MATHS

BOOKS - ML KHANNA

TANGENTS AND NORMALS

Problem Set 1 Multiple Choice Questions

1. For the curve $x = t^2 - 1, y = t^2 - t,$ the tangent line is perpendicular to x-axis, where

A. t=0

B. $t = \infty$

C. $t = 1/\sqrt{3}$

D. $t = 1/\sqrt{3}$

Answer: A

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2. The slope of the tangent to the curve $x = t^2 + 3t - 8, y = 2t^2 - 2t - 5$ at the point (2, -1), is

A. $\frac{22}{7}$

B. $\frac{6}{7}$

C. -6

D. None of these

Answer: B

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3. Angle between the .tangents to the curve $y = x^2 - 5x + 6$ at the points (2, 0) and (3, 0) is :

A. $\pi/2$

B. $\pi/6$

C. $\pi/4$

D. $\pi/3$

Answer: A

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4. The tangent of the curve $y = 2x^2 - x + 1$ is parallel to the line y = 3x + 9 at the point

A. (3, 9)

B. (2,-1)

C. (2, 1)

D. (1, 2)

Answer: D

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5. The tangentto the curve $x^2 + y^2 - 2x - 3 = 0$ is parallel to x-axis at the points

A. $(2 \pm \sqrt{3})$

B. $(1, \pm 2)$

C. $(\pm 1, 2)$

D. $(\pm 3, 0)$

Answer: B

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6. The points on the curve $y = x^3 + 5$ at which the tangents are perpendicular to the line x + 3y = 2 are

A. (6,1),(1,4)

B. (1,6),(1,4)

C. (6,1)(4,-1)

D. (1,6)(-1,4)

Answer: D

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7. The equation of the tangent at the point P(t) ,wheret is any parameter, to the parabola $y^2 = 4ax$ is

A. $yt = x + at^2$

B. $y = xt + at^2$

C. $y = tx$

D. $y = ta/t$

Answer: A

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8. The tangent to a given curve is perpendicular to x-axis if

A. $\frac{dy}{dx} = 0$

B. $\frac{dy}{dx} = 1$

C. $\frac{dx}{dy} = 0$

D. $\frac{dx}{dy} = 1$

Answer: C

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9. Tangents to the folium of descartes $x^3 + y^3$ = 3axy at the point where it meets the parabola $y^2 = ax$ are parallel to

A. x-axis

B. y-axis

C. y = x

D. none

Answer: B

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10. The values ·of a for whic.h $y = x^2 + ax + 25$ touches the axis of x are

A. ± 5

B. ± 10

C. ± 15

D. none

Answer: B

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11. The point on the curve $y^2 = x$, the tangent at which makes an angle of 45° with x-axis will be given by

A. $\left(\frac{1}{2}, \frac{1}{4}\right)$

B. $\left(\frac{1}{2}, \frac{1}{2}\right)$

C. $(2, 4)$

D. $\left(\frac{1}{4}, \frac{1}{2}\right)$

Answer: A

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12. If lhe tangent to the curve $x + y = e^{xy}$ be parallel to y-axis, then the point of contact is

A. (1, 0)

B. (0,1)

C. (1,1)

D. None

Answer: A

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13. If the parametric of a curve given by $x = e^t \cos t, y = et \sin t$, then the tangent to

the curve at the point $t = \pi/4$ makes with axis of x the angle

A. 0

B. $\pi/4$

C. $\pi/3$

D. $\pi/2$

Answer: D

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14. The slope of the tangent to the curve $x = t^2 + 3t - 8, y = 2t^2 - 2t - 5$ at the point (2, -1), is

A. $\frac{22}{7}$

B. $\frac{6}{7}$

C. 6

D. none

Answer: B

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15. The straight line x + y =a will be a tangent to the ellipse $x^2/9 + y^2/16 = 1$ if a=

A. 8

B. ± 5

C. ± 10

D. ± 6

Answer: B

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16. The curve $y - e^{xy} + x = 0$ has a vertical tangent at the point :

A. (1, 1)

B. at no point

C. (0, 1)

D. (1, 0)

Answer: D

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17. The point(s) on the curve $y^3 + 3x^2 = 12y$ where the tangent is vertical, is(are) ??

