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MATHS

BOOKS - MHTCET PREVIOUS YEAR PAPERS AND PRACTICE PAPERS

APPLICATIONS OF DERIVATIVES

Topical Problems

1. The asbscissa of the point on the curve $y = a\left(e^{x/a} + e^{-x/a}\right)$ where the tangent is parallel to the X-axis, is

A. 0

B. a

C. $2a$

D. $-2a$

Answer: A

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2. The point on the curve $y = x^3$ at which the tangent to the curve is parallel to the X-axis, is

A. $(2, 2)$

B. $(3, 3)$

C. $(4, 4)$

D. $(0, 0)$

Answer: D

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3. The length of the subtangent at (2,2) to the curve $x^5 = 2y^4$ is

A. $\frac{5}{2}$

B. $\frac{8}{5}$

C. $\frac{2}{5}$

D. $\frac{5}{8}$

Answer: B

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4. The equation of the normal to the curve $y^4 = ax^3$ at (a, a) is

A. $x + 2y = 3a$

B. $3x - 4y + a = 0$

C. $4x + 3y = 7a$

D. $4x - 3y = 0$

Answer: C

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5. Let $g(x) = \begin{cases} 2e & \text{if } x \leq 1 \\ \log(x-1) & \text{if } x > 1 \end{cases}$ The equation of the normal to $y = g(x)$ at the point $(3, \log 2)$, is

A. $y - 2x = 6 + \log 2$

B. $y + 2x = 6 + \log 2$

C. $y - 2x = 6 - \log 2$

D. $y + 2x = -6 + \log 2$

Answer: B

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6. The equation of the tangent to the curve $y = x + \frac{4}{x^2}$, l

thant 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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7. Find the equation of the tangent to the curve $\sqrt{x} + \sqrt{y} = a$ at the point $\left(\frac{a^2}{4}, \frac{a^2}{4}\right)$

A. $xy = a^2$

B. $x + y = \frac{a^2}{2}$

C. $xy = \frac{a^2}{2}$

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

Answer: B

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

A. 3

B. 5

C. 15

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

Answer: C

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9. Find the length of normal to the curve $x = a(\theta + \sin\theta), y = a(1 - \cos\theta)$ at $\theta = \frac{\pi}{2}$.

A. $2a$

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

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

D. $\sqrt{2}a$

Answer: D

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10. The equation of the normal to the curve $y = \sin\frac{\pi x}{2}$ at (1,1) is

A. $y = 1$

B. $x = 1$

C. $y = x$

D. $y - 1 = \frac{-2}{\pi}(x - 1)$

Answer: B

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11. 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 $f'(3) =$ (a) -1 (b) $-\frac{3}{4}$ (c) $\frac{4}{3}$ (d) 1

A. -1

B. $-3/4$

C. $4/3$

D. 1

Answer: D

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12. The equation of tangent to the curve $y = 2\cos x$ at $x = \frac{\pi}{4}$ is

A. $y - \sqrt{2} = 2\sqrt{2}\left(x - \frac{\pi}{4}\right)$

B. $y + \sqrt{2} = \sqrt{2}\left(x + \frac{\pi}{4}\right)$

C. $y - 2\sqrt{2} = -\sqrt{2}\left(x - \frac{\pi}{4}\right)$

D. $y - \sqrt{2} = \sqrt{2}\left(x - \frac{\pi}{4}\right)$

Answer: C

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13. If the line $ax + by + c = 0$ is a tangent to the curve $xy = 4$ then

A. $a < 0, b > 0$

B. $a \leq 0, b > 0$

C. $a < 0, b < 0$

D. $a \leq 0, b < 0$

Answer: C

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14. Find the coordinates of the point on the curve $y = x^2 - 3x + 2$ where the tangent is perpendicular to the straight line $y = x$

A. (0,2)

B. (1,0)

C. (-1,6)

D. (2,-2)

Answer: B

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15. Find the value of $n \in N$ such that 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).

