APPLICATION OF DERIVATIVES

SECTION - A

TANGENT & NORMAL AT A POINT ON CURVE

1. Find the number of points on the curve $x^2 + y^2 - 2x - 3 = 0$ at which the tangents are parallel to the x-axis.

(A) 1

(B) 2

(C) 3

(D) None of these

2. At what point of the curve $y = 2x^2 - x + 1$ tangent is parallel to $y = 3x + 4$

(A) $(0,1)$

(B) $(1,2)$

(C) $(-1,4)$

(D) $(2,7)$

3. The equation of normal to the curve $x^{2/3} + y^{2/3} = a^{2/3}$ at the point $(a, 0)$ is-

(A) $\mathrm{x} = \mathrm{a}$

(B) $x = -a$

(C) $y = a$

(D) $y = -a$

4. The tangent to the curve $(x-2)^4 + (y-1)^4 = 81$ at the point $(5,1)$ is-

(A) $2x + y = 1$

(B) $x + 5y = 10$

(C) $y = 1$

(D) $x = 5$

5. The equation of the normal to the curve $y^2 = 4ax$ at point $(\mathrm{a}, 2\mathrm{a})$ is-

(A) $x - y + a = 0$

(B) $x + y - 3a = 0$

(C) $\mathrm{x} + 2\mathrm{y} + 4\mathrm{a} = 0$

(D) $x + y + 4a = 0$

6. If tangent at point $(1,2)$ on the curve $y = ax^2 + bx + \frac{7}{2}$ be parallel to normal at $(-2,2)$ on the curve $y = x^2 + 6x + 10$, then

(A) $\mathrm{a} = 1$

(B) $\mathrm{a} = -1$

(C) $b=-5/2$

(D) $b=5/2$

7. Find the points on the curve $y=x^3+x^2+x$ at which the tangent to the curve is parpendicular to the line $x+y=1$.

(A) $(0,0)$

(B) $(-2/3,-14/27)$

(C) $(0,14/27)$

(D) $(-2/3,0)$

8. The equation of normal to the curve $\left(\frac{x}{a}\right)^n+\left(\frac{y}{b}\right)^n=2(n\in N)$ at the point with abscissa equal to 'a' can be

(A) $ax+by=a^2-b^2$

(B) $ax+by=a^2+b^2$

(C) $ax-by=a^2-b^2$

(D) $bx-ay=a^2-b^2$

SECTION - B

TANGENT & NORMAL WHEN SLOPE IN KNOWN

9. If the normal to the curve $y=f(x)$ at the point $(3,4)$ makes an angle $\frac{3\pi}{4}$ with the positive x-axis, then $f'(3)$ is equal to

(A) -1

(B) $-3/4$

(C) $4/3$

(D) 1

10. If tangent at any point of the curve $y=x^3+\lambda x^2+x+5$ makes acute angle with x-axis, then

(A) $0<\lambda<3$

(B) $-\sqrt{3}<\lambda<\sqrt{3}$

(C) $|\lambda|<1$

(D) $\lambda\in(0,1)$

11. The distance between the origin and the normal to the curve $y=e^{2x}+x^2$ drawn at the point $x=0$ is

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

(B) $\frac{2}{\sqrt{5}}$

(C) $\frac{-1}{\sqrt{5}}$

(D) $\frac{2}{\sqrt{3}}$

12. If tangent of the curve $x = t^2 - 1, y = t^2 - t$ is perpendicular to x - axis, then-

(A) $t = 0$

(B) $t = 1/\sqrt{2}$

(C) $t = \infty$

(D) $t = -1/\sqrt{3}$

13. If equation of normal at a point $(m^2, -m^3)$ on the curve $x^3 - y^2 = 0$ is $y = 3mx - 4m^3$, then m^2 equals-

(A) 0

(B) 1

(C) $-2/9$

(D) $2/9$

14. Find the equation of normal to the curve $x^3 + y^3 = 8xy$ at point where it is meet by the curve $y^2 = 4x$, other than origin.