$\left(\pm \frac{4}{\sqrt{3}}, -2 \right)$ (b) $\left(\pm \sqrt{\frac{11}{3}}, 1 \right)$ $(0, 0)$ (d) $\left(\pm \frac{4}{\sqrt{3}}, 2 \right)$

A. $\left(\pm \frac{4}{\sqrt{3}}, -2 \right)$

B. $\left(\pm \sqrt{\frac{11}{3}}, 1 \right)$

C. $(0, 0)$

D. $\left(\pm \frac{4}{\sqrt{3}}, 2 \right)$

Answer: D

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18. The tangent to the curve $y = e^{2x}$ at the point (0, 1) meets the x-axis at

A. $(0, a)$

B. $(2, 0)$

C. $(-1/2, 0)$

D. None of these

Answer: C

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19. The equation of the tangent to the curve $y = be^{-x/a}$ at point where x = 0 is

A. x/a-y/b=1

B. y/b-x/a=1

C. x/a+y/b=1

D. None of these

Answer: C

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20. The curve $\left(\frac{x}{a}\right)^n + \left(\frac{y}{b}\right)^n$ =2 touches the straight line $\frac{x}{a} + \frac{y}{b} = 2$ at the point (a,b) then the value of n is

A. 2

B. 3

C. 4

D. any real number

Answer: D

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21. The line $\frac{x}{a}+\frac{y}{b}=1$ touches the curve $y=be^{-x/a}$ at the point

A. (a,b /a)

B. (-a,b/a)

C. (a,a/b)

D. None of these

Answer: D

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22. Equation of tangent to the curve $x = a\cos^3 t, y = a\sin^3 t$ at $'t'$ is

A. x sec t-y cosec t =a

B. x sec t + y cosec t =a

C. $x\cos ect + y\cos ect = a$

D. None of these

Answer: B

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23. The equation of the tangent at the pointt on the curve x= a(t +sin t),y = a(1-cost) is

A. y=(x-at).tan(t/2)

B. y=(x+at).tan(t/2)

C. y=(x-at).cot(t/2)

D. None of these

Answer: A

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24. The tangent to the survey= $x^2 + 3x$ will pass through the point (0, - 9) if jt is drawn at the point

A. (3, 18)

B. (1, 4)

C. (-4,4)

D. (-3,0)

Answer: A::D

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25. If the tangent at P (1, 1) on $y^2 = x(2-x)^2$ meets the curve again at Q then the point Q is

A. $(-1, 2)$

B. $\left(\frac{9}{4}, \frac{3}{8}\right)$

C. $(4, 4)$

D. None of these

Answer: B

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26. The co-ordinates of the point on the curve $y = x^2 + 3x + 4$ the tangent at which passes through the origin is equal to

A. (2, 14), (-2,2)

B. (2, 14), (-2,-2)

C. (2, 14) (2, 2)

D. None of these

Answer: A

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27. Tangents are drawn to the curve $x^2y = 1 - y$ at the points where it is met by the curve xy = 1-y . The point of intersection of these tangents is.

A. (0, -1)

B. (0, 1)

C. (1, 1)

D. none

Answer: B

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28. If the tangent at (1, 1) on $y^2 = x(2-x)^2$ meets the curve again at P then P is

A. $(-1, 2)$

B. $(4, 4)$

C. $\left(\frac{9}{4}, \frac{3}{8}\right)$

D. none

Answer: C

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29. If tangent at any point on the curve $e^y = 1 + x^2$ makes an angle θ with +ive direction of x-axis, then

A. $|\tan\theta| > 1$

B. $|\tan\theta| < 1$

C. $\tan\theta > 1$

D. $|\tan\theta| \leq 1$

Answer: D

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30. If the tangent at any point on the curve $y = x^3 - \lambda x^2 + x + 1$ makes an acute angle with the +ive direction of x-axis, then

A. $\lambda > 0$

B. $\lambda \leq \sqrt{3}$

C. $-\sqrt{3} \leq \lambda \leq \sqrt{3}$

D. None

Answer: C

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31. The number of points on the curve $x^{3/2} + y^{3/2} = a^{3/2}$ where the tangents are equally inclined to the axes is

A. 1

B. 2

C. 4

D. None

Answer: A

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32. The point on the curve $\sqrt{x} + \sqrt{y} = 2a^2$ at which the tangent is equally inclined to the axes is

A. $(4a^4, 0)$

B. $(0, 4a^4)$

C. (a^4, a^4)

D. None

Answer: C

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33. If tangent to the curve $x = at^2, y = 2at$ is perpendicular to x-axis then its point of contact is

A. (a.a)

B. (0,a)

C. (a,0)

D. (0,0)

Answer: D

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34. The area of the triangle formed by the tangent to the curve $y = 8/(4 + x^2)$ at x = 2 and the co-ordinate axes is

A. 2 sq. units

B. 4 sq. units

C. 8 sq. units

D. 7 /2 sq. units

Answer: B

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35. Find the value of |a| for which the area of triangle included between the coordinate axes and any tangent to the curve $x^a y = \lambda^a$ is constant (where λ is constnat.),

