(1) If the centroid of a triangle whose vertices are $(0, 0)$, $(\text{Cos}\theta, \text{Sin}\theta)$ and $(\text{Sin}\theta, -\text{Cos}\theta)$ lies on the line $3x - 2y = 0$, then θ = ... where $\theta \in \left(\frac{\pi}{2}, \frac{3\pi}{2}\right)$.

(a) $\tan^{-1} 3$ (b) $\tan^{-1} 5$ (c) $\pi - \tan^{-1} 5$ (d) $\pi - \tan^{-1} 3$

Ans. (c)

(2) The foot of the perpendicualr from (1, 2, 3) to the line $\frac{6-x}{-3} = \frac{y-7}{2} = \frac{7-z}{2}$ is ....

(a) (8, 7, 2) (b) (0, 0, 0) (c) (3, 5, 9) (d) (9, 5, 3)

Ans. (c)

(3) $\int_{\pi}^{3\pi/2} \left(\frac{5\pi}{2}x - x^2\right)\cos 2x\, dx =$ ....

(a) $2\int_{0}^{3\pi/2} \left(\frac{5\pi}{2}x - x^2\right)\cos 2x\, dx$ (b) $2\int_{0}^{2\pi} \left(\frac{5\pi}{2}x - x^2\right)\cos 2x\, dx$

(c) 0 (d) None of these

Ans. (c)

(4) If a differential equation $\frac{dy}{dx} = \frac{ax+b}{cy+d}$ represents a parabola, then the values of ‘a’ and ‘c’ are ....

(a) a = 0, c = 0 (b) a = 1, c = –2 (c) a = 0, c ≠ 0 (d) a = 1, c = 1

Ans. (c)

(5) $\int \frac{7+\log x}{(8+\log x)^2} dx =$ .... + c, x > 0.

(a) $\frac{x}{\log_e x - 8}$ (b) $\frac{\log x}{8 - \log_e x}$ (c) $\frac{x}{\log_e (8+x)}$ (d) $\frac{x}{8 + \log_e x}$

Ans. (d)

(6) At .... point on the parabola $x^2 = 4y$, the rate of increase of the x-coordinate is the same as the rate of the increasing y-coordinate.

(a) (–3, 1) (b) (2, 1) (c) $\left(\frac{7}{4}, \frac{1}{4}\right)$ (d) $\left(-2, \frac{1}{4}\right)$

Ans. (b)

(7) The equation $(ex - \pi y)^2 + (\pi x + ey)^2 = \pi^2 - e^2$ represents a/an ....

(a) pair of lines (b) ellipse (c) circle (d) hyperbola

Ans. (c)

(8) If $x \in N^*(-2, \delta) \Rightarrow f(x) \in (8.99, 9.01)$, then the maximum value of δ is .... where $f(x) = 5 - 2x$.

(a) 0.005 (b) 0.009 (c) 0.001 (d) None of these

Ans. (a)

(9) The locus of the midpoints of the segment of the tangents to the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ cut off by the axes is the curve ....

(a) $\frac{x^2}{a^2}+\frac{y^2}{b^2}=4$ (b) $\frac{a^2}{x^2}+\frac{b^2}{y^2}=4$

(c) $a^2x^2-b^2y^2=4$ (d) $b^2x^2-b^2y^2=4$

Ans. (b)

(10) The incentre of a triangle whose vertices are A(2, 4), B(2, 6), $C(2+\sqrt{3}, 5)$ is ....

(a) $\left(2+\frac{1}{\sqrt{3}}, 5\right)$ (b) $\left(1+\frac{1}{2\sqrt{3}}, \frac{5}{2}\right)$ (c) (2, 5) (d) None of these

Ans. (a)

(11) To a man, walking on a horizontal road at a speed of 6 km/h, it seems that a stone is falling from the terrace of a building in the vertical direction. If the speed of the stone is 12 km/h, then find the true direction of the stone making an angle to the vertical direction.

(a) $\frac{\pi}{4}$ (b) $\frac{\pi}{6}$ (c) $\frac{\pi}{3}$ (d) None of these

Ans. (b)

(12) The radius of a sphere touching both the plances $x+2y-3z=2$ and $2x+4y-6z+2=0$ is ...

(a) $\frac{2}{3\sqrt{14}}$ (b) $\frac{3}{2\sqrt{14}}$ (c) $\frac{3}{\sqrt{14}}$ (d) $\frac{2}{\sqrt{14}}$

Ans. (b)

(13) The area bounded by the curve $y=\cos 2x$, and the lines x = 0 and $x=\pi/3$ is ....

(a) $\frac{\sqrt{3}}{4}$ (b) $\frac{\sqrt{3}-4}{4}$ (c) $\frac{2-\sqrt{3}}{4}$ (d) $\frac{4-\sqrt{3}}{4}$

Ans. (a)

(14) $\int_0^{13} e^{\sqrt[3]{2x+1}}\,dx=$ ....