15. Find the equation of the tangent line to the curve $y = x^2 - 2x + 7$ which is

(a) parallel to the line $2x - y + 9 = 0$

(b) perpendicular to the line $2y - x + 1 = 0$

16. Find the points on the curve $y = x^3$ at which slope of the tangent is equal to the y-coordinates of the point.

SECTION - C

TANGENT & NORMAL FROM OUTSIDE POINT

17. The coordinates of the point on the curve $y = x^2 + 3x + 4$, the tangent at which passes through the origin are-

(A) $(-2,2), (2,14)$

(B) $(1,-1), (3,4)$

(C) $(2,14), (2,2)$

(D) $(1,2), (14,3)$

18. The perpendicular distance between origin and normal to curve $y = e^{2x} + x^2$ at $x = 0$ is

(A) $\frac{2}{\sqrt{3}}$

(B) $\frac{2}{\sqrt{5}}$

(C) $\frac{2}{\sqrt{7}}$

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

19. If $x+4y=14$ is a normal to the curve $y^2=\alpha x^3-\beta$ at (2,3), then the value of $\alpha+\beta$ is

(A) 9

(B) -5

(C) 7

(D) -7

20. The equation of tangent drawn to the curve $\mathrm{y}^2-2\mathrm{x}^3-4\mathrm{y}+8=0$ from the point (1,2) is

(A) $2x\sqrt{3}+2y+(1+\sqrt{3})=0$

(B) $2\sqrt{3}x+y-2(1+\sqrt{3})=0$

(C) $2x\sqrt{3}+y-(1+\sqrt{2})=0$

(D) $2x+y-2(1+\sqrt{3})=0$

21. Find the equation of tangent to the curve $y=1+e^{-2x}$ where it cuts the line $\mathrm{y}=2$.

SECTION - D

TANGENT & NORMAL CUTTING CURVE AGAIN

22. A curve is represented by the equations, $\mathrm{x}=\sec^2\mathrm{t}$ and $y=\cot\ t$ where t is a parameter. If the tangent at the point P on the curve where $\mathrm{t}=\pi/4$ meets the curve again at the point Q then |PQ| is equal to

(A) $\frac{5\sqrt{3}}{2}$

(B) $\frac{5\sqrt{5}}{2}$

(C) $\frac{2\sqrt{5}}{3}$

(D) $\frac{3\sqrt{5}}{2}$

23. If the tangent at P of the curve $\mathrm{y}^2=\mathrm{x}^3$ intersects the curve again at Q and the straight lines OP, OQ make angles α,β with the x-axis, where ' O ' is the origin, then $\tan\ \alpha/\tan\ \beta$ has the value equal to

(A) -1

(B) -2

(C) 2

(D) $\sqrt{2}$

24. Let C be the curve $\mathrm{y}=\mathrm{x}^3$ (where x takes all real values). The tangent at A meets the curve again at B. If the gradient at B is K times the gradient at A then K is equal to

(A) 4

(B) 2

(C) -2

(D) $\frac{1}{4}$

25. If the tangent at (1,1) on $y^2 = x(2-x)^2$ meets the curve again at P, then find coordinates of P.

26. The tangent at a variable point P of the curve $y = x^2 - x^3$ meets it again at Q. Show that the locus of the middle point of PQ is $\mathrm{y} = 1 - 9\mathrm{x} + 28\mathrm{x}^2 - 28\mathrm{x}^3$.