A. $1/2$

B. 2

C. $3/2$

D. 1

Answer: D

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36. Any tangent at a point $P(x, y)$ to the ellipse $\frac{x^2}{8} + \left(y^2\right) = 1$ meets the coordinate axes in the points A and B such that the area of the triangle OAB is least, then the point P is

A. $\left(\sqrt{8}, 0\right)$

B. $\left(0, \sqrt{18}\right)$

C. $(2, 3)$

D. none

Answer: C

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37. The equation of the tangent to the curve y=2 sin x +sin 2x at $x = \frac{\pi}{3}$ is equal to

A. $2y = 3\sqrt{3}$

B. $y = 3\sqrt{3}$

C. $2y + 3\sqrt{3} = 0$

D. $y + 3\sqrt{3} = 0$

Answer: A

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38. The points on the curve $y = \frac{x}{(1 - x^2)}$ where the tangent is inclined at angle $\pi/4$ to the x-axis

A. $(0, 0), (\sqrt{3}, -\sqrt{3}/2)$

B. $(0, 0), (-\sqrt{3}, \sqrt{3}/2)$

C. $(0, 0), (\sqrt{3}, , \sqrt{3}/2)$

D. None of these

Answer: A::B

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39. The point P on the curve $y = x \tan \alpha - \frac{1}{2} \frac{x^2}{u^2 \cos^2 \alpha}, \alpha \in \left(0, \frac{\pi}{2}\right)$ has a tangent parallel to y = x + 5. If the ordinate of P is $\frac{u^2}{4}$ then $\alpha =$

A. 15°

B. 30°

C. 45°

D. 60°

Answer: D

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40. Co-ordinates of the point Pon the curve $y^2 = 2x^3$, the tangent at which is

perpendicular to the line 4x-3y+2=0 are given by

A. $(2, 4)$

B. $(0, 0)$

C. $(1/8, -1/16)$

D. None of these

Answer: C

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41. The points on the curve $4x^2 - 9y^2 = 36$ tangent at which is perpendicular to the line 5x + 2y - 10 = 0 is given by

A. $\left(\frac{\sqrt{117}}{2}, 3\right)$

B. $(\sqrt{18}, 2)$

C. $(\sqrt{18}, -2)$

D. none

Answer: D

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42. If y = 4x-5 is a tangent to the curve $y^2 = ax^3 + b$ at (2,3), then

A. a=2,b=-7

B. a=-2,b=7

C. a=-2,b=-7

D. a=2,b=7

Answer: A

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43. If the tangent to the curve $xy + ax + by = 0$ at (1, 1) is inclined at an angle $\tan^{-1} 2$ to axis of x then (a,b) is equal to

A. (-1,-2)

B. (-1,2)

C. (1,-2)

D. (1, 2)

Answer: C

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44. A function y = f (x) has a second order derivative f''(x) = 6 (x-1). If the graph passes through the point (2, 1) and at this point tangent to the graph is y = 3x - 1, then function is :

A. $(x-1)^3$

B. $(x-1)^2$

C. $(x+1)^3$

D. $(x+1)^2$

Answer: A

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45. The equation(s) of the tangent(s) to the curve $y = x^4$ from the point (2, 0) not on the curve is given by

A. y=0

B. y-1=5(x-1)

C. $y - \frac{4098}{81} = \frac{2046}{27}\left(x - \frac{8}{3}\right)$

D. $y - \frac{32}{243} = \frac{80}{81}\left(x - \frac{2}{3}\right)$

Answer: A::C

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46. The tangent and normal at the point $P\left[at^2, 2at\right)$ to the parabola $y^2 = 4ax$ meet the x-axis in T and G respectively, then the angle at which the tangent at P to the parabola is inclined to the tangent at P to the circle through T, P, G is

A. $\tan^{-1} t^2$

B. $\cot^{-1} t^2$

C. $\tan^{-1} t$

D. $\cot^{-1} t$

Answer: C

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47. The equation of tangents to the curve $y = \cos(x + y), \ -2\pi \leq x \leq 2\pi$ that are parallel to the line $x + 2y = 0$, is

A. x+2y=1

B. x+2y=$\pi / 2$

C. $x + 2y = \pi/4$

D. None of these

Answer: B

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48. All points on the curve $y^2 = 4a\left(x + a \sin\frac{x}{a}\right)$ at which the tangents are parallel to the axis of x lie on a

A. Circle

B. Parabola

C. Line

D. None of these

Answer: B

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49. The points of contact of the tangents drawn from the origin to the curve $y = \sin x$ lie on the curve

