



MATHS

BOOKS - NDA PREVIOUS YEARS

APPLICATION OF DERIVATIVES

Example

1. Under what condition is the tangent to a given curve at a given curve at a point perpendicular to x axis?

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

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

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

D. $\frac{d^2y}{dx^2} = 1$

Answer: C



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2. If $f(x) = (x - x_0)\phi(x)$ and $\phi(x)$ is continuous at $x = x_0$ then what is $f(x_0)$ equal to ?

A. $\phi(x)$

B. $\phi(x_0)$

C. $x_0\phi(x_0)$

D. $2\phi(x_0)$

Answer: B



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3. The sum of two number is 20 what are the numbers if the product of the square of one and the cube of the other is maximum ?

A. 6,14

B. 15,5

C. 12,8

D. 10,10

Answer: C



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4. Find the equations of the tangent and normal to the parabola $y^2 = 4ax$ at the point $(at^2, 2at)$.

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

B. t

C. $-t$

D. $-\frac{1}{t}$

Answer: C



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5. Which one of the following statement is correct ?

- A. The derivation of $f(x)$ at $x = a$ is the slope of the graph of $f(x)$ at the point $[a, f(a)]$
- B. $f(x)$ has a positive derivative at $x = a$ means $f(x)$ increase as x increase from 'a'
- C. The sum of two differentiable functions is differentiable
- D. If a function is continuous at a point it is also differentiable at the same point

Answer: D



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6. Which one of the following is correct in respect of the curve $4y - x^2 - 8 = 0$?

A. The curve is increasing in $(-4,4)$

B. The curve is increasing $(-4,0)$

C. The curve is increasing in $(0,4)$

D. The curve is decreasing in $(-4,4)$

Answer: C



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7. Find minimum value of $px + qy$ where $p > 0, q > 0, x > 0, y > 0$ when $xy = r,^2$ without using derivatives.

A. $2r\sqrt{pq}$

B. $2pq\sqrt{r}$

C. $-2r\sqrt{pq}$

D. $2rpq$

Answer: A



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8. What is / are the critical points (s) of the function $f(x) = x^{2/3}(5 - 2x)$ on the interval $[-1,2]$?

A. 1 only

B. 0,1

C. $\frac{3}{2}$ only

D. 0, $\frac{3}{2}$

Answer: A



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9. Match List I with List II and select the correct answer using the code given below the list:

List I	List II
(a) $f(x) = \cos x$	1. The graph cuts y-axis in infinite number of points
(b) $f(x) = \ln x$	2. The graph cuts x-axis in two point
(c) $f(x) = x^2 - 5x + 4$	3. The graph cuts y-axis in only one point
(d) $f(x) = e^x$	4. The graph cuts x-axis in only one point
	5. The graph cuts x-axis in infinite number of points

A. 1, 4, 5, 3

B. 1, 3, 5, 4

C. 5, 4, 2, 3

D. 5, 3, 2, 4

Answer: C



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10. If $x+y = 12$ what is the maximum value of xy ?

A. 25

B. 36

C. 49

D. 64

Answer: B



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11. What is the x coordinate of the point on the curve $f(x) = \sqrt{x}(7x - 6)$ where the tangent is parallel to x axis ?

A. $-\frac{1}{3}$

B. $\frac{2}{7}$

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

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

Answer: B



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12. If $(\sin x)(\cos y) = \frac{1}{2}$, then $\frac{d^2y}{dx^2}$ at $\left(\frac{\pi}{4}, \frac{\pi}{4}\right)$

is -4 (b) -2 (c) -6 (d) 0

A. -4

B. -2

C. -6

D. 0

Answer: A





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13. What is the interval in which the function

$f(x) = \sqrt{9 - x^2}$ is increasing? ($f(x) > 0$)

A. $0 < x < 3$

B. $-3 < x < 0$

C. $0 < x < 9$

D. $-3 < x < 3$

Answer: B



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14. A wire 34cm long is to be bent in the form of a quadrialteral of which each angle is 90° what is the maximum area which can be enclosed inside the quadrialteral

A. 68 cm^2

B. 70 cm^2

C. 71.25 cm^2

D. 72.25 cm^2

Answer: D



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15. Which one of the following is correct ? The function

$$f(x) = (x - 1)e^x + 1 \text{ is}$$

- A. negative for all $x > 0$
- B. positive for all $x > 0$
- C. increasing for all $x > 0$
- D. decreasing for all x

Answer: C



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16. The motion of a particle is described as $S = 2 - 3t + 4t^3$ what is the acceleration of the particle at the point where its velocity is zero ?