(a) $\frac{3e}{2}(5e^2-1)$ (b) $\frac{2e}{3}(5e^2-1)$ (c) $\frac{3e}{2}(1-5e^2)$ (d) $\frac{2e}{3}(1-5e^2)$

Ans. (a)

(15) If $\frac{d}{dx}(f'(x))=g(x)$, then $\frac{d}{dx}\left(-\frac{1}{g(x)}\right)=$ ...., $(g(x)\neq 0)$.

(a) $\frac{\frac{d}{dx}(f'(x))}{\left(\frac{d}{dx}(f'(x))\right)^2}$ (b) $\frac{g(x)}{\left\{\frac{d}{dx}g(x)\right\}^2}$ (c) $\frac{\frac{d^2}{dx^2}(f'(x))}{\left\{\frac{d}{dx}(f'(x))\right\}^2}$ (d) $\frac{\frac{d^2}{dx^2}(f(x))}{\left\{\frac{d}{dx}(g'(x))\right\}^2}$

Ans. (c)

(16) If the plane 3x – 4y – kz = 7 contains the line $\frac{1-x}{-2}=\frac{y+1}{3}=\frac{z}{4}$, then k = ...

(a) $\frac{3}{2}$ (b) $-\frac{2}{3}$ (c) $-\frac{3}{2}$ (d) Can not find k

Ans. (a)

(17) $\int\left\{e^{ex\log_e x}+\frac{\log x}{e^{-ex\log_e x}}\right\}dx = ...+c$

(a) $\frac{1}{e}x^{-ex}$ (b) $\frac{1}{e}x^{ex}$ (c) $-\frac{1}{e}x^{ex}$ (d) None of these

Ans. (b)

(18) If the direction vector of a line passing through (1, –3, 5) makes equal angles with the coordinate axes, then the equation of that line is ……..

(a) x = 1 = y + 3 = z – 5 (b) x – 1 = y + 3 = z

(c) x + 1 = y – 3 = z + 5 (d) None of these

Ans. (a)

(19) If $\int\frac{(x-1)^2}{(x^2-1)^2}dx=\tan^{-1}x+f(x)+c$, then $f(x)=$ ……..

(a) $\frac{1}{(x^2+1)^2}$ (b) $\tan^{-1}x+\frac{1}{x^2+1}$ (c) $\frac{1}{x^2+1}$ (d) None of these

Ans. (c)

(20) $\frac{d}{dx}\left\{\frac{\sum_{i=1}^{5}x^{i-1}}{\sum_{i=1}^{5}x^{-i+1}}\right\}=$ ………… $(x\in R^+)$

(a) –32 (b) 16 (c) 32 (d) –16

Ans. (c)

(21) Find a point on the curve y = x^3 + 3x, such that the tangent at that point is parallel to the chord joining the points A(1, 4) and B(2, 14) from the following.

(a) $\left(-\sqrt{\frac{7}{3}},-\frac{16}{3}\sqrt{\frac{7}{3}}\right)$ (b) $\left(\sqrt{\frac{7}{3}},\frac{16}{3}\sqrt{\frac{7}{3}}\right)$

(c) (–1, –4) (d) None of these

Ans. (b)

(22) $\lim_{x\to -1^{-1}}\sum_{i=2000}^{2009}|x-i|=$ …….

(a) 20050 (b) –20055 (c) 20055 (d) None of these

Ans. (c)

(23) Find the equation of the plane passing through A(–1, 2, 3) and B(3, –5, 6) and parallel to the line $\frac{x-4}{2}=\frac{3-y}{-4}=\frac{z-2}{5}$ from the following.

(a) $47x + 14y - 30z + 109 = 0$ (b) $47x + 14y - 30z = 109$
(c) $47x + 14y + 30z - 109 = 0$ (d) None of these

Ans. (a)

(24) Which of the following real numbers ever belongs to any neighbourhood of zero?

(a) 10^{-5} (b) -10^{-5} (c) $\left[-10^{-5}\right]$ (d) $\left[10^{-5}\right]$

Ans. (d)

(25) If $f(x) = \log_{x^2}(\log x)$, then $f'(e)$ is ………….. , $(x \in R^+)$.

(a) 0 (b) 1 (c) e^{-1} (d) $(2e)^{-1}$

Ans. (d)

(26) If the curves $y^2 = x$ and $xy = c$ are orthogonal, then c = ……….. $(x, y \in R^+)$; $(c \neq 0)$.