A. $x^2 - y^2 = xy$

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

C. $x^2 - y^2 = x^2y^2$

D. None of these

Answer: C

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50. The angle which the perpendicular from the origin on the tangent makes with the x-

axis for the curve whose parameteric equations are $x = a\sin^3\theta, y = a\cos^3\theta$ is

A. $\theta/2$

B. θ

C. 2θ

D. none

Answer: B

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51. If p_1 and p_2 be the lengths of perpendiculars from the origin on the tangent and normal to the curve $x^{2/3} + y^{2/3} = a^{2/3}$ respectively, then $4p_1^2 + p_2^2 =$

A. $4a^2$

B. $2a^2$

C. a^2

D. none

Answer: C

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52. The curve $y = ax^3 + bx^2 + cx + 5$ touches the x-axis at $P(-2, 0)$ and cuts the y-axis at a point Q where its gradient is 3, then $2a + 4b$ is equal to :

A. $-\frac{1}{2}, -\frac{3}{4}, 3$

B. $3, \frac{1}{2}, -\frac{3}{4}$

C. $-\frac{3}{4}, -\frac{1}{2}, 3$

D. none

Answer: A

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53. If the curve $y = ax^3 + bx^2 + cx$ is inclined at 45° to x-axis at (0, 0) but touches x-axis at (1, 0) , then

A. $(1, -2, 1)$

B. $(1, 1, -2)$

C. $(-2, 1, 1)$

D. $(-1, 2, 1)$

Answer: A

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54. If the tangent at the point $P\left(at^2, at^3\right)$ on the curve $ay^2 = x^3$ meets the curve again at Q whose para-meter is t' then t' =

A. 2t

B. $-t$

C. $t/2$

D. $-t/2$

Answer: B

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55. A curve is given by the equations $x = \sec^2\theta, y = \cot\theta$. If the tangent at $Pwhere\theta = \frac{\pi}{4}$ meets the curve again at $Q, then[PQ]$ is, where [.] represents the greatest integer function, _____.

A. $\sqrt{15}$

B. $\frac{3}{2}\sqrt{5}$

C. $\frac{1}{2}\sqrt{15}$

D. none

Answer: B

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56. If the line ax+ by+ c = 0 is a normal to the curve xy = 1, then

A. $a > 0, b > 0$

B. $a > 0, b < 0$

C. $a < 0, b > 0$

D. $a < 0, b < 0$

Answer: B::C

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57. The normal to a given curve is parallel to $x -$ axis if

A. $\frac{dy}{dx} = 0$

B. $\frac{dy}{dx} = 1$

C. $\frac{dx}{dy} = 0$

D. $\frac{dx}{dy} = 1$

Answer: C

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58. The normal at the.point (1, 1) on the curve $2y = 3 - x^2$ is

A. $x + y = 0$

B. $x + y + 1 = 0$

C. $x - y + 1 = 0$

D. $x - y = 0$

Answer: D

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59. The normal to the curve $x = a(\cos\theta + \theta\sin\theta), y = a(\sin\theta - \theta\cos\theta)$ at any θ is such that

A. it makes a constant angle with x-axis

B. it passes through the origin

C. it is at a constant distance from the origin

D. none of these

Answer: C

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60. The equation to the normal to the curve y =sin x at (0, 0) is

A. x=0

B. y=0

C. x+y=0

D. x-y=0

Answer: C

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61. Equation of norinal to the curve $y = \sin x, at[\pi, 0]$ is

A. $x + y = \pi$

B. $x + y + \pi = 0$

C. $x - y = \pi$

D. $x - y + \pi = 0$

Answer: C

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62. Equation of normal to the curve y = x+ sin x cos x at $x = \pi/2$ is

A. $x = \pi$

B. $x = 2$

C. $x + \pi = 0$

D. $x = \pi/2$

Answer: D

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63. The normal to the curve $x = a(1 + \cos\theta), y = a\sin\theta$ at $'\theta'$ always passes through the fixed point

A. (a, a)

B. (a,0)

C. (0,a)

D. none of these

Answer: B

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64. Find the equation of normal to the curve $y(x-2)(x-3)-x+7=0$ at that point at which the curve meets X-axis.