A. 0

B. 4 unit

C. 8 unit

D. 12 unit

Answer: D



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17. What is the product of two parts of 20 such that the product of one part and the cube of the other is maximum?

A. 75

B. 91

C. 84

D. 96

Answer: A



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18. Find the maximum slope of the curve

$$y = -x^3 + 3x^2 + 2x - 27.$$

A. 1

B. 2

C. 5

D. -23

Answer: C



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19. What is the area of the largest rectangle field which can be enclosed with 200 m fencing ?

A. $1600 m^2$

B. $2100 m^2$

C. $2400 m^2$

D. $2500 m^2$

Answer: D



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20. What is the smallest value of m for which

$f(x) = x^2 + mx + 5$ is increasing in the interval

$1 \leq x \leq 2$?

A. $m = 0$

B. $m = -1$

C. $m = -2$

D. $m = -3$

Answer: C



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21. What is the maximum value of xy subject to the condition $x+y=8$?

A. 8

B. 16

C. 24

D. 32

Answer: B



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22. What is the equation of the curve whose slope any point is equal to $2x$ and which passes through the origin?

A. $y(1 - x) = x^2$

B. $y^2(1 + x^2) = x^4$

C. $y^2 = (x + 1)^2$

D. $y = x^2$

Answer: D



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23. What is the maximum value of the function $\log x - x$?

A. -1

B. 0

C. 1

D. ∞

Answer: A



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24. A rectangular box with a cover is to have a square base. The volume is to be 10 cubic cm. The surface area of the box in terms of the side x is given by which one of the following functions ?

A. $f(x) = \left(\frac{40}{x}\right) + 2x^2$

B. $f(x) = \left(\frac{40}{x}\right) + x^2$

$$\text{C. } f(x) = \left(\frac{40}{x}\right) + x$$

$$\text{D. } f(x) = \left(\frac{60}{x}\right) + 2x$$

Answer: A



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25. $f(x) = \cos x$ is monotonic decreasing under which one of the following conditions ?

A. $0 < x < \frac{\pi}{2}$ only

B. $\frac{\pi}{2} < x < \pi$ only

C. $0 < x < \pi$

D. $0 < x < 2\pi$

Answer: C



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26. What is the minimum value of

$$2x^2 - 3x + 5?$$

A. 0

B. $3/4$

C. $31/4$

D. $31/8$

Answer: D



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27. Assertion (A) : The tangent to the curve

$y = x^3 - x^2 - x + 2$ at $(1,1)$ is parallel to the

x - axis
Reason (R) : The slope of the

tangent to the curve at $(1,1)$ is zero

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true but R is the correct explanation of A

C. A is true but R is false

D. A is false but R is true

Answer: A



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28. The function $f(x) = x^2 - 2x$ increase for all

A. $x > -1$ only

B. $x < = 1$ only

C. $x > 1$ only

D. $x < 1$ only

Answer: C



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29. Let a and b be two distinct roots of a polynomial equation $f(x) = 0$. Then there exist at least one root lying between a and b of the polynomial equation

A. $f(x) = 0$

B. $f'(x) = 0$

C. $f''(x) = 0$

D. none of these

Answer: B



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30. The profit function in rupees of a firm selling x items ($x \geq 0$) per week is given by $P(x) = -3500 + (400 - x)x$. How many items should the firm sell so that the firm has maximum profit ?

A. 400

B. 300

C. 200

D. 100

Answer: C



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31. A stone thrown vertically upward satisfies the equation $s = 64t - 16t^2$ where s is in meter and t is second .What is the time required to reach the maximum height ?

A. 1s

B. 2s

C. 3s

D. 4s

Answer: B



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32. If $f(x) = 3x^2 + 6x - 9$ then

A. $f(x)$ is increasing in $(-1, 3)$

B. $f(x)$ is decreasing in $(3, \infty)$

C. $f(x)$ is increasing in $(-\infty, -1)$

D. $f(x)$ is decreasing in $(-\infty, -1)$

Answer: D



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33. If $x \cos \theta + y \sin \theta = 2$ is perpendicular to the line $x - y = 3$ then what is one of the value of θ ?