A. 2

B. 3

C. 4

D. any real number

Answer: D

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16. The equation of normal to the curve $x^{2/3} + y^{2/3} = a^{2/3}$ at $\left(a \sin^3 \theta, a \cos^3 \theta\right)$ is

A. $\sin \theta x - \cos \theta y = a \sin^4 \theta - \cos^4 \theta$

B. $\sin\theta x + \cos\theta y = a\sin^4\theta + a\cos^4\theta$

C. $\sin\theta x - \cos\theta y = a\sin^4\theta + a\cos^4\theta$

D. None of the above

Answer: A

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17. The equation of the tangent to the curve $y = 4e^{-\frac{x}{4}}$ at the point where the curve crosses Y-axis is equal to

A. $3x + 4y = 16$

B. $4x + y = 4$

C. $x + y = 4$

D. $4x - 3y = -12$

Answer: C

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18. The equation of the tangent to the curve $x^2 - 2xy + y^2 + 2x + y - 6 = 0$ at (2,2) is

A. $2x + y - 6 = 0$

B. $2y + x - 6 = 0$

C. $x + 3y - 8 = 0$

D. $3x + y - 8 = 0$

Answer: A

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19. The lengths of tangent, subtangent, normal and subnormal for the curve $y = x^2 + x - 1$ at (1,1) are A,B,C and D respectively, then their increasing order is

A. B,D,A,C

B. B,A,C,D

C. A,B,C,D

D. B,A,D,C

Answer: D

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20. The point on the curve $y^2 = x$ where tangent makes 45° angle with x-axis, is

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

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

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

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

Answer: A

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21. The length of the subtangent to the curve $x^2y^2 = a^4$ at $(-a, a)$ is

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

B. $2a$

C. a

D. $\frac{a}{3}$

Answer: C

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22. 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. a straight line

B. a circle

C. a parabola

D. an ellipse

Answer: C

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23. Find the equation of the normal at the point (am^2, am^3) for the curve $ay^2 = x^3$.

A. $2x + 3my - 3am^3 - 2am^2 = 0$

B. $2x + 3my - 3am^4 - 2am^2 = 0$

C. $2x + 3m^2y - 3am^3 - 2am^3 = 0$

D. None of the above

Answer: B

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

A. m

B. n

C. $1/n$

D. $1/m$

Answer: B

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25. At which point the tangent to the curve $x^2 + y^2 = 25$ is parallel to the line $3x - 4y = 7$?

A. $(3, 4), (-3, -4),$

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

C. $(4, 3)(-4, -3)$

D. $(-4, 3)(4, -3)$

Answer: B

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26. The equation of the tangent to the curve $y = \sqrt{9 - 2x^2}$ at the point where the ordinate & the abscissa are equal is

A. $2x + y - 3\sqrt{3} = 0$

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

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

D. None of these

Answer: A

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27. If the normal line at $(1, -2)$ on the curve $y^2 = 5x - 1$ is $ax - 5y + b = 0$ then the values of a and b are

A. 4,-14

B. 4,14

C. $-4, 14$

D. $4, 2$

Answer: A

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28. The sum of the intercepts made on the axes of coordinates by any tangent to the curve $\sqrt{x}+\sqrt{y}=\sqrt{a}$ is equal to

A. a

B. $2a$

C. $2\sqrt{a}$

D. None of these

Answer: A

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29. Find the equation of a normal to the curve $y = x \log_e x$ which is parallel to the line $2x - 2y + 3 = 0$.

A. (0,0)

B. (e, e)

C. $\left(e^2, 2e^2\right)$

D. $\left(e^{-2}, -2d^{-2}\right)$

Answer: D

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30. If the distance s travelled by a particle in time t is $s = a\sin t + b\cos 2t$, then the acceleration at $t = 0$ is

A. a

B. $-a$

C. $4b$

D. $-4b$

Answer: D

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31. A ladder of length $17m$ rests with one end againts a vertical wall and the other on the vessel ground. If the lower end slips away at the rate of $1ms^{-1}$, then when it is

$8m$ away from the wall, its upper end is coming down at the rate of

A. $\frac{5}{8}ms^{-1}$

B. $-\frac{8}{15}ms^{-1}$

C. $\frac{5\pi}{4}ms^{-1}$

D. $\frac{8}{5}ms^{-1}$

Answer: B

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32. The maximum height is reached is $5s$ by a stone thrown vertically upwards and moving under the equation

$10s = 10ut - 49t^2$, where s is in metre and t is in second.