A. x-20y=7

B. 20x-y=7

C. 20x+y=140

D. 20x-y=140

Answer: C

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65. Equation of normal to the curve y = x (2 - x) at the point (2, 0) is

A. x-2y=2

B. 2x+y=4

C. x-2y+2=0

D. None of these

Answer: A

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66. If the normal to the curve y = f (x) at the point (3, 4) makes an angle $3\pi/4$ with the positive x-axis, then f' (3) =

A. -1

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

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

D. 1

Answer: D

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67. The point on the curve where the normal to the curve $9y^2 = x^3$ makes equal intercepts with the axes is

A. $\left(4, \frac{8}{3}\right)$

B. $\left(-4, \frac{8}{.3}\right)$

C. $\left(4, -\frac{8}{3}\right)$

D. none

Answer: A::C

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68. The values of parameter 'a' so that the line $(3-a)x + ay + a^2 - 1 = 0$ is a normal to the curve xy = 1 is/are :

A. $(3, \infty)$

B. $(-\infty, 0)$

C. $(0, 3)$

D. none

Answer: A::B

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69. If PG_1 and PG_2 be the normals to the curves $y^2 = 4ax$ and $ay^2 = 4x^3$ at a common

point other than origin meeting x-axis in G_1 and G_2 , then G_1G_2 =

A. 2a

B. 4a

C. 6a

D. none

Answer: B

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70. The abscissa of the point on the curve $ay^2 = x^3$, the normal at which cuts off equal intercepts from the axes is

A. 2a/3

B. 4a/9

C. 3a

D. none

Answer: B

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71. The normal to a curve at P(x, y) meets the x-axis at G. If the distance of G from the origin is twice the abscissa of P, then the curve is a (1) ellipse (2) parabola (3) circle (4) hyperbola

A. ellipse

B. parabola

C. circle

D. hyperbola

Answer: A::D

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72. The normal at anypoint P (ct,c/t) on the curve xy = c^2 meets the curve at $Q(ct_1, c/t_1)$, then $t_1 =$

A. $-t$

B. $1/t^2$

C. $-1/t^3$

D. none

Answer: C

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73. A curve C has the property that if the tangent drawn at any point P on C meets the co-ordinate axis at A and B , then P is the mid-point of AB. The curve passes through the point (1,1). Determine the equation of the curve.

A. xy=1

B. $y^2 = 2x - 1$

C. $x^2 = 2y - 1$

D. none

Answer: A

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74. The equation of the normal to the curve $y^2 = ax^3$ at [a,a) is

A. $x + 2y = 3a$

B. $x - 4y = -a$

C. 4x+3y=7a

D. none of these

Answer: C

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75. The tangent to the curve $y = ax^2 + bx$ at (2, - 8) is parallel to x-axis. Then

A. a=2,b=-2

B. a=2,b=-4

C. a=2,b=-8

D. none of these

Answer: C

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76. The equation of the tangent at (- 4, - 4) on the curve $x^2 = 4y$ is

A. 2x+y=4

B. 2x-y=12

C. 2x+y=-4

D. 2x-y=-4

Answer: D

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77. The abscissa of the point on the curve $y = a\left[e^{x/a} + e^{-x/a}\right]$ when the tangent is parallel to the x-axis is

A. 0

B. 1

C. a

D. 2a

Answer: A

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78. The intercept on x-axis made by tangents to the curve $y = a\left[e^{x/a} + e^{-x/a}\right]$ when ihe tangent is parallel to the x-axis is

A. 0

B. 1

C. a

D. 2a

Answer: A

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79. The equation of the tangent to the curve $y = x + \frac{4}{x^2}$, that is parallel to the x-axis, is

A. $y = 0$

B. $y = 1$

C. $y = 2$

D. $y = 3$

Answer: D

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Problem Set 1 True And False

1. Prove that the equation of the normal to $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$ is $y\cos\theta - x\sin\theta = a\cos 2\theta,$

where θ is the angle which the normal makes with the axis of x.

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2. Normal to the parabola $y^2 = 4ax$ is of the form $y = mx - 2am - am^3$ where m is the slope of the tangent.

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3. Tangent to the parabola $y^2 = 4ax$ is of the form $y = mx + \frac{a}{m}$ where m is the slope of the tangent.

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4. The normal to the curve $5x^5 - 10x^3 + x + 2y + 6 = 0$ at P (0, - 3) meets the curve again at two points at which equation of tangents to the curve are same.

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5. The angle between the tangents at any point P and the line joining P to the origin O is the same at all points of the curve

$$\log\left(x^2+y^2\right)=k\tan^{-1}(y/x)$$

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6. The equation of the tangent to the curve $y=\frac{x(x-1)(x+1)}{(x+3)(x+4)}$ where x=0, is y=12x.

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Problem Set 1 Fill In The Blanks

1. The point on the curve $x^3 + y^3 = 3axy$ at which the tangent is parallel to x-axis is given by ..... .

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2. Let C be the curve $y^3 - 3xy + 2 = 0$. If H is the set of points on the curve C, where the tangent is horizontal and V is the set of points

on the curve C, where the tangent is vertical, then H = ... and V = ...

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3. The tangent to the curve $y = 4 - x^2$ at a point P is parallel to the chord connecting the points A (-2, 0) and B (1, 3). Then the co-ordinates of P are .....