A. $\pi / 6$

B. $\pi / 4$

C. $\pi / 2$

D. $\pi / 3$

Answer: B



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34. The function $y = \tan^{-1} x - x$

- A. is always decreasing
- B. is always increasing
- C. first increases and then decreases
- D. first decreases and then increases

Answer: A



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35. The velocity v of a particle at any instant t moving in a straight line is given by $v = s + 1$ where s meter is the distance travelled in t second what is the time taken by the particle to cover a distacne of 9m ?

A. 1s

B. $(\log 10)s$

C. $2 (\log 10)s$

D. 10 s

Answer: B



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36. The velocity of telegraphic communication is given by $v = x^2 \log(1/x)$ where x is the displacement for maximum velocity x equals to ?

A. $e^{1/2}$

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

C. $2e^{-1}$

D. $2e^{-1/2}$

Answer: B



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37. What is the maximum point on the curve

$$x = e^x y?$$

A. (1,e)

B. $(1, e^{-1})$

C. $(e, 1)$

D. $(e^{-1}, 1)$

Answer: B



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38. A balloon is pumped at the rate of 4cm^3 per second what is the rate at which its surface area increase and radius is 4 cm?

A. $1\text{cm}^2 / \text{s}$

B. $2\text{cm}^2 / \text{s}$

C. $3\text{cm}^2 / \text{s}$

D. $4\text{cm}^2 / \text{s}$

Answer: B



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39. If the function

$f(x) = kx^3 - 9x^2 + 9x + 3$ is monotonically

increasing in every interval, then (a) $k < 3$ (b)

$k \leq 3$ (c) $k > 3$ (d) $k \geq 3$

A. $k < 3$

B. $j \leq 3$

C. $k > 3$

D. $k \geq 3$

Answer: C



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40. Given two squares of sides x and y such that $y = x + x^2$ what is the rate of change of area of the second square with respect to the area of the first square?

A. $1 + 3x + 2x^2$

B. $1 + 2x + 3x^2$

C. $1 - 2x + 3x^2$

D. $1 - 2x - 3x^2$

Answer: A



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41. Statement I : $y = -\tan^{-1}(x^{-1}) + 1$ is an increasing function of x

Statement II : $\frac{dy}{dx}$ is positive for all values of x

which one of the following is correct in respect of the above statements?

- A. Both statement I and II are independently correct and statement II is the correct explanation of statement I

- B. Both I and II are independently correct
but statement II is not the correct
explanation of statement I
- C. Statement I is correct but statement I is
false
- D. Statement I is false but staement II is
correct

Answer:



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42. least value of the function

$$f(x) = 2x^3 - 3x^2 - 12x + 1 \text{ on } [-2, 2.5]$$

A. -3

B. 8

C. -19

D. 16.5

Answer: A



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43. What is the interval over which the function

$f(x) = 6x - x^2, x > 0$ is increasing ?

A. (0,3)

B. (3,6)

C. (6,9)

D. none of these

Answer: A



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44. If f and g are two decreasing function such that $f \circ g$ is defined, then $f \circ g$ will be-

A. $f \circ g$ is always an increasing function

B. $f \circ g$ is always an increasing function

C. $f \circ g$ is neither an increasing nor a decreasing function

D. none of these

Answer: B



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45. For a point of inflection of $y = f(x)$ which one of the following is correct ?

- A. $\frac{dy}{dx}$ must be zero
- B. $\frac{d^2y}{dx^2}$ must not be zero
- C. $\frac{dy}{dx}$ must be non zero
- D. $\frac{d^2y}{dx^2}$ must be zero

Answer: D



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46. What is the value of p for which the function

$$f(x) = p \sin x + \frac{\sin 3x}{3}$$

has an extremum at $x = \frac{\pi}{3}$?

A. 0

B. 1

C. -1

D. 2

Answer: B



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47. If at any instant t for a sphere r denotes the radius s denotes the surface area and v denotes the volume then what is $\frac{d}{dt}$ equal to ?