The value of u is

A. $4.9ms^{-1}$

B. $49ms^{-1}$

C. $98ms^{-1}$

D. None of these

Answer: B

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33. If the edge of a cube increases at the rate of $60cm$ per second, at what rate the volume in increasing when the edge is $90cm$

A. $486000cm^3s^{-1}$

B. $1458000cm^3s^{-1}$

C. $43740000cm^3s^{-1}$

D. None of the above

Answer: B

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34. The diagonal of square is changing at the rate of $0.5cms^{-1}$. Then the rate of change of area, when the area is $400cm^2$, is equal to

A. $20\sqrt{2}cm^2s^{-1}$

B. $10\sqrt{2}cm^2s^{-1}$

C. $\frac{1}{10\sqrt{2}} cm^2 s^{-1}$

D. $\frac{10}{\sqrt{2}} cm^2 s^{-1}$

Answer: B

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35. A particle is moving in a straight line. At time t the distance between the particle from its starting point is given by $x = t - 6t^2 + t^3$. Its acceleration will be zero at

A. $t = 1$ unit time

B. $t = 2$ units time

C. $t = 3$ units time

D. $t = 4$ units time

Answer: B

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36. If there is an error of $\pm 0.04cm$ in themeasurement of the diameter of sphere then the percentage error in its volume, when radius is $10cm$

A. ± 1.2

B. ± 1.0

C. ± 0.8

D. ± 0.6

Answer: D

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37. The instantaneous rate of change at $t = 1$ for the function $f(t) = te^{-1} + 9$ is

A. -1

B. 9

C. 0

D. 2

Answer: C

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38. The distance covered by a particle in t second is given by $x = 3 + 8t - 4t^2$. After $1s$ its velocity will be

A. 0 unit

B. 3 units

C. 4 units

D. 7 units

Answer: A

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39. A stone is thrown vertically upwards from the top of a tower $64m$ high according to the law of motion given by

$s = 48t - 16t^2$. The greatest height attained by the stone above ground is

A. $36m$

B. $32m$

C. $100m$

D. $64m$

Answer: C

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40. A lizard, at an initial distance of 21 cm behind an insect, moves from rest with an acceleration of $2cms^{-2}$ and pursues the insect which is crawling uniformly along a

straight line at a speed of $20cms^{-1}$. Then the lizard will catch the insect after

A. $24s$

B. $21s$

C. $1s$

D. $20s$

Answer: B

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41. The distance travelled by a motor car in t seconds after the brakes are applied is s feet where $s = 22t - 12t^2$. The distance travelled by the car before it stops, is

A. $10.08ft$

B. $10ft$

C. $11ft$

D. $11.5ft$

Answer: A

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42. The circumference of a circle is measured as 56 cm with an error 0.02 cm. The percentage error in its area is

A. $1/7$

B. $1/28$

C. $1/14$

D. $1/56$

Answer: C

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43. A stone is falling freely and describes a distance s in t seconds given by equation $s = \frac{1}{2}gt^2$.

The acceleration of the stone is

A. uniform

B. zero

C. non-uniform

D. indeterminate

Answer: A

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44. A spherical balloon is expanding. If the radius is increasing at the rate of 2cm min^{-1}, the rate at which the volume increases in cubic centrimeters per minute when theradius is 5 cm is

A. $10\pi cm^3 \text{ min}^{-1}$

B. $100\pi cm^3 \text{ min}^{-1}$

C. $200\pi cm^3 \text{ min}^{-1}$

D. $50\pi cm^3 \text{ min}^{-1}$

Answer: C

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45. If the surface area of a sphere of radius r is increasing uniformly at the rate $8\frac{(cm)^2}{s}$, then the rate of change of its volume is:

A. constant

B. proportional to $\sqrt{R}$

C. proportional to r^2

D. proportional to r

Answer: D

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46. A Spherical balloon is being inflated at the rate of 35cc/min. The rate of increase in the surface area(in cm2/min.) of the balloon when its diameter is 14 cm, is

A. 10

B. $\sqrt{10}$

C. 100

D. $10\sqrt{10}$

Answer: A

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47. If there is 2% error in measuring the radius of sphere, then..... will be the percentage error in the surface area.

A. 0.03

B. 0.01

C. 0.04

D. 0.02

Answer: C

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48. A man of $2m$ height walks at a uniform speed of $6kmh^{-1}$ away from a lamp post of 6m height. The rate at which the length of his shadow increase in

A. $2kmh^{-1}$

B. $1kmh^{-1}$

C. $3kmh^{-1}$

D. $6kmh^{-1}$

Answer: C

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49. A particle moves along the curve $y = x^2 + 2x$. At what point(s) on the curve are the x and y coordinates of the particle changing at the same rate?