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Problem Set 2 Multiple Choice Questions

1. The curve $x^3 - 3xy^2 + 2 = 0$ and $3x^2y - y^3 - 2 = 0$ cut at an angle of

A. 45°

B. 60°

C. 90°

D. 30°

Answer: C

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2. The angle of intersection of the curves $y = x^2, 6y = 7 - x^3$ at (1, 1), is

A. $\pi/4$

B. $\pi/3$

C. $\pi/2$

D. None

Answer: C

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3. The curves $y = x^3 + x + 1, 2y = x^3 + 5x, \text{at}(1, 3)$ are

A. touching each other

B. intersecting orthogonally

C. not intersecting

D. None of these

Answer: A

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4. The angle at which the curve $y = me^{mx}$ intersects the y-axis is

A. $\cot^{-1}(m^2)$

B. $\tan^{-1}(m^2)$

C. $\frac{\sin^{-1}1}{\sqrt{1+m^4}}$

D. $\sec^{-1}\sqrt{1+m^4}$

Answer: A

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5. The curves $ax^2 + by^2 = 1$ and $a'x^2 + b'y^2 = 1$ intersect orthogonally if

A. $1/a - 1/b = 1/a' - 1/b'$

B. $1/a + 1/b = 1/a' + 1/b'$

C. $1/a + 1/a' = 1/b + 1/b'$

D. None of these

Answer: A

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6. If the curves $\frac{x^2}{a^2} + \frac{y^2}{4} = 1$ and $y^3 = 16x$ intersects at right angles then a^2=

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

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

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

D. none

Answer: C

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7. The curves $y = e^{-ax} \sin bx$ and $y = e^{-ax}$ touch at the points for which bx=

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

B. $2n\pi + \frac{\pi}{3}$

C. $2n\pi + \frac{\pi}{4}$

D. none

Answer: A

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8. Angle of intersection of the curves $y = 4 - x^2$ and $y = x^2$ is

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

B. $\tan^{-1}\left(\frac{4}{3}\right)$

C. $\frac{\tan^{-1}\left(4\sqrt{2}\right)}{7}$

D. None

Answer: C

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9. The angle between the curves $y^2 = x$ and $x^2 = y$ at (1,1) is

A. $\tan^{-1}\left(\frac{4}{5}\right)$

B. $\tan^{-1}\left(\frac{3}{4}\right)$

C. 45°

D. 90°

Answer: B

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10. Angle of intersection of the curve $x^2 = 32y$ and $y^2 = 4x$ at.the point (16, 8) is

A. 60°

B. 90°

C. $\tan^{-1}(4/3)$

D. $\tan^{-1}(3/5)$

Answer: D

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11. If the curves $y^2 = 16x$ and $9x^2 + by^2 = 16$ cut each other at right angles, then the value of b is

A. 2

B. 4

C. $9/2$

D. None

Answer: C

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12. If the two curves $y = a^x$ and $y = b^x$ intersect at an angle α, then $\tan \alpha$ equals

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

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

C. $\dfrac{\log a - \log b}{1 - \log a - \log b}$

D. none of these

Answer: A

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13. Out of the four curves given below chciose the curve which intersects the parabola $y^2 = 4ax$ orthogonally

A. $x^2 + y^2 = a^2$

B. $y = e^{-x/2a}$

C. $y = ax$

D. $x^2 = 4ay$

Answer: B

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14. The length of the subnormal to the parabola $y^2 = 4ax$ at any point is equal to

A. $\sqrt{2}a$

B. $2\sqrt{2}a$

C. $\frac{a}{\sqrt{(2)}}$

D. 2a

Answer: D

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15. If at any point (x, y) on a curve subtangent and subnormal are of equal length, then the length of the tangent is

A. $\sqrt{2y}$

B. $\sqrt{2}y$

C. y

D. none

Answer: B

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16. The length of sub-tangent to the curve $\sqrt{x} + \sqrt{y} = 3$ at the point (4,1) is

A. 2

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

C. -3

D. 4

Answer: A

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17. The length of the subtangent to the curve $x^2 + xy + y^2 = 7$ at $(1, -3)$ is

A. 3

B. 5

C. 15

D. $3/5$

Answer: C

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18. The length of the normal at t on the curve

$x = a(t + \sin t), y = a(1 - \cos t),$ is

A. asint

B. $2a \sin^3(t/2)\sec(t/2)$

C. $2\alpha \sin(t/2)\tan(t/2)$

D. $2\alpha \sin(t/2)$

Answer: C

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19. The length of the normal to the curve x= a(t +sin t),y = a(1-cos t), "at" t= pi// 2` is