SECTION - E

CONDITION FOR TANGENT & NORMAL

27. If the curve $y = x^2 + bx + c$, touches the line $y = x$ at the point (1,1), then values of b and c are-

(A) $-1,2$

(B) $-1,1$

(C) 2, 1

(D) $-2,1$

28. Line joining the points (0,3) and $(5,-2)$ is a tangent to the curve $y = \frac{ax}{1-x}$, then

(A) $\mathrm{a} = 1 \pm \sqrt{3}$

(B) $a = 2 \pm 2\sqrt{3}$

(C) $\mathrm{a} = -1 \pm \sqrt{3}$

(D) $\mathrm{a} = -2 \pm 2\sqrt{3}$

29. If a variable tangent to the curve $x^2y = c^3$ makes intercepts a, b on x and y axis respectively, then the value of a^2b is

(A) $27\mathrm{c}^3$

(B) $\frac{4}{27}c^3$

(C) $\frac{27}{4}c^3$

(D) $\frac{4}{9}\mathrm{c}^3$

30. If the line $ax + by + c = 0$ is a normal to the curve $\mathrm{xy} = 1$, then-

(A) $a, b \in R$

(B) $a > 0, b > 0$

(C) $\mathrm{a} < 0, \mathrm{b} > 0$ or $\mathrm{a} > 0, \mathrm{b} < 0$

(D) $\mathrm{a} < 0, \mathrm{b} < 0$

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

(A) $(-a, be)$

(B) $\left(-a, \frac{b}{e}\right)$

(C) $\left(a, \frac{b}{e}\right)$

(D) $(0, b)$

32. The tangent to $y = ax^2 + bx + \frac{7}{2}$ at $(1,2)$ is parallel to the normal at the point $(-2,2)$ on the curve $y = x^2 + 6x + 10$ then find $a - b$.

(A) $\frac{3}{2}$ (B) $\frac{1}{2}$ (C) $\frac{7}{2}$ (D) $-\frac{1}{2}$

33. If $y = f(x)$ be the equation of a parabola which is touched by the line $y = x$ at the point where $x = 1$. Then

(A) $f'(1) = 1$

(B) $f'(0) = f'(1)$

(C) $2f(0) = 1 - f'(0)$

(D) $f(0) + f'(0) + f''(0) = 1$

34. If the line, $ax + by + c = 0$ is a normal to the curve $xy = 2$, then

(A) $a < 0, b > 0$ (B) $a > 0, b < 0$ (C) $a > 0, b > 0$ (D) $a < 0, b < 0$

35. Let the parabolas $y = x^2 + ax + b$ and $y = x(c - x)$ touch each other at the point $(1,0)$. Then

(A) $a = -3$

(B) $b = 1$

(C) $c = 2$

(D) $b + c = 3$

36. The co-ordinates of the point(s) on the graph of the function, $f(x) = \frac{x^3}{3} - \frac{5x^2}{2} + 7x - 4$ where the tangent drawn cut off intercepts from the coordinate axes which are equal in magnitude but opposite in sign is

(A) $(2, 8/3)$

(B) $(3, 7/2)$

(C) $(1, 5/6)$

(D) None of these

37. For the curve represented parametrically by the equation, $x = 2\ell n\cot t + 1$ and $y = \tan t + \cot t$

(A) tangent at $t = \pi/4$ is parallel to x-axis

(B) normal at $t = \pi/4$ is parallel to y-axis

(C) tangent at $t = \pi/4$ is parallel to the line $y = x$

(D) tangent and normal intersect at the point (2,1)

SECTION - F

GEOMETRY OF TANGENT & NORMAL

38. If the tangent to the curve $x = a(\theta + \sin\ \theta), y = a(1 + \cos\ \theta)$ at $\theta = \frac{\pi}{3}$ makes an angle $\alpha(0 \leq \alpha < \pi)$ with x-axis, then α equals

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

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

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

(D) $\frac{5\pi}{6}$

39. The coordinates of the point of the parabola $y^2 = 8\mathrm{x}$, which is at minimum distance from the circle $\mathrm{x}^2 + (\mathrm{y} + 6)^2 = 1$ are

(A) $(2, -4)$

(B) $(18, -12)$

(C) $(2,4)$

(D) None of these

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

(A) $\frac{2a}{9}$

(B) $\frac{4a}{9}$

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

(D) $-\frac{2a}{9}$

41. The ordinate of $y = (a/2)\left(e^{x/a} + e^{-x/a}\right)$ is the geometric mean of the length of the normal and the quantity