A. $1, 3$

B. $\left(\frac{1}{2}, \frac{5}{2}\right)$

C. $\left(-\frac{1}{2}, -\frac{3}{4}\right)$

D. $(-1, -1)$

Answer: C

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50. Gas is being pumped into a spherical balloon at the rate of $30 ft^3 \text{ min}^{-1}$. Then the rate at which the radius increases when it reaches the value 15 ft, is

A. $\frac{1}{30\pi} ft \text{ min}^{-1}$

B. $\frac{1}{15\pi} ft \text{ min}^{-1}$

C. $\frac{1}{20} ft \text{ min}^{-1}$

D. $\frac{1}{15} ft \text{ min}^{-1}$

Answer: A

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51. The distance travelled s in metres by a particle in t second is given by $s = t^3 + 2t^2 + t$. The speed of the particle after $1s$ will be

A. $8cms^{-1}$

B. $6cms^{-1}$

C. $2cms^{-1}$

D. None of these

Answer: A

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52. $f(x) = x^3 - 3x + 5$, $f(1.99)$ is equal to

A. 6.91

B. 9.19

C. 9.06

D. None of these

Answer: A

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53. $\cos(90^\circ 30')$, approximately given that $1^\circ = 0.0175$ is

A. -0.0082

B. -0.0087

C. 0.0087

D. 0.0081

Answer: B

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54. Approximate value of $\tan^{-1}(0.999)$ is

A. $\frac{\pi}{4} - 0.005$ radian

B. $\frac{\pi}{2} - 0.003$ radia

C. $\frac{\pi}{3} - 0.002$ radian

D. $\frac{\pi}{4} - 0.0005$ radian

Answer: D

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55. The apprximate value of $\sin(31^\circ)$, given that $1^\circ = 0.0175, \cos 30^\circ = 0.8660$ is

A. 0.5100

B. 0.5152

C. 0.5295

D. 0.5175

Answer: B

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56. Moving along the X-axis there are two points with $x = 10 + 6t, x = 3 + t^2$. The speed with which they are reaching from each other at the time of encounter is (x is cm and $t$is in second)

A. $16cms^{-1}$

B. $20cms^{-1}$

C. $8cms^{-1}$

D. $12cms^{-1}$

Answer: C

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57. An object is moving in the clockwise direction around the unit circle $x^2 + y^2 = 1$. As it passes through the point $\left(\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$, its y-coordinate is decreasing at the rate of 3 unit per second. The rate at which the x-coordinate changes at this point is (in unit per second)

A. 2

B. $3\sqrt{3}$

C. $\sqrt{3}$

D. $2\sqrt{3}$

Answer: B

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58. A particle is moving along the curve $x = at^2 + bt + c$. If $ac = b^2$, then particle would be moving with uniform

A. rotation

B. velocity

C. acceleration

D. retardation

Answer: C

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59. The position of a point in time t is given by $x = a + bt - ct^2, y = at + bt^2$. Its acceleration at time t is

A. $b - c$

B. $b + c$

C. $2b - 2c$

D. $2\sqrt{b^2 + c^2}$

Answer: D

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60. The distance s metres covered by a boy in t second, is given by $s = 3t^2 - 8t + 5$. The boy will stop after

A. $1s$

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

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

D. $4s$

Answer: C

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61. A ladder 20 ft long has one end on the ground and the other end in contact with a vertical wall. The lower end slips along the ground. If the lower end of the ladder is 16 t away from the wall, upper end is moving λ time as fast as the lower end, then λ is

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

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

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

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

Answer: C

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62. The aproximate value of square root of 25.2 is

A. 5.01

B. 5.02

C. 5.03

D. 5.04

Answer: B

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63. The approxiamte value of $(0.007)^{\frac{1}{3}}$ is

A. $\frac{21}{120}$

B. $\frac{23}{120}$

C. $\frac{29}{120}$

D. $\frac{31}{120}$

Answer: B

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64. A spherical balloon is punped at the rate of $10\text{inch}^3\ \text{min}^{-1}$, the rate of increase of its radius if its radius is 15 inch is

A. $\frac{1}{30\pi}\text{inch min}^{-1}$

B. $\frac{1}{60\pi}\text{inch min}^{-1}$

C. $\frac{1}{90\pi}\text{inch min}^{-1}$

D. $\frac{1}{120\pi}\text{inch min}^{-1}$

Answer: C

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

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

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

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

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

Answer: C

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66. The speed v of a particle moving along a straight line is given by $a + bv^2 = x^2$, where x is its distance from the origin. The acceleration of the particle is