A. $\frac{1}{2}S \frac{dr}{dt}$

B. $\frac{1}{2}r \frac{ds}{dt}$

C. $r \frac{ds}{dt}$

D. $\frac{1}{2}r^2 \frac{ds}{dt}$

Answer: C



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48. The function $f(x) = k \sin x + \frac{1}{3} \sin 3x$ has maximum value at $x = \frac{\pi}{3}$ what is the value of k ?

A. 3

B. $\frac{1}{3}$

C. 2

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

Answer:



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49. Consider the following statement in respect of the function

$$f(x) = x^3 - 1x \in [-1, 1]$$

I $f(x)$ is increasing in $[-1, 1]$

II $f(x)$ has no root in $(-1, 1]$

Which of the statement given above is /are correct

A. only I

B. only II

C. Both I and II

D. Neither I nor II

Answer: A



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50. The largest value of $2x^3 - 3x^2 - 12x + 5$

for $-2 \leq x \leq 2$ occurs when

A. $x = -2$

B. $x = -1$

C. $x = 2$

D. $x = 0$

Answer: B



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51. The function $y = f(x) = mx + c$ has

A. maximum point but no minimum point

B. minimum point but no maximum point

C. both maximum and minimum points

D. neither maximum point nor minimum
point

Answer: D



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52. At an extreme point of a function $f(x)$ the
tangent to the curve is

A. parallel to the x axis

B. perpendicular to the x axis

C. inclined at an angle 45° to the x axis

D. inclined at an angle 60° to the x axis

Answer: A



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53. The point in the interval $[0, 2\pi]$ where

$f(x) = e^x \sin x$ has maximum slope is

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

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

C. π

D. $\frac{3\pi}{4}$

Answer: A



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54. If the rate of change in volume of spherical soap bubble is uniform then the rate of change of surface area varies as

A. square of radius

B. square root of radius

C. inversely proportional to radius

D. cube of the radius

Answer: C



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55. If $f(x) = x \ln x$ then $f(x)$ attains minimum value at which one of the following points ?

A. $x = e^{-2}$

B. $x = e$

C. $x = e^{-1}$

D. $x = 2e^{-1}$

Answer:



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

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

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

C. (3,0) and (-3,0)

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

Answer: A



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57. Which of the following statement is correct

?

A. The derivative of a function $f(x)$ at a point will exist if there is one tangent to the curve $y = f(x)$ at that point and the tangent is parallel to the y-axis

B. The derivative of function $f(x)$ at a point will exist if there is one tangent to the curve $y = f(x)$ at that point and the tangent must be parallel to the x-axis

C. The derivative of a function $f(x)$ at a point will exist if there is one and only one

tangent to the curve $y = f(x)$ at the point

and the tangent is not parallel to y axis

D. none of the abvoe

Answer: C



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58. How many tangents are parallel to X-axis

for the curve $y = x^2 - 4x + 3$?

A. 1

B. 2

C. 3

D. no tangent is parallel to x axis

Answer: A



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59. What is the rate of change of $\sqrt{x^2 + 16}$ with respect to x^2 at $x=3$?

A. $1/5$

B. $1/10$

C. $1/20$

D. none of the above

Answer: B



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60. 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. $7/6$

B. $6/7$

C. 1

D. $5/6$

Answer: B



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61. Which one of the following statement is correct ?

A. e^x is an increasing function

B. e^x is a decreasing function

C. e^x is neither an increasing nor a decreasing function

D. e^x is a constant function

Answer: A



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62. The radius of a circle is increasing uniformly at the rate of 3 cm/s. Find the rate at which the area of the circle is increasing when the radius is 10 cm.

A. $6\pi cm^2 / s$

B. $10\pi cm^2 / s$

C. $30\pi cm^2 / s$

D. $60\pi cm^2 / s$

Answer: D



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63. The function $f(x) = x^3 - 3x^2 + 6$ is an increasing function for :

A. $0 < x < 2$

B. $x < 2$

C. $x > 2$ or $x > 0$

D. all x

Answer: C



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64. What is the minimum value of $|x|$?