(A) $a/2$

(B) a

(C) e

(D) None of these

42. For a curve $\frac{(\text{ length of normal })^2}{(\text{ length of tangent })^2}$ is equal to

(A) (subnormal) / (subtangent)

(B) (subtangent) / (subnormal)

(C) (subnormal) / (subtangent) ^{2}

(D) None of these

43. If at any point on a curve the subtangent and subnormal are equal, then the length of tangent is equal to

(A) ordinate

(B) $\sqrt{2}$ ordinate

(C) $\sqrt{2(\text{ ordinate })}$

(D) None of these

44. The x-intercept of the tangent at any arbitrary point of the curve $\frac{a}{x^2}+\frac{b}{y^2}=1$ is proportional to

(A) square of the abscissa of the point of tangency (B) square root of the abscissa of the point of tangency

(C) cube of the abscissa of the point of tangency

(D) cube root of the abscissa of the point of tangency.

45. If the area of the triangle included between the axes and any tangent to the curve $\mathrm{x}^{\mathrm{n}}\mathrm{y}=\mathrm{a}^{\mathrm{n}}$ is constant, then n is equal to

(A) 1

(B) 2

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

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

46. The beds of two rivers (within a certian region) are a parabola $y=x^2$ and a straight line $y=x-2$ These rivers are to be connected by a striaght canal.The co - ordinates of the ends of the shortest distance of canal can be

(A) $\left(\frac{1}{2},\frac{1}{4}\right)$ and $\left(-\frac{11}{8},\frac{5}{8}\right)$

(B) $\left(\frac{1}{2},\frac{1}{4}\right)$ and $\left(\frac{11}{8},-\frac{5}{8}\right)$

(C) $(0,0)$ and $(-1,-1)$

(D) None of these

47. Show that for any point of the curve $x^2-y^2=a^2$ the segment of the normal from the point to the point of intersection of the normal with the x-axis is equal to the distance of the point from the origin.

48. Prove that the length of segment of all tangents to curve $x^{2/3}+y^{2/3}=a^{2/3}$ intercepted between coordinate axes is same.

49. Find the abscissa of the point on the curve, $xy = (c - x)^2$ the normal at which cuts off numerically equal intercepts from the axes of co_ ordinates.

SECTION - G

ANGLE OF INTERSECTION &ORTHOGONALITY

50. The curves $x^3 + pxy^2 = -2$ and $3x^2y - y^3 = 2$ are orthogonal for

(A) $\mathrm{p} = 3$

(B) $p = -3$

(C) no value of p

(D) $p = \pm 3$

51. If curves $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ and $\mathrm{xy} = \mathrm{c}^2$ intersect orthogonally, then

(A) $a + b = 0$

(B) $a^2 = b^2$

(C) $a + b = c$

(D) None of these

52. Equation of the normal to the curve $\mathrm{y} = -\sqrt{x} + 2$ at the point of its intersection with the curve $y = \tan(\tan^{-1} \mathrm{x})$ is

(A) $2\mathrm{x} - \mathrm{y} - 1 = 0$

(B) $2x - y + 1 = 0$

(C) $2x + y - 3 = 0$

(D) None of these

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

(A) $\pi/4$

(B) $\pi/3$

(C) $\pi/2$

(D) None of these

54. If α be the angle of intersection between the curves $\mathrm{y} = \mathrm{a}^{\mathrm{x}}$ and $\mathrm{y} = \mathrm{b}^{\mathrm{x}}$, then $\tan \alpha$ is equal to -

(A) $\frac{\log a - \log b}{1 + \log a \log b}$

(B) $\frac{\log a + \log b}{1 - \log a \log b}$

(C) $\frac{\log a - \log b}{1 - \log a \log b}$

(D) None of these

55. If curves $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ and $\frac{x^2}{\ell^2} - \frac{y^2}{m^2} = 1$ intersect orthogonally, then -

(A) $\mathrm{a}^2 + \mathrm{b}^2 = \ell^2 + \mathrm{m}^2$

(B) $a^2 - b^2 = \ell^2 - m^2$

(C) $a^2 - b^2 = \ell^2 + m^2$

(D) $a^2 + b^2 = \ell^2 - m^2$

56. If curves $y^2 = 6x$ and $9x^2 + by^2 = 16$ intersect orthogonally, then b is equal to

(A) 4

(B) 2

(C) 9/2

(D) 2/9

57. If the radius of a sphere is measured as 9 m with an error of 0.03 m, then find the approximae error in calculating its surface area.