A. bx

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

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

D. $\frac{x}{ab}$

Answer: C

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67. The rate of change of surface area of a sphere of radius r when the radius is increasing at the rate of 2 cm/sec is proportional to

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

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

C. r

D. r^2

Answer: C

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68. verify Rolle's theorem for the function $f(x) = x(x+3)e^{-\frac{x}{2}}$ in $[-3, 0]$

A. 0

B. -1

C. -2

D. -3

Answer: C

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69. The function $f(x) = ax + b$ is strictly decreasing for all $x \varepsilon R$ if

A. 0

B. $a < 0$

C. $a > 0$

D. None of these

Answer: B

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70. The function $f(x) = 2 - 3x$ is

A. increasing

B. decreasing

C. neither decreasing nor increasing

D. None of the above

Answer: B

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71. The function $f(x) = \tan^{-1}(\sin x + \cos x)$ is an increasing function in $\left(-\frac{\pi}{2}, \frac{\pi}{4}\right)$ (b) $\left(0, \frac{\pi}{2}\right)$ $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ (d) $\left(\frac{\pi}{4}, \frac{\pi}{2}\right)$

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

B. $\left(-\frac{\pi}{2}, \frac{\pi}{4}\right)$

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

D. $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$

Answer: B

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72. A value of C for which the conclusion of mean value theorem bolds for the function $f(x) = glo_e x$ on the interval $[1, 3]$ is $\frac{1}{2}(\log)_e 3$ (b) $(\log)_3 e$ $(\log)_e 3$ (d) $2(\log)_3 e$

A. $2\log_3 e$

B. $\frac{1}{2}\log_e 3$

C. $\log_3 e$

D. $\log_e 3$

Answer: A

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73. Value of c of Rolle's theorem for $f(x) = \log\left(x^4 + 3\right)$ on $[-1, 1]$

A. 0

B. 1

C. -1

D. does not exist

Answer: A

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74. A function is matched below against an interval where it is supposed to be increasing. Which of the following parts is incorrectly matched? Interval, Function $[2, \infty)$, $2x^3 - 3x^2 - 12x + 6$ $(-\infty, \infty)$, $x^3 = 3x^2 + 3x + 3$ $(-\infty - 4)$, $x^3 + 6x^2 + 6$ $\left(-\infty, \frac{1}{3}\right)$, $3x^2 - 2x + 1$

A.

Function	Interval
$x^3 + 6x^2 + 6$	$(-\infty, -4)$

B.

Function	Interval
$3x^2 - 2x + 1$	$\left(-\infty, \frac{1}{3}\right)$

C.

Function	Interval
$2x^3 - 3x^2 - 12x + 6$	$[2, \infty)$

D.

Function	Interval
$x^3 - 3x^2 + 3x + 3$	$(-\infty, \infty)$

Answer: B

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75. The function $f(x) = \log(1+x) - 2 \cdot \frac{x}{2+x}$ is increasing on

A. $(-1, \infty)$

B. $(-\infty, 0)$

C. $(-\infty, \infty)$

D. None of these

Answer: A

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76. $f(x) = \left(\frac{e^{2x}-1}{e^{2x}+1}\right)$ is

A. an increasing function

B. a decreasing function

C. an even function

D. None of these

Answer: A

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77. The set of all points for which $f(x) = x^2 e^{-x}$ stricltly increasing is

A. $(0, 2)$

B. $(2, \infty)$

C. $(-2, 0)$

D. $(-\infty, \infty)$

Answer: A

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78. If

$f(x) = x^3 + bx^3 + cx + d$ and $0 < b^2 < c$then in$(-\infty, \infty)$

A. $f(x)$ is strictly increasing function

B. $f(x)$ has a local maxima

C. $f(x)$ is strictly decreasing function

D. $f(x)$ is bounded

Answer: A

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79. The function $f(x) = \cot^{-1} x + x$ increases in the interval (a) $(1, \infty)$ (b) $(-1, \infty)$ (c) $(-\infty, \infty)$ (d) $(0, \infty)$

A. $(1, \infty)$

B. $(-1, \infty)$

C. $(-\infty, \infty)$

D. $(0, \infty)$

Answer: C

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80. For every value of x the function $f(x) = \frac{1}{5^x}$ is