A. -1

B. 0

C. 2

D. 4

Answer: B



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65. The function $f(x) = x^2 - 4x$, $x \in [0, 4]$

attains minimum value at

A. $x=0$

B. $x=1$

C. $x=2$

D. $x=4$

Answer: C



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66. The curve $y = xe^x$ has minimum value equal to

A. $-\frac{1}{e}$

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

C. $-e$

D. e

Answer: A



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67. The maximum value of the function $f(x) =$

$$x^3 + 2x^2 - 4x + 6$$
 exists at

A. $x = -2$

B. $x = 1$

C. $x = 2$

D. $x = -1$

Answer: A



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68. The minimum value of the function $F(x)=|x-4|$ exists at

A. $x=0$

B. $x=2$

C. $x=4$

D. $x=-4$

Answer: C



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69. What is the slope of the tangent to the curve $y = \sin^{-1}(\sin^2 x)$

A. 0

B. 1

C. 2

D. none of these

Answer: A



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70. Consider the curve $y = e^{2x}$

What is the slope of the tangent to the curve
at $(0,1)$?

A. 0

B. 1

C. 2

D. 4

Answer: C



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

A. $(1,0)$

B. $(2,0)$

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

D. $(1/2, 0)$

Answer: C



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72. Consider the function

$$f(x) = \frac{x^2 - x + 1}{x^2 + x + 1}$$

What is the maximum value of the function ?

A. $1/2$

B. $1/3$

C. 2

D. 3

Answer: D



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73. Consider the function

$$f(x) = \frac{x^2 - x + 1}{x^2 + x + 1}$$

What is the minimum value of the function ?

A. $1/2$

B. $1/3$

C. 2

D. 3

Answer: B



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74. A rectangular box is to be made from a sheet of 24 inch length and 9 inch width cutting out identical squares of side length x from the four corners and turning up the sides

What is the value of x for which the volume is maximum ?

A. 1 inch

B. 1.5 inch

C. 2 inch

D. 2.5 inch

Answer: C



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75. A rectangular box is to be made from a sheet of 24 inch length and 9 inch width cutting out identical squares of side length x from the four corners and turning up the sides

What is the maximum volume of the box ?

A. 200 cubic inch

B. 400 cubic inch

C. 100 cubic inch

D. none of these

Answer: A



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76. Show that the height of the cylinder of maximum volume that can be inscribed in a

sphere of radius R is $\frac{2R}{\sqrt{3}}$.

A. $\frac{2r}{\sqrt{3}}$

B. $\frac{r}{\sqrt{3}}$

C. $2r$

D. $\sqrt{3r}$

Answer: B



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77. A cylinder is inscribed in a sphere of radius r

What is the radius of the cylinder of maximum volume ?

A. $\frac{2r}{\sqrt{3}}$

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

C. r

D. $\sqrt{3r}$

Answer: C



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78. Consider the following statements

1. $y = \frac{e^x + e^{-x}}{2}$ is an increasing function on $[0, \infty)$

2. $y = \frac{e^x - e^{-x}}{2}$ is an increasing function on $(-\infty, \infty)$

Which of the above statement is / are are correct ?

A. 1 only

B. 2 only

C. both 1 and 2

D. neither 1 nor 2

Answer: B



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79. Consider the function $f(x) = \frac{x^2 - 1}{x^2 + 1}$

where $x \in \mathbb{R}$

At what value of x does $f(x)$ attain minimum value ?

A. -1

B. 0

C. 1

D. 2

Answer: C



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80. What is the minimum value of $f(x)$?

A. 0

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

C. -1

D. 2

Answer: C



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81. Consider the function

$$f(x) = 0.75x^4 - x^3 - 9x^2 + 7$$

What is the

maximum value of the function ?

A. 1

B. 3

C. 7

D. 9

Answer: C



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82. Consider the following value of the function ?

1 The function attains local minima at $x = -2$ and

$$x = 3$$

2 The function increases in the interval $(-2, 0)$

which of the above statements is/are correct?

A. 1 only

B. 2 only

C. both 1 and 2

D. neither 1 nor 2

Answer:



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83. Consider the parametric equation

- A. It represents a circle of diameter a
- B. It represents a circle of radius a
- C. It represents a parabola
- D. none of the above

Answer: D



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84. What is $\frac{dy}{dx}$ equal to ?

A. $\frac{y}{x}$

B. $-\frac{y}{x}$

C. $\frac{x}{y}$

D. $-\frac{x}{y}$

Answer: D



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85. What is $\frac{d^2y}{dx^2}$ equal to ?