(A) $2.16\pi m^2$

(B) $.216\pi m^2$

(C) $21.6\pi m^2$

(D) $0.3\pi m^2$

58. The approximate change in the volume of a cube of side x metres caused by increasing the side by 3% is

(A) $0.06x^3$ m^3

(B) $0.6x^3$ m^3

(C) $0.09x^3$ m^3

(D) $0.9x^3$ m^3

59. A balloon is pumped at the rate of acm^3/ minute. The rate of increase of its surface 3 area when the radius is bcm, is -

(A) $\frac{2a^2}{b^4}$ cm^2/min

(B) $\frac{a}{2b}$ cm^2/min

(C) $\frac{2a}{b}$ cm^3/min

(D) None of these

60. x and y are the sides of two squares such that $y = x - x^2$. The rate of change of the area of the second square with respect to that of the first square is -

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

(B) $2x^2 - 3x + 1$

(C) $2(2x^2 - 3x + 1)$

(D) None of these

61. A man 2 metres high, walks at a uniform speed of 6 metre per minute away from a lamp post, 5 metres high. The rate at which the length of his shadow increases is -

(A) 1 metres/ minute

(B) 2 metres / minute

(C) 4 metres/ minute

(D) 3 metres/ minute

62. At (0,0). the curve $y^2 = x^3 + x^2$

(A) touches X - axis

(B) bisects the angle between the axes

(C) makes an angle of 60° with OX

(D) None of these

63. The angle at which the curve $\mathrm{y} = \mathrm{ke}^{\mathrm{kx}}$ intersects the y-axis is :

(A) $\tan^{-1}(\mathrm{k}^2)$

(B) $\cot^{-1}(\mathrm{k}^2)$

(C) $\sin^{-1}\left(\frac{1}{\sqrt{1+k^4}}\right)$

(D) $\sec^{-1}\left(\sqrt{1+k^4}\right)$

64. Which of the following pair(s) of curves is/are orthogonal

(A) $\mathrm{y}^2 = 4\mathrm{ax}; \mathrm{y} = \mathrm{e}^{-\mathrm{x}/2\mathrm{a}}$

(B) $y^2 = 4ax; x^2 = 4ay$

(C) $xy = a^2; x^2 - y^2 = b^2$

(D) $y = ax; x^2 + y^2 = c^2$

65. Find the angle of intersection of the curve $y = 2\sin^2 x$ and $\mathrm{y} = \cos 2\mathrm{x}$.

66. If the two curves $C_1: x = y^2$ and $C_2: xy = k$ cut at right angles find the value of k.

SECTION - H

COMMON TANGENT OF TWO CURVES

67. The curve $C_1: y = 1 - \cos x, x \in (0, \pi)$ and $C_2: y = \frac{\sqrt{3}}{2}|x| + \mathrm{a}$ will touch each other if

(A) $a = \frac{3}{2} - \frac{\pi}{\sqrt{3}}$

(B) $a = \frac{3}{2} - \frac{\pi}{2\sqrt{3}}$

(C) $a = \frac{1}{2} - \frac{\pi}{\sqrt{3}}$

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

SECTION - I

APPROXIMATION & DIFFERENTIAL

68. Use differential to approximate $\sqrt{36.6}$

(A) 6.05

(B) 6.5

(C) 6.005

(D) 6

69. Find the approximate change in the surface area of a cube of side x metres caused by decreasing the side by 1%.

(A) $0.12x^2\ m^2$

(B) $0.012x^2\ m^2$

(C) $1.2x^2\ m^2$

(D) $0.0012x^2\ m^2$

70. If $f(x) = 3x^2 + 15x + 5$, then the approximate value of f(3.02) is

(A) 47.66

(B) 57.66

(C) 67.66

(D) 77.06

SECTION - J

RATE MEASURE

71. Water is being poured on to a cylindrical vessel at the rate of $1\ m^3/min$. If the vessel has a circular base of radius 3 m, the rate at which the level of water is rising in the vessel is