A. Decreasing

B. Increasing

C. Neither increasing nor decreasing

D. increasin for $x > 0$ and decreasing for $x < 0$

Answer: A

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81. The function $f(x) = \frac{\log(\pi + x)}{\log(e + x)}$ is

A. increasing on $(0, \infty)$

B. decreasing on $(0, \infty)$

C. increasing on $\left(0, \frac{\pi}{e}\right)$, decreasing on $\left(\frac{\pi}{e}, \infty\right)$

D. decreasing onn $\left(0, \frac{\pi}{e}\right)$, increasing on $\left(\frac{\pi}{e}, \infty\right)$

Answer: B

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

A. increasing in $[-1/2, 1]$

B. decreasing in R

C. increasing in R

D. decreasing in $[-1/2, 1]$

Answer: A

Watch Video Solution

83. In which of the following functions, Rolle's theorem is applicable?

A. $f(x) = |x|$ in $-2 \leq x \leq 2$

B. $f(x) = \tan x$ in $0 \leq x \leq \pi$

C. $f(x) = 1 + (x-2)^{2/3}$ in $1 \leq x \leq 3$

D. $f(x) = x(-2)^2$ in $0 \leq x \leq 2$

Answer: D

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84. The interval of increase of the function $f(x) = x - e^x + \tan\left(\frac{2\pi}{7}\right)$ is

A. $(0, \infty)$

B. $(-\infty, 0)$

C. $(1, \infty)$

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

Answer: B

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85. The function $f(x) = \left(9 - x^2\right)^2$ increases in

A. $(-3, 0) \cup (3, \infty)$

B. $(-\infty, -3) \cup (3, \infty)$

C. $(-\infty, -3) \cup (0, 3)$

D. $(-3, 3)$

Answer: A

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86. If $f(x) = \frac{\sin x}{e^x}$ in $[0, \pi]$ then $f(x)$

A. satisfies Rolle's theorem and $c = \frac{\pi}{4}$ so that $f'\left(\frac{\pi}{4}\right) = 4$

B. does not satisfy Rolle's theorem but $f'\left(\frac{\pi}{4}\right) > 0$

C. satisfies Rolle's theorem and $f'\left(\frac{\pi}{4}\right) = 0$

D. satisfies Lagrange's Mean Value theorem but $f'\left(\frac{\pi}{4}\right) \neq 0$

Answer: C

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87. Select the correct statement from a., b., c., d.. The function $f(X) = xe^{1-x}$

A. strictly increase in the inverval $\left(\frac{1}{2}, 2\right)$

B. increases in the interval $(0, \infty)$

C. decreases in the interval $(0, 2)$

D. strictly decreases in the interval $(1, \infty)$

Answer: D

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88. The function $f(x) = 1 - x^3$

A. increases everywhere

B. decreases in $(0, \infty)$

C. increases in $(0, \infty)$

D. None of these

Answer: B

Watch Video Solution

89. If $a < 0$, the function $f(x) = e^{ax} + e^{-ax}$ is a monotonically decreasing function for values of x given by

A. $x < 0$

B. $x > 0$

C. $x < 1$

D. $x > 1$

Answer: A

Watch Video Solution

90. For a given integer k in the interval $\left[2\pi k - \frac{\pi}{2}, 2\pi k + \frac{\pi}{2}\right]$ the graph of $\sin x$ is

A. increasing from -1 to 1

B. decreasing from -1 to 0

C. decreasing from 0 to 1

D. None of these

Answer: A

Watch Video Solution

91. On the interval $\left(0, \frac{\pi}{2}\right)$ the function $\log \sin x$ is

A. increasing

B. decreasing

C. neither increasing nor decreasing

D. None of the above

Answer: A

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92. If $f(x) = \cos x, 0 \leq x \leq \frac{\pi}{2}$ then the real number c of the mean value theorem is

