax$ bounded by its latus rectum is

A) $-\frac{16}{3}a^2$

B) $\frac{4}{3}a^2$

C) $\frac{8}{3}a^2$

D) $4a^2$

10) The area enclosed by the curve $x = 4\cos\theta, y = 3\sin\theta$ is

A) 4π

B) 6π

C) 8π

D) 12π

11) The smallest area enclosed by circle $x^2 + y^2 = 4$ and line $x + y = 2$ is

A) $\pi + 2$

B) $\pi - 2$

C) π

D) $\cdot\, 2\pi$

12) The order and degree of differential equation $\left\{1 + \left(\frac{dy}{dx}\right)^2\right\}^{3/2} = \frac{d^2y}{dx^2}$ are p and q respectively then $p + q =$

A) 6

B) 4

C) 2

D) 5

13) Integrating factor of differential equation $(\tan^{-1}y - x)dy = (1 + y^2)dx$ is

A) e^{1+y^2}

B) e^{y}

C) $e^{\tan^{-1}x}$

D) $e^{\tan^{-1}y}$

14) The differential equation $y\frac{dy}{dx} + x = k$ represents

A) circles

B) hyperbolas

C) - parabolas

D) ellipses

15) If $\vec{a} = 2\hat{\imath} - \hat{\jmath} + \hat{k}, \vec{b} = \hat{\imath} + \hat{\jmath} - 2\hat{k}, \vec{c} = \hat{\imath} + 3\hat{\jmath} - \hat{k}$, if $\vec{a}$ is perpendicular to $\lambda\vec{b} + \vec{c}$, then the value of λ is

A) 0

B) 2

C) -2

D) 3

16) For three vectors $\vec{a}, \vec{b}, \vec{c}$ satisfies $\vec{a} + \vec{b} + \vec{c} = \vec{0}$ and $|\vec{a}| = 3, \left|\vec{b}\right| = 4, |\vec{c}| = 2$ then $\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a} =$

A) 29

B) $\frac{29}{2}$

C) $-\frac{9}{2}$

D) $-\frac{29}{2}$

17) If $|\vec{a}| = 3$ then value of $|\vec{a} \times \hat{\imath}|^2 + |\vec{a} \times \hat{\jmath}|^2 + \left|\vec{a} \times \hat{k}\right|^2 =$

A) 9

B) 18

C) 27

D) 36

18) The co-ordinates of the foot of perpendicular drawn from origin to the plane $2x - 3y + 4z - 6 = 0$ is

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

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

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

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

19) The angle between the line $\frac{x+1}{2} = \frac{y}{3} = \frac{z-3}{6}$ and the plane $10x + 2y - 11z = 3$ is

A) $\cdot \cos^{-1}\frac{8}{21}$

B) $\tan^{-1}\frac{8}{\sqrt{377}}$

C) $\sin^{-1}\frac{8}{\sqrt{377}}$

D) $\sin^{-1}\left(\frac{21}{8}\right)$

20) If the points $(1,1,p)$ and $(-3,0,1)$ be equidistant from the plane $\vec{r}\cdot\left(3\hat{\imath}+4\hat{\jmath}-12\hat{k}\right)+13=0$ then the values of p are

A) $1,\frac{7}{3}$

B) $1,\frac{4}{3}$

C) $2,\frac{4}{3}$

D) $\frac{7}{3},2$

21) The maximum value of $Z=3x+4y$ subject to constraints $x+y\leq 4, x\geq 0, y\geq 0$ is

A) 16

B) 12

C) 0

D) not possible

22) If A and B are independent events such that $P(A)=p, P(B)=2p$ and P(Exactly one of A and B) $=\frac{5}{9}$ then $p=$

A) $\frac{1}{3},\frac{5}{12}$

B) $\frac{1}{2},\frac{3}{4}$

C) $\frac{1}{12},\frac{5}{3}$

D) $\frac{2}{15},\frac{5}{12}$

23) For the probability distribution

X	1	2	3	4
P(X)	$\frac{1}{10}$	$\frac{1}{5}$	$\frac{3}{10}$	$\frac{2}{5}$

$$E(X^2)=$$

A) 7

B) 5

C) 3

D) 10

24) If A and B are any two events such that $P(A) + P(B) - P(A \cap B) = P(A)$ then