(A) $1/9\pi m/min$

(B) $0\pi m/min$

(C) $1/3\pi m/min$

(D) $3\pi m/min$

72. Water is poured into an inverted conical vessel of which the radius of the base is 2 m and height 4 m, at the rate of 77 litre/minute. The rate at which the water level is rising at the instant when the depth is 70 cm is: (use $\pi = 22/7$)

(A) 10 cm/min

(B) 20 cm/min

(C) 40 cm/min

(D) None of these

73. A particle moves along the curve $6y = x^3 + 2$. Find the points on the curve at which the y coordinate is changing 8 times as fast as the x co-ordinate.

74. The length x of rectangle is decreasing at a rate of 3 cm/min and the width y is increasing at the rate of 2 cm/min, when x = 10 cm and y = 6 cm, find the rates of changes of
(i) the perimeter, and (ii) the area of the rectangle.

75. A light shines from the top of a pole 50ft high. A ball is dropped from the same height from a point 30ft away from the light. How fast is the shadow of the ball moving along the ground 1/2sec. later? [Assume the ball falls a distance $s = 16t^2$ft in ' t ' sec.]

76. A man 1.5 m tall walks away from a lamp post 4.5 m high at the rate of 4 km/hr.
(i) how fast is the farther end of the shadow moving on the pavement?
(ii) how fast is his shadow lengthening?

SECTION - K :

MIXED PROBLEMS

77. The area of the triangle formed by the positive x-axis and the normal and the tangent to the circle $x^2 + y^2 = 4$ at $(1, \sqrt{3})$ is
(A) $3\sqrt{3}$ sq. units
(B) $2\sqrt{3}$ sq. units
(C) $4\sqrt{3}$ sq. units
(D) $\sqrt{3}$ sq. units

78. Consider the curve $f(x) = x^{1/3}$, then
(A) the equation of tangent at (0,0) is $x = 0$
(B) the equation of normal at (0,0) is $y = 0$
(C) normal to the curve does not exist at (0,0)
(D) $f(x)$ and its inverse meet at exactly 3 points.

79. In which of the following cases the given equations has atleast one root in the indicated interval?
(A) $x - \cos x = 0$ in $(0, \pi/2)$
(B) $x + \sin x = 1$ in $(0, \pi/6)$
(C) $\frac{a}{x-1} + \frac{b}{x-3} = 0, a, b > 0$ in (1,3)
(D) $f(x) - g(x) = 0$ in (a, b) where f and g are continuous on [a, b] and f(a) > g (a) and f(b) < g (b).

80. The tangent to the graph of the function $y = f(x)$ at the point with abscissa x = a forms with the x-axis an angle of $\pi/3$ and at the point with abscissa $x = b$ at an angle of $\pi/4$, then find the value of the integral, $\int_a^b f'(x) \cdot f''(x) dx$ [assume $f''(x)$ to be continuous]

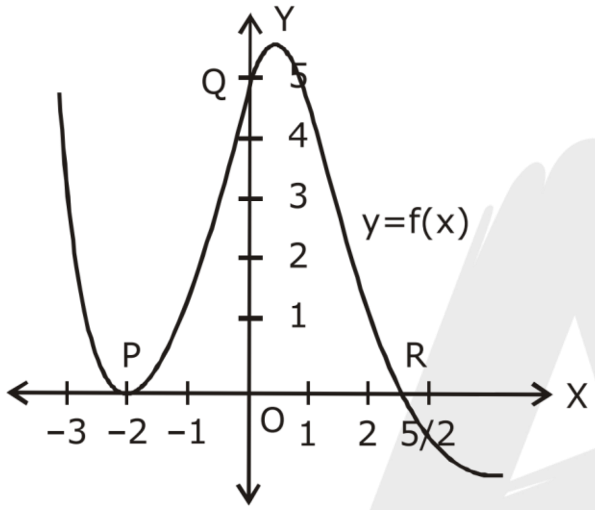
81. Find the set of values of p for which the equation $|\ell nx| - px = 0$ possess three distinct roots is.