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

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

C. $\sin^{-1}\left(\frac{2}{\pi}\right)$

D. $\cos^{-1}\left(\frac{2}{\pi}\right)$

Answer: C

Watch Video Solution

93. If $f(x) = \frac{a\sin x + b\cos x}{c\sin x + d\cos x}$ is decreasing for all x, then

A. $ad - bc > 0$

B. $ad - bc < 0$

C. $ab - cd > 0$

D. $ab - cd < 0$

Answer: B

Watch Video Solution

94. Find the value of a in order that $f(x) = \sqrt{3}\sin x - \cos x - 2ax + b$ decreases for all real values of x.

A. $a < 1$

B. $a \geq 1$

C. $a \geq \sqrt{2}$

D. $a < \sqrt{2}$

Answer: B

Watch Video Solution

95. Which of the following statements is /are true?

A. $\log(1+x) > x - \frac{x^2}{2}, \forall x \varepsilon (0, \infty)$

B. $\log(1+x) < x - \frac{x^2}{2}, \forall x \varepsilon (0, \infty)$

C. $\sin x < x < \tan x, \forall x \varepsilon \left(-\frac{\pi}{2}, \frac{\pi}{2} \right)$

D. $\sin x > x > \tan x, \forall x \varepsilon \left(0, \frac{\pi}{2} \right)$

Answer: A

Watch Video Solution

96. The function f defined by $f(x) = (x+2)e^{-x}$ is

A. decreasing for all x

B. decreasing on $(-\infty, -1)$ and increasing in $(-1, \infty)$

C. increasing for all x

D. decreasing in $(-1, \infty)$ and increasing in $(-\infty, -1)$

Answer: D

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97. The function $f(x) = \tan x - x$

A. always increases

B. always decreases

C. never decreases

D. sometimes increases and sometimes decreases

Answer: A

Watch Video Solution

98. What are the values of c for which Rolle's theorem for the function $f(x) = x^3 - 3x^2 + 2x$ in the interval $[0, 2]$ is verified?

A. $c = \pm 1$

B. $c = 1 \pm \frac{1}{\sqrt{3}}$

C. $c = \pm 2$

D. None of these

Answer: B

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99. The interval in which the function $y = x^3 + 5x^2 - 1$ is decreasing is

A. $\left(0, \frac{10}{3}\right)$

B. $(0, 10)$

C. $\left(\frac{-10}{3}, 0\right)$

D. $(2, 9)$

Answer: C

Watch Video Solution

100. The point in the interval $(0, 2\pi)$ where $f(X) = e^x$ sinx has maximum slope is

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

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

C. π

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

Answer: B

Watch Video Solution

101. The function $f(x) = x^3 + ax^2 + bx + c$, $a^2 \leq 3b$ has

A. one maximum value

B. one minimum value

C. no extreme value

D. one maximum and one minimum value

Answer: C

Watch Video Solution

102. If $y = \dfrac{\sin(x + a)}{\sin(x + b)}$, $a \neq b$, then y is

A. minima at $x = 0$

B. maxima at $x = 0$

C. neither minima nor maxima at $x = 0$

D. None of the above

Answer: C

Watch Video Solution

103. सिद्ध कीजिए की दी हुई तिर्यक ऊंचाई और महत्तम आयतन वाले शंकु का अर्ध शीर्ष कोण $\tan^{-1}\sqrt{2}$ होता है |

A. 2

B. 1

C. $\sqrt{2}$

D. $\sqrt{3}$

Answer: C

Watch Video Solution

104. Let $P(x) = a_0 + a_1 x^2 + a_2 x^4 + + a_n x^{2n}$ be a polynomial in a real variable x with `0

A. neither a maximum nor a minimum

B. only one maximum

C. only one minimum

D. only one maximum and only one minimum

Answer: C

Watch Video Solution

105. The equation of the tangent to the curve $y = (2x - 1)e^{2(1-x)}$ at the point of its maximum, is

A. $y - 1 = 0$

B. $x - 1 = 0$

C. $x + y - 1 = 0$

D. $x - y + 1 = 0$

Answer: A

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106. The number of values of x where the function $f(x) = \cos x + \cos\left(\sqrt{2}x\right)$ attains its maximum is 0 (b) 1 (c) 2 (d) infinite

A. 1

B. 0

C. 2

D. infinite

Answer: A

Watch Video Solution

107. let $f(x) = 1 + 2x^2 + 2^2x^4 + \ldots\ldots + 2^{10}x^{20}$. The , $f(x)$ has

A. more than one minimum

B. exactly one minimum

C. atleast one maximum

D. None of the above

Answer: B

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108. the maximum value of $f(x) = \frac{x}{4 + x + x^2}$ on $[-1, 1]$ is (i) $-\frac{1}{4}$ (ii)$-\frac{1}{3}$ (iii)$\frac{1}{6}$ (iv)$\frac{1}{b}$

