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Class: XII
Subject: Maths
Topic: Application of Derivative
No. of Questions: 28

1. The point M (x, y) of the graph of the function $y = e^{-|x|}$ so that area bounded by the tangent at M and the coordinate axes is greatest is

   A. $(1, e^{-1})$
   B. $(2, e^{-2})$
   C. $(-2, e^{2})$
   D. (0, 1)

2. The number of inflection points of a function given by a third degree polynomial is exactly

   A. 2
   B. 1
   C. 3
   D. 0

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

   A. (-4, 4)
   B. (– 1, 2)
   C. (9/4, 3/8)
   D. None of these

4. Let $f(x) = 2\tan^{-1} x + \sin^{-1}\frac{2x}{1+x^2}$ then

   A. max $f(x) = \pi/2$
   B. min $f(x) = \pi/4$
   C. max $f(x) = \pi$
   D. none of thee

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5. The abscissa of the point on the curve $9y^2 = x^3$, the normal at which cuts off equal intercepts on the coordinate axes is

   A. 2
   B. -4
   C. 4
   D. - 2

6. If the normal to the curve $x^3 = y^2$ at the point $(m^2, -m^3)$ is $y = mx - 2m^3$, then the value of m^2 is

   A. 1
   B. 1/2
   C. 1/3
   D. 2/3

7. If the curves $y^2 = 6x$, $9x^2 + by^2 = 16$, cut each other at right angles then the value of b is

   A. 2
   B. 4
   C. 9/2
   D. None of these

8. The tangent to the curve $y = e^x$ drawn at the point (c, e^c) intersects the line joining the points $(c - 1, e^c - 1)$ and $(c + 1, e^{c+1})$

   A. on the left of x = c
   B. on the right of x = c
   C. at no point
   D. at all points

9. On the interval [0, 1] the function $x^{25} (1 - x)^{75}$ takes its maximum value at the point

   A. 0
   B. 1/3
   C. 1/2
   D. ¼

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10. A curve passes through the point (2, 0) and the slope of the tangent at any point (x, y) is $x^2 - 2x$ for all value of x. The point of maximum ordinate on the curve is

    A. (0, 4/3)
    B. (0, 2/3)
    C. (1, 2/3)
    D. (2, 4/3)

11. If $f(x) = x\, e^{x(1-x)}$, then f(x) is

    A. increasing on [– 1/2, 1]
    B. decreasing on R
    C. increasing on R
    D. decreasing on [– 1/2, 1]

12. An equation of the circle that is tangent to $y = x^3$ at (1, 1) and has the same second derivative there, is

    A. $x^2 + y^2 + 24x - 28y + 2 = 0$
    B. $2(x^2 + y^2) + 12x - 8y - 8 = 0$
    C. $3(x^2 + y^2) - 24x + 10y + 8 = 0$
    D. None of these

13. If f and g are defined on $[0, \infty)$ by $f(x) = \lim_{n\to\infty} \frac{x^n - 1}{x^n + 1}$ and $g(x) = \int_0^x f(t)\, dt$. Then

    A. g has local maximum at x = 1
    B. g has local minimum at x = 1
    C. g is an increasing function on $(0, \infty)$
    D. g is a decreasing function on $(0, \infty)$

14. If the tangent to the curve $2y^3 = ax^2 + x^3$ at the point (a, a) cuts off intercepts a and b on the coordinate axes, where $\alpha^2 + \beta^2 = 61$ then the value of |a| is

    A. 16
    B. 28
    C. 30
    D. 31

15. Let $x, p \in R, x + 1 > 0, p \neq 0, 1$. Then

A. $(1 + x)^p > 1 + px$ for $p > 0$
B. $(1 + x)^p > 1 + px$ for $p \in (-\infty, 0) \cup (1, \infty)$
C. $(1 + x)^p > 1 + px$ for $0 < p < 1$
D. $(1 + x)^p < 1 + px$ for $0<p < 1$

16. Let $f(x) = \sin x + \cos x$ then

A. $x = 17\pi/4$ is a point of minima
B. $x = 13\pi/4$ is a point of maxima
C. $x = 21\pi/4$ is a point of minima
D. $x = 29\pi/4$ is a point of maxima

17. Let $g(x) = (\log (1 + x))^{-1} - x^{-1}, x > 0$ then

A. $1 < g(x) < 2$
B. $- 1 < g(x) < 0$
C. $0 < g(x) < 1$
D. None of these

18. Let $f(x) = 2 \sin x + \cos 2x (0 \leq x \leq 2\pi)$ and $g(x) = x + \cos x$ then

A. g is a decreasing function
B. f increase on $(0, \pi/2)$
C. f increases on $(0, \pi/6) \cup (\pi/2, 5\pi/6)$
D. f decreases on $(0, \pi/2)$

19. The maximum and minimum value of $f(x) = ab \sin x + b\sqrt{1-a^2} \cos x + c$ lie in the interval (assuming $|a| < 1, b > 0$)

A. $[b - c, b + c]$
B. $(b - c, b + c)$
C. $[c - b, b + c]$
D. none of these

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

    A. (2, – 4)
    B. (18, – 12)
    C. (2, 4)
    D. None of these

21. Find the intervals in which the function f (x) = sin X + cos x, $0 \leq x \leq 2\pi$ is strictly increasing or strictly decreasing. [Hots; Foreign 2011; All India 2009]

22. Find the intervals in which the function f(x) = (x–1) $(x-2)^2$ is increasing or decreasing. [Delhi 2009C]

23. Find the intervals in which the following function
    f (x) $= 20 - 9x + 6x^2 - x^3$ is
    (i) Strictly increasing.
    (ii) Strictly decreasing. [All India 2010]

24. Find the equation of tangent to the curve $x_2 + 3y = 3$, which is parallel to line y –4x + 5 = 0. [Delhi 2009]

25. Find the equations of tangents to the curve
    $3x^2 - y^2 = 8$, which passes through the
    $Point\ \left(\frac{4}{3}, 0\right)$.

26. An open box with a square base is to be mad out of a given quantity of cardboard of area C^2 sq units. Show that the maximum volume of box is $\frac{C^3}{6\sqrt{3}}$ cu nits. [All India 2012]

27. A manufacturer can self x items at a price of
    Rs. $\left(5 - \frac{x}{100}\right)$ each. The cost price of x items is
    Rs. $\left(\frac{x}{5} + 500\right)$. Find the number of items he should sell to each maximum profit.

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28. If the sum of the lengths of the hypotenuse and a side of a right angled triangle is given, show that the area of the triangle is maximum when the angle between them is $\pi/3$.

[Hots; All India 2009]