(a) $\frac{1}{2\sqrt{2}}$ (b) $-\frac{1}{2\sqrt{2}}$ (c) $\pm\frac{1}{2}$ (d) $\frac{1}{8}$

Ans. (a)

(27) If $|\bar{x}| = |\bar{y}| = 1$ and $(\bar{x}, \wedge\, \bar{y}) = \frac{\pi}{6}$, then $|\bar{x} - \bar{y}|$ = ………

(a) 1 (b) $\frac{\sqrt{6}-\sqrt{2}}{4}$ (c) $\frac{\sqrt{6}+\sqrt{2}}{2}$ (d) $\frac{\sqrt{6}-\sqrt{2}}{2}$

Ans. (d)

(28) Let N be the foot of a perpendicular from the point P(t) of the parabola $y^2 = 4ax$. A line parallel to the X-axis and bisecting $\overline{PN}$ meets the curve at Q. If $\overline{NQ}$ mets the Y-axis at T, then the coordinates of T are ……..

(a) $\left(0, \frac{4}{3}at\right)$ (b) $(0, 2at)$ (c) $\left(\frac{1}{4}at^2, at\right)$ (d) $(0, at)$

Ans. (a)

(29) The number of points at which the function $f(x) = |x - 0.5| + |x - 1| + \tan x$ is not differentiable in the interval (0, 2) are ………

(a) 1 (b) 2 (c) 3 (d) 4

Ans. (c)

(30) $\int \frac{\sqrt{\cot x}}{\sin x \cos x} dx =$ ……… $+ c;\ x \neq \frac{n\pi}{2}, n \in Z, \cot x > 0$.

(a) $-2\sqrt{\cot x}$ (b) $2\sqrt{\cot x}$ (c) $2\sqrt{\tan x}$ (d) $-2\sqrt{\tan x}$

Ans. (a)

(31) If $|\bar{x} \times \bar{y}|^2 = 169 - (\bar{x} \,.\, \bar{y})^2$ and $|\bar{x}| = 9$, then $|\bar{y}| =$ ……..

(a) $\frac{9}{13}$ (b) $\frac{169}{9}$ (c) $\frac{13}{9}$ (d) $\frac{169}{81}$

Ans. (c)

(32) The locus of the midpoints of the chords of the circle $x^2+y^2=4r^2$ which subtend a right angle at the centre of the circle is ………

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

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

Ans. (c)

(33) A unit vector in the XZ-plane which is perpendicular to the vector $(2,4,-3)$ is ………

(a) $\pm\frac{1}{13}(3,0,-2)$ (b) $\pm\frac{1}{\sqrt{18}}(3,0,3)$

(c) $\pm\frac{1}{3}(3,0,2)$ (d) $\pm\frac{1}{\sqrt{13}}(-3,0,2)$

Ans. (b)

(34) The length of a side of a square OPQR is 'a', O is the origin, $\overline{OP}$ and $\overline{OR}$ are along the positive direction of the X and Y axis respectively. If A and B are the midpoints of $\overline{PQ}$ and $\overline{QR}$ respectively, then the measure of an angle between $\overleftrightarrow{OA}$ and $\overleftrightarrow{OB}$ is ………

(a) $\cos^{-1}\frac{3}{5}$ (b) $\tan^{-1}\frac{4}{3}$ (c) $\cot^{-1}\frac{3}{4}$ (d) $\sin^{-1}\frac{3}{5}$

Ans. (d)

(35) For $A\left(\frac{1}{2},0,\frac{1}{2}\right)$ and $B\left(\frac{1}{2},-1,-\frac{1}{2}\right)$; the direction angles of $\overrightarrow{AB}$ are …………

(a) $\frac{\pi}{2},\frac{3\pi}{4},\frac{3\pi}{4}$ (b) $\frac{\pi}{2},\frac{\pi}{4},\frac{\pi}{4}$

(c) $\frac{\pi}{2},\frac{3\pi}{4},\frac{\pi}{4}$ (d) None of these

Ans. (a)

(36) The area bounded by the parabola $y^2=8x$, X-axis and a latus-rectum is …………

(a) $\frac{32}{3}$ (b) $\frac{16\sqrt{2}}{3}$ (c) $\frac{16}{3}$ (d) $\frac{32\sqrt{2}}{3}$

Ans. (a)

(37) If $(a-3)x^2+ay^2=9$ represents a rectangular hyperbola, then 'a' = ……..

(a) 0 (b) $-\frac{3}{2}$ (c) $\frac{3}{2}$ (d) None of these

Ans. (c)

(38) An equilateral triangle is inscribed in the parabola $y^2 = 4x$. If the vertex of this triangle is the vertex of the parabola, then the length of a side of this triangle is ……

(a) $\frac{\sqrt{3}}{2}$ (b) $\frac{4\sqrt{3}}{2}$ (c) $\frac{8\sqrt{3}}{2}$ (d) $8\sqrt{3}$

Ans. (d)

(39) If a line $3x + 4y = 24$ intersects the axes at A and B, then the inradius of ΔOAB is …..

(a) 1 (b) 2 (c) 3 (d) 4

Ans. (b)

(40) The equation of a line containing a side of an equilateral triangle is $\sqrt{3}x + y = 2$. If $(0, -1)$ is one of the vertices, then the length of its side is ………

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

Ans. (a)