A. $\frac{a^2}{y^2}$

B. $\frac{a^2}{x^2}$

C. $-\frac{a^2}{y^2}$

D. $-\frac{a^2}{y^3}$

Answer: C



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86. The function $f(x) = \frac{x^2}{e^x}$ monotonically increasing if

A. $x < 0$ only

B. $x > 2$ only

C. $0 < x < 2$

D. $x \in (-\infty, 0) \cup (2, \infty)$

Answer: C



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87. Consider the following statements

1 $f(x) = \ln x$ is an increasing function on $(0, \infty)$

2 $f(x) = e^x - x(\ln x)$ is an increasing function on $(1, \infty)$

Which of the above statement is / are correct ?

A. 1 only

B. 2 only

C. both 1 and 2

D. neither 1 nor 2

Answer: C



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88. Consider the function $f(x) = \left(\frac{1}{x}\right)^{2x^2}$, where $x > 0$. At what value of x does the function attain maximum value?

A. e

B. \sqrt{e}

C. $\frac{1}{\sqrt{e}}$

D. $\frac{1}{e}$

Answer: C



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89. The maximum value of the function is

A. e

B. $\frac{2}{e^e}$

C. $e^{\frac{1}{e}}$

D. $\frac{1}{e}$

Answer: C



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90. Consider $f(x) = \frac{x^2}{2} - kx + 1$ such that $f(0) = 0$ and $f(3) = 15$

The value of k is

A. $\frac{5}{3}$

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

C. $-\frac{5}{3}$

D. $-\frac{3}{5}$

Answer: D



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91. $f''\left(-\frac{2}{3}\right)$ is equal to

A. -1

B. $\frac{1}{3}$

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

D. 1

Answer: A



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92. Separate the intervals of monotonicity for the function $f(x) = -2x^3 - 9x^2 - 12x + 1$

A. $(-2, -1)$

B. $(-\infty, -2)$

C. $(-1, 2)$

D. $(-1, \infty)$

Answer: D



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93. The function $f(x)$ is a decreasing function in the interval

A. $(-2, -1)$

B. $(-\infty, -2)$

C. $(-1, 2)$

D. $(-\infty, -2) \cup (-1, \infty)$

Answer: D



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94. Consider the function $f(\theta) = 4(\sin^2 \theta + \cos^4 \theta)$

what is the maximum value of the function $f(\theta)$?

A. 1

B. 2

C. 2

D. 4

Answer: D



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95. What is the minimum value of the function $f(\theta)$?

A. 0

B. 1

C. 2

D. 3

Answer: C



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96. Consider the following statements:

1 $f(\theta) = 2$ has no solution

2 $f(\theta) = \frac{7}{2}$ has a solution

which of the above statement is/are correct ?

A. 1 only

B. 2 only

C. both 1 and 2

D. neither 1 nor 2

Answer: B



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97. Consider the equation $k \sin x + \cos 2x = 2k - 7$

If the equation possesses solution then that what is the minimum value of k ?

A. 1

B. 2

C. 4

D. 6

Answer: D



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98. If the equation $x^2 + kx + 1 = 0$ has real roots then what is the maximum value of k ?

A. 1

B. 2

C. 4

D. 6

Answer: B



99. Which one of the following statement is correct in respect of the function $f(x)=x^3 \sin x$?

A. It has local maximum at $x = 0$

B. It has local minimum at $x=0$

C. It has neither maximum nor minimum at $x = 0$

D. It has maximum value 1

Answer: A



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100. The maximum value of $\sin\left(\theta + \frac{\pi}{6}\right) + \cos\left(\theta + \frac{\pi}{6}\right)$ is attained at $\theta \in \left(0, \frac{\pi}{2}\right)$

A. $\frac{\pi}{12}$

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

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

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

Answer: A



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101. The length of the longest interval, in which the function $3 \sin x - 4 \sin^3 x$ is increasing is

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

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

C. $\frac{3\pi}{2}$

D. (π)

Answer: A



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102. What is the maximum value of the function $f(x) = 4\sin^2 x + 1$?

A. 5

B. 3

C. 2

D. 1

Answer:



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103. Let $f(x) = x + \frac{1}{x}$ when $x \in (0,1)$ Then

which one of the following is correct ?