A. 2a

B. $a\sqrt{2}$

C. $a/2$

D. $a/\sqrt{2}$

Answer: B

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20. Sum of squares of intercepts made on co-ordinate axes hy the tangents to the curve $x^{2/3} + y^{2/3} = a^{2/3}$ is

A. a^2

B. $2a^2$

C. $3a^2$

D. $4a^2$

Answer: A

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21. The portion of the tangent of the curve $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$,which is intercepted between the axes is (a>0)

A. a

B. 2a

C. 3a

D. none

Answer: A

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22. At a point $(a/8, a/8)$ on the curve $x^{1/3} + y^{1/3} = a^{1/3}$ (a>0) tangent is drawn. If the portion of the tangent intercepted betweenthe axes be of length $\sqrt{2}$ then a=

A. 1

B. 2

C. 4

D. 8

Answer: C

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23. In the curve x =$a[\cos t + \log \tan(t/2)]$, y =a sin t, the portion of the tangent between the point of contact and the x-axis is of length

A. 2a

B. a

C. a/2

D. none

Answer: B

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24. The triangle formed by the tangent to the curve $f(x) = x^2 + bx - b$ the point (1, 1) and the co-ordinate axes, lies in the first quadrant. If its area is 2, then the value of b is

A. -1

B. 3

C. -3

D. 1

Answer: C

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25. The length of the normal at θ on the curve $x = a\cos^3\theta, y = a\sin^3\theta$ is

A. $a\sin^2\theta$

B. $a\sin^2\theta\tan\theta$

C. $a\sin^2\theta\cos\theta$

D. $a\sin^3\theta\tan\theta$

Answer: B

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26. The length of the normal to the curve at (x, y) $y = a\left(\frac{e^{x/a} + e^{-x/a}}{2}\right)$ at any point varies as

A. x

B. x^2

C. y

D. y^2

Answer: D

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27. The value of n for which the length of the subnormal of the curve $xy^n = a^{n+1}$ is constant

A. 1

B. -1

C. 2

D. -2

Answer: D

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28. If the tangent at P on the curve $x^m y^n = d^{m+n}$ meets the co-ordinates axes at A and B, then AP : PB=

A. $m:n$

B. $n:m$

C. $-m:n$

D. $-n:m$

Answer: A

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29. For the parabola $y^2 = 4ax$, the ratio of the subtangentto the abscissa is

A. $1:1$

B. $2:1$

C. $x:y$

D. $x^2:y$

Answer: B

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30. The tangent at any point. on the curve $x^4+y^4=a^4$ cuts off intercepts p and q on the co-ordinate axes then the value of $p^{-\frac{4}{3}}+q^{-4/3}$ is equal to

A. $a^{-4/3}$

B. $a^{-1/2}$

C. $a^{1/2}$

D. none

Answer: A

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Problem Set 2 True And False

1. Angle of intersection of the following curves

$x^2 + y^2 = a^2\sqrt{2}, x^2 + y^2 = a^2$, is $\pi/4$.

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2. Angle of intersection of the following curves

$xy = a^2, x^2 + y^2 = 2a^2$ is 0 i.e. the touch.

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3. Angle of intersection of the following curves

$y^2 = 16x, 2x^2 + y^2 = 4$ is $\pi/2$

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4. Angle of intersection of the following curves

$y = x^2, 6y = 7 - x^2$ is $\tan^{-1} 7.$

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5. For the curve $xy = c^2$

The intercept between the axes on the tangent at any point is bisected at the point of contact.

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6. For the curve $xy = c^2$

The tangent at any point makes with co-ordinate axes a triangle of constant area.

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7. In the curve $x^{m+n} = a^{m-n}y^{2n}$, mth power of subtangent varies as the nth power of the sub-normal.

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Problem Set 2 Fill In The Blanks

1. If x_1, y_1 be the parts of the axes intercepted-by the tangent at any point [x, y) on the curve

$\left(\frac{x}{a}\right)^{2/3} + \left(\frac{y}{b}\right)^{2/3} = 1,$ then $\frac{x_1^2}{a^2} + \frac{y_1^2}{a^2} + \frac{y_1^2}{b^2}$=.....