A) $\mathrm{P(B/A)} = 1$

B) $P(A/B) = 0$

C) , $\mathrm{P(B/A)} = 0$

D) $\mathrm{P(A/B)} = 1$

25) Let $f: \mathrm{R} \to \mathrm{R}$ be defined by $f(x) = 2x^2 - 5$ and $g: \mathrm{R} \to \mathrm{R}$ by $g(x) = \frac{x}{x^2+1}$ then $g \circ f$ is

A) $\frac{2x^2-5}{4x^4+20x^2+26}$

B) $\frac{2x^2-5}{4x^4-20x^2+26}$

C) $\frac{2x^2}{x^4+2x^2-4}$

D) $\frac{2x^2}{4x^4-20x^2+26}$

26) Let $f: [2, \infty) \to \mathrm{R}$ be the function defined by $f(x) = x^2 - 4x + 5$. Then the range of f is

A) $[1, \infty)$

B) $[4, \infty)$

C) R

D) $[5, \infty)$

27) On R, binary operation is defined by $a * b = a + b + ab$ then identity and inverse of $*$ are respectively.

A) $0, \frac{a}{1-a}$

B) $1, \frac{a}{1+a}$

C) $0, -\frac{a}{1+a}$

D) $1, \frac{a}{1-a}$

28) $\sin^{-1}\left(\frac{3}{5}\right) - \sin^{-1}\left(\frac{8}{17}\right) =$

A) $\cos^{-1}\left(\frac{84}{85}\right)$

B) $\cos^{-1}\left(\frac{24}{85}\right)$

C) $\sin^{-1}\left(\frac{24}{85}\right)$

D) $\sin^{-1}\left(\frac{84}{85}\right)$

29) $\tan^2(\sec^{-1}3) + \text{cosec}^2(\cot^{-1}2) + \cos^2\left(\cos^{-1}\frac{2}{3} + \sin^{-1}\frac{2}{3}\right) =$

A) 15

B) 16

C) 14

D) 13

30) 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) $1 - a^2 - bc = 0$

31) If A is a square matrix such that $A^2 = I$ then $(A - I)^3 + (A + I)^3 - 7A$ is equal to

A) I + A

B) I-A

C) A

D) 3A

32) If $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$ and inverse of A is $\frac{1}{2}\begin{bmatrix} 1 & -1 & 1 \\ -8 & 6 & -2 \\ x & -3 & 1 \end{bmatrix}$ then $x =$

A) 5

B) 3

C) 2

D) 4

33) Let $f(t) = \begin{vmatrix} \cos t & t & 1 \\ 2\tan t & t & 2t \\ \tan t & t & t \end{vmatrix}$. Then $\lim_{t\to 0} \frac{f(t)}{t^2}$ is equal to

A) 3

B) 1

C) - 1

D) 0

34) If $x, y \in$ R and $\begin{vmatrix} (a^x + a^{-x})^2 & (a^x - a^{-x})^2 & 1 \\ (b^x + b^{-x})^2 & (b^x - b^{-x})^2 & 1 \\ (c^x + c^{-x})^2 & (c^x - c^{-x})^2 & 1 \end{vmatrix} = 2y + 6$ then $y =$

A) 0

C) -3

B) 3

D) 6

35) For $\triangle ABC$, the value of $\begin{vmatrix} 0 & \sin A & \tan B \\ -\sin(B + C) & 0 & \cos C \\ \tan(A + C) & -\cos C & 0 \end{vmatrix} =$

A) -1

B) 0

C) 1

D) $\sin A \cos C$

36) If function $f(\alpha) = \begin{cases} \frac{1-\cos 6\alpha}{36\alpha^2} & \text{if } \alpha \neq 0 \\ k & \text{if } \alpha = 0 \end{cases}$ is continuous at $\alpha = 0$ then

$k =$ _____.

A) $-\frac{1}{2}$

B) 1

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

D) 0

37) If $y = \sin^{-1}\left(\frac{2^{x+1}}{1+4^x}\right)$ and $\frac{dy}{dx} = \frac{2^{x+1}\log 2}{f(x)}$ then $f(0) =$

A) 0

B) -2

(C) 2

D) 2log2

38) For function $f(x) = x + \frac{1}{x}, x \in [1,2]$, the value of C for mean value theorem is

A) 2

B) $\sqrt{2}$

C) 1

D) $\sqrt{3}$

39) The interval in which $y = x^2e^{-x}$ is increasing is

A) $(0,2)$

B) $(2, \infty)$

C) $(-\infty, \infty)$

D) $(-2,0)$

40) The rate of change of volume of sphere with respect to its radius r at $r = 2$ is

A) 24π

B) 32π

C) 16π

D) 8π