A. $f(x)$ fluctuates in the interval

B. $f(x)$ increases in the interval

C. $f(x)$ decreases in the interval

D. none of the above

Answer: A::C



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104. Consider the following statement :

1 $\frac{dy}{dx}$ at a point on the curve gives slope of the tangent at that point

2 If $a(t)$ denotes acceleration of a particle then

$\int a(t)dt + c$ gives velocity of the particle

3 If $s(t)$ gives displacement of a particle at time

t then $\frac{ds}{dt}$ gives its acceleration at that instant

Which of the above statement is / are correct ?

A. 1 and 2 only

B. 2 only

C. 1 only

D. 1,2 and 3

Answer: A



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105. Which one of the following is correct in respect of the function

$$f(x) = x(x - 1)(x - 1) ?$$

- A. The local maximum value is larger than local minimum value
- B. The local maximum value is smaller than local minimum value
- C. The function has no local maximum
- D. The function has no local minimum

Answer: B



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106. The maximum value of $\frac{\ln x}{x}$ is

A. e

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

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

D. 1

Answer: B



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107. Match List I with List II and select the correct answer using the code given below the lists:

List-I (Function)	List-II (Maximum value)
A. $\sin x + \cos x$	1. $\sqrt{10}$
B. $3\sin x + 4\cos x$	2. $\sqrt{2}$
C. $2\sin x + \cos x$	3. 5
D. $\sin x + 3\cos x$	4. $\sqrt{5}$

A. 2, 3, 1, 4

B. 2 3 4 1

C. 3 2 1 4

D. 3 2 4 1

Answer: B



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108. A cylindrical jar without a lid has to be constructed using a given surface area of a metal sheet if the capacity of the jar times the height of the jar The value of k is

A. 1

B. 2

C. 3

D. 4

Answer: A



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109. The maximum value of

$$\sin\left(x + \frac{\pi}{5}\right) + \cos\left(x + \frac{\pi}{5}\right),$$

where

$x \in \left(0, \frac{\pi}{2}\right)$, is attained at

A. $\frac{\pi}{20}$

B. $\frac{\pi}{15}$

C. $\frac{\pi}{10}$

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

Answer: A



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110. What is the maximum value of $16 \sin \theta - 12 \sin^2 \theta$?

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

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

C. $\frac{16}{3}$

D. 4

Answer: C



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111. Which one of the following is correct in respect of the function

$$f(x) = x \sin x + \cos x + \frac{1}{2} \cos^2 x ?$$

A. It is increasing in the interval $\left(0, \frac{\pi}{2}\right)$

B. It remain constant in the interval
 $\left(0, \frac{\pi}{2}\right)$

C. It is decreasing in the interval $\left(0, \frac{\pi}{2}\right)$

D. It is decreasing in the interval $\left(\frac{\pi}{4}, \frac{\pi}{2}\right)$

Answer: C



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112. Maximum possible area that can be enclosed by a wire of length 20 cm by bending it in form of a circular sector is 10 b. 25 c. 30 d. 20

A. 25cm^2

B. 20 m

C. 10 m

D. 5 m

Answer: A



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113. What is the minimum value of $[x(x - 1) + 1]^{\frac{1}{3}}$ where $0 < x < 1$?

A. $\left(\frac{3}{4}\right)^{\frac{1}{3}}$

B. 1

C. $\frac{1}{3}$

D. $\left(\frac{3}{8}\right)^{\frac{1}{3}}$

Answer: A



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114. If $y = |\sin X|^x$ then what is the value

of $\frac{dy}{dx}$ at $x = \frac{\pi}{6}$?

A. $\left(\frac{2^\pi}{6}\right) \frac{6\ln 2 - \sqrt{3}\pi}{6}$

B. $\left(\frac{2^\pi}{6}\right) \frac{6\ln 2 + \sqrt{3}\pi}{6}$

C. $\left(\frac{2^\pi}{6}\right) \frac{6\ln 2 + \sqrt{3}\pi}{6}$

D. $\left(\frac{2^\pi}{6}\right) \frac{6\ln 2 - \sqrt{3}\pi}{6}$

Answer: A



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115. 40. A given quantity of metal is to be cast into a half cylinder with a rectangular base and semicircular ends. Show that in order that the total surface area may be minimum, the ratio of the length of the cylinder to the diameter of its semi-circular ends is w`

A. $\pi : (\pi + 2)$

B. $(\pi + 2) : \pi$

C. 1 : 1

D. none of the above

Answer: A



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