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Misscellaneous Exercise Assertion And Reason

1. Given : A circle $2x^2 + 2y^2 = 5$ and a parabola $y^2 = 4\sqrt{5}x$

Statement-1 : An equation of the common tangent to these curve is $y = x + \sqrt{5}$

Statement-2 : If the line y = $mx + \frac{\sqrt{5}}{m}, m \neq 0$

is their common tangent, then m satisfies

$m^4 - 3m^2 + 2 = 0$

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Self Assessment Test Multiple Choice Questions

1. For the curve $x = t^2 - 1, y = t^2 - t$, the tangent line is perpendicular to x-axis, where

A. $t = 0$

B. $t = \infty$

C. $t = 1/\sqrt{3}$

D. $t = 1/\sqrt{3}$

Answer: A

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2. The slope of the tangent to the curve $x = t^2 + 3t - 8, y = 2t^2 - 2t - 5$ at the point (2, -1), is

A. $\frac{22}{7}$

B. $6/7$

C. -6

D. None of these

Answer: B

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3. The tangent of the curve $y = 2x^2 - x + 1$ is parallel to the line y = 3x + 9 at the point

A. $(3, 9)$

B. $(2, -1)$

C. $(2, 1)$

D. $(1, 2)$

Answer: D

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4. The tangentto the curve $x^2 + y^2 - 2x - 3 = 0$ is parallel to x-axis at the points

A. $(2, \pm\sqrt{3})$

B. $(1, \pm 2)$

C. $(\pm 1, 2)$

D. $(\pm 3, 0)$

Answer: B

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5. Let C be the curve $y^3 - 3xy + 2 = 0$. If H is the set of points on the curve C, where the tangent is horizontal and V is the set of points

on the curve C, where the tangent is vertical, then H = ... and V = ...

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6. The *curve* $x^3 - 3xy^2 + 2 = 0$ and $3x^2y - y^3 - 2 = 0$ cut at an angle of

A. 45°

B. 60°

C. 90°

D. 30°

Answer: C

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7. The angle of intersection of the curve $y = x^2$ and $6y = 7 - x^2$ at (1,1) is

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

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

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

D. None of these

Answer: D

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8. The equation of the tangent at the point P(t) ,wheret is any parameter, to the parabola $y^2 = 4ax$ is

A. $yt = x + at^2$

B. $y = xt + at^2$

C. $y = tx$

D. $y = txq/t$

Answer: A

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9. The normal drawn at a point $\left(at_1^2, 2at_1\right)1)$ on the parabola $y^2 = 4ax$ meets it again at the point $\left(at_2^2, 2at_2\right)$, then

A. $t_1 = 2t_2$

B. $t_1^2 = 2t_2$

C. $t_1 t_2 = -1$

D. None of those

Answer: D

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10. The tangent to a given curve is perpendicular to x-axis if

A. $\frac{dy}{dx} = 0$

B. $\frac{dy}{dx} = 1$

C. $\frac{dx}{dy} = 0$

D. $\frac{dx}{dy} = 1$

Answer: C

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11. The normal to a given curve is parallel to $x-$ axis if

A. $\frac{dy}{dx}=0$

B. $\frac{dy}{dx}=1$

C. $\frac{dx}{dy}=0$

D. $\frac{dx}{dy}=1$

Answer: C

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12. The point on the curve $y^2 = x$, the tangent at which makes an angle of 45° with x-axis will be given by

A. $\left(\frac{1}{2}, \frac{1}{4}\right)$

B. $\left(\frac{1}{2}, \frac{1}{2}\right)$

C. $(2, 4)$

D. $\left(\frac{1}{4}, \frac{1}{2}\right)$

Answer: D

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13. The tangent to the curve $y = e^{2x}$ at the point (0, 1) meets the x axis at

A. $(0, 1)$

B. $(2, 0)$

C. $\left(-\frac{1}{2}, 0\right)$

D. None of these

Answer: C

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14. The length of the subnormal to the parabola $y^2 = 4ax$ at any point is equal to

A. $\sqrt{2}a$

B. $2\sqrt{2}a$

C. $\frac{a}{\sqrt{(2)}}$

D. $2a$

Answer: D

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15. The normal at the.point (1, 1) on the curve $2y = 3 - x^2$ is

A. x+y=0

B. x+y+1=0

C. x-y+1=0

D. x-y=0

Answer: D

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16. The normal to the curve $x = a(\cos\theta + \theta\sin\theta), y = a(\sin\theta - \theta\cos\theta)$ at any θ is such that

A. it makes a constant angle with x-axis,

B. it passes through the origin

C. it is at a constant distance from the origin

D. None of these.

Answer: C

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17. If the parametric equation of a curve is given by $x = e^t \cos t, y = e^t \sin t,$ then the tangent to the curve at the point $t = \pi/4$ makes with the axis of x the angle

A. 0

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

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

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

Answer: D

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18. The angle of intersection of the curves $y = x^2, 6y = 7 - x^3$ at (1, 1), is

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

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

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

D. None

Answer: C

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19. The equation of the tangent to the curve $y = x + \frac{4}{x^2}$, that is parallel to the x-axis, is

A. y=0

B. $y=1$

C. $y=2$

D. $y=3$

Answer: D

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