82. Find the minimum value of

$$(x_1 - x_2)^2 + \left(\sqrt{2 - x_1^2} - \frac{9}{x_2}\right)^2 \text{ where } x_1 \in (0, \sqrt{2}) \text{ and } x_2 \in R^+.$$

COMPREHENSION

A polynomial of degree three as shown in the figure and at Q gradient is 3.



83. The number of solutions of the equation $|\ f(|\mathbf{x}|)\ | - 3 = 0$

(A) 2

(B) 3

(C) 4

(D) 5

84. The equation of normal at R is

(A) $6x - 81y - 15 = 0$

(B) $8x - 81y - 20 = 0$

(C) $2x - 81y - 5 = 0$

(D) $4x - 81y - 10 = 0$

85. The equation of tangent at Q is

(A) $4x - y + 5 = 0$

(B) $3x - 2y + 10 = 0$

(C) $3x - 2y + 10 = 0$

(D) $3x - y + 5 = 0$

86.

Column- I	**Column – II**
(A) The slope of the curve $2y^2 = ax^2 + b$ at $(1, -1)$ is -1 , then	**(P)** $a - b = 2$

(B) If (a, b) be the point on the curve $9y^2 = x^3$ where normal to the curve makes equal intercepts with the axes, then	**(Q)** $a - b = 7/2$
	(R) $a - b = 4/3$
(C) If the tangent at any point $(1,2)$ on the curve $y = ax^2 + bx + \frac{7}{2}$ be parallel to the normal at $(-2,2)$ on the curve $y = x^2 + 6x + 10$, then	**(S)** $a + \lvert b \rvert = \frac{20}{3}$
	(T) $5a + 2b = 0$

PREVIOUS YEAR

87. The shortest distance between the line $y - x = 1$ and the curve $x = y^2$ is - **[AIEEE 2009]**

(A) $\frac{3\sqrt{2}}{8}$

(B) $\frac{2\sqrt{3}}{8}$

(C) $\frac{3\sqrt{2}}{5}$

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

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

[AIEEE 2010]

(A) $y = 0$

(B) $y = 1$

(C) $y = 2$

(D) $y = 3$

89. The intercepts on x-axis made by tangents to the curve, $y = \int_0^x |t|dt, x \in R$, which are parallel to the line $y = 2x$, are equal to : **[JEE MAIN 2013]**

(A) ± 3

(B) ± 4

(C) ± 1

(D) ± 2

90. The normal to the curve, $x^2 + 2xy - 3y^2 = 0$, at $(1,1)$: **[JEE MAIN 2015]**

(A) meets the curve again in the third quadrant.

(B) meets the curve again in the fourth quadrant.

(C) does not meet the curve again.

(D) meets the curve again in the second quadrant.

91. Consider $f(x)=\tan^{-1}\left(\sqrt{\frac{1+\sin x}{1-\sin x}}\right), x \in\left(0, \frac{\pi}{2}\right)$.

A normal to $y=f(x)$ at $x=\frac{\pi}{6}$ also passes through the point: **[JEE MAIN 2016]**

(A) $\left(0, \frac{2\pi}{3}\right)$

(B) $\left(\frac{\pi}{6}, 0\right)$

(C) $\left(\frac{\pi}{4}, 0\right)$

(D) $(0,0)$

92. The normal to the curve $y(x-2)(x-3)=x+6$ at the point where the curve intersects the y - axis passes through the point: **[JEE MAIN 2017]**

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

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

(C) $\left(\frac{1}{2},-\frac{1}{3}\right)$

(D) $\left(\frac{1}{2}, \frac{1}{3}\right)$

93. The tangent to the curve $\mathrm{y}=\mathrm{e}^{\mathrm{x}}$ drawn at the point (c, e^{c}) intersects the line joining the points $(c-1, e^{c-1})$ and $(c+1, e^{c+1})$ **[JEE 2007]**

(A) on the left of $x=c$

(B) on the right of $x=c$

(C) at no point

(D) at all points

94. Let $f(x)=x \sin \pi x, x>0$. Then for all natural numbers n, $\mathrm{f}'(\mathrm{x})$ vanishes at **[JEE 2013]**

(A) a unique point in the interval $\left(n, n+\frac{1}{2}\right)$

(B) a unique point in the interval $\left(n+\frac{1}{2}, n+1\right)$

(C) a unique point in the interval $(\mathrm{n}, \mathrm{n}+1)$

(D) two points in the interval $(n, n+1)$

ANSWER KEY

1.	**(B)**	**2.**	**(B)**	**3.**	**(A)**	**4.**	**(D)**	**5.**	**(B)**	**6.**	**(AC)**	**7.**	**(AB)**
8.	**(AC)**	**9.**	**(D)**	**10.**	**(B)**	**11.**	**(B)**	**12.**	**(A)**	**13.**	**(D)**		
14.	**(**$y = x$**)**												
15.	(a) $y - 2x - 3 = 0$, (b) $2x + y - 7 = 0$												
16.	(0, 0) ; (3, 27)												
17.	**(A)**	**18.**	**(B)**	**19.**	**(A)**	**20.**	**(B)**			**21.**	**(**$2x + y = 2$**)**		
22.	**(D)**	**23.**	**(B)**	**24.**	**(A)**	**25.**	(9/4, 3/8)			**26.**	**()**	**27.**	**(B)**
28.	**(B)**	**29.**	**(C)**	**30.**	**(C)**	**31.**	**(D)**	**32.**	**(C)**	**33.**	**(AC)**	**34.**	**(AB)**
35.	**(AD)**	**36.**	**(AB)**	**37.**	**(AB)**	**38.**	**(D)**	**39.**	**(A)**	**40.**	**(B)**	**41.**	**(B)**
42.	**(A)**	**43.**	**(B)**	**44.**	**(C)**	**45.**	**(A)**	**46.**	**(B)**	**47.**	**()**	**48.**	**()**
49.	**(**$\pm\frac{c}{\sqrt{2}}$**)**	**50.**	**(B)**	**51.**	**(B)**	**52.**	**(A)**	**53.**	**(C)**	**54.**	**(A)**	**55.**	**(C)**
56.	**(C)**	**57.**	**(A)**	**58.**	**(C)**	**59.**	**()**	**60.**	**(B)**	**61.**	**(C)**	**62.**	**(B)**
63.	**(BC)**	**64.**	**(ACD)**			**65.**	**(**$\frac{\pi}{3}$**)**	**66.**	**(**$\pm\frac{1}{2\sqrt{2}}$**)**				
67.	**(A)**	**68.**	**(A)**	**69.**	**(A)**	**70.**	**(D)**	**71.**	**(A)**	**72.**	**(B)**		
73.	(4, 11) & (–4, –31/3)					**74.**	(i) –2 cm/min, (ii) 2 cm^2 /min						
75.	**(**–1500 ft/sec**)**					**76.**	(i) 6 km/h (ii) 2 km/hr						
77.	**(B)**	**78.**	**(ABD)**			**79.**	**(ABCD)**						
80.	**(-1)**	**81.**	**()**	**82.**	**()**	**83.**	**(C)**	**84.**	**(B)**	**85.**	**(D)**		
86.	(A)–P ; (B)–R,S ; (C)–Q,T												
87.	**(A)**	**88.**	**(D)**	**89.**	**(C)**	**90.**	**(B)**	**91.**	**(A)**	**92.**	**(B)**	**93.**	**(A)**
94.	**(BC)**												