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

B. $-\frac{1}{4}$

C. $\frac{1}{4}$

D. $\frac{1}{6}$

Answer: D

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109. The largest value of $2x^3 - 3x^2 - 12x + 5$ for $-2 \leq x \leq 4$ occurs at x equals

A. -4

B. 0

C. 1

D. 4

Answer: D

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110. The minimum value of $2x + 3y$, when $xy = 6$ is

A. 9

B. 12

C. 8

D. 6

Answer: B

Watch Video Solution

111. The maximum value of xy when $x + 2y = 8$ is

A. 20

B. 16

C. 24

D. 8

Answer: D

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112. The minimum value of $e^{\left(2x^2-2x+1\right)\sin^2 x}$ is

A. 0

B. 1

C. 2

D. 3

Answer: B

Watch Video Solution

113. All possible value of $f(x) = (x+1)^{\frac{1}{3}} - (x-1)^{\frac{1}{3}}$ on [0,1] is 1 (b) 2 (c) 3 (d) $\frac{1}{3}$

A. 0

B. 1

C. 2

D. -1

Answer: C

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114. The function $f(x) = \frac{x}{2} + \frac{2}{x}$ has a local minimum at $x = 2$ (b) $x = -2$ $x = 0$ (d) $x = 1$

A. $x = -2$

B. $x = 0$

C. $x = 1$

D. $x = 2$

Answer: D

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115. The function $y - a(1 - \cos x)$ is maximum when x is equal to

A. π

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

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

D. $-\frac{\pi}{6}$

Answer: A

Watch Video Solution

116. The denominator of a fraction is greater than 16 of the square numerator, then least value of fraction is

A. $-\frac{1}{4}$

B. $-\frac{1}{8}$

C. $\frac{1}{12}$

D. $\frac{1}{16}$

Answer: B

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117. The minimum value of $f(x) - \sin^4 x + \cos^4 x, 0 \leq x \leq \frac{\pi}{2}$ is

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

B. $\frac{1}{4}$

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

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

Answer: D

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118. Find the points of local maxima or local minima, if any, of the following function, using the first derivative test. Also, find the local maximum or local minimum values, as the case may be: $f(x) = (x-1)(x+2)^2$

A. $-4, -4$

B. $0, -4$

C. $4, 0$

D. $0, 0$

Answer: B

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119. If x = -1 and x = 2 are extreme points of f(x) = $\alpha \log|x| + \beta x^2 + x$, then

A. $\alpha = 2, \beta = \frac{1}{2}$

B. $\alpha = 2, \beta = \frac{1}{2}$

C. $\alpha = -6, \beta = \frac{1}{2}$

D. $\alpha = -6, \beta = -\frac{1}{2}$

Answer: A

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120. For $x\varepsilon\left(0, \frac{5\pi}{2}\right)$, definite $f(x) = \int_0^x \sqrt{t}\sin t dt$. Then f has

A. local minimum at π and 2π

B. local minimum at π and local maximum at 2π

C. local maximum at π and local minimum at 2π

D. local maximum at π and 2π

Answer: C

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Miscellaneous Problems

1. The approximate value of $(80.7)^{1/4}$ is

A. 2.99822

B. 2.96600

C. 2.95399

D. 2.99722

Answer: D

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2. If the distance s covered by a particle in time t is proportional to the cube root of its velocity, then the acceleration is

A. a constant

B. $\propto s^3$

C. $\propto \frac{1}{s^3}$

D. $\propto s^5$

Answer: D

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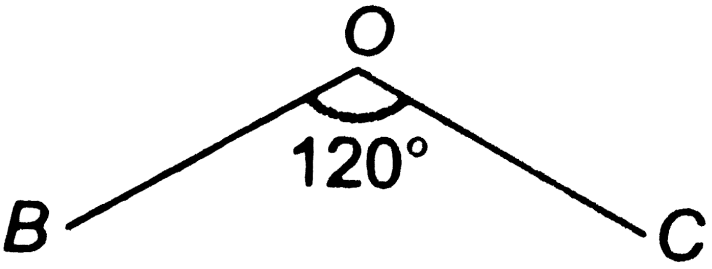
3. OB and OC are two roads enclosing an angle of 120°. X and Y start along OB with a speed of $4kmh^{-1}$ and Y travels alog OC with a speed of $3kmh^{-1}$. The rate at which the

shortest distance between X and Y is increasing after 1h is



A. $\sqrt{37}kmh^{-1}$

B. $37kmh^{-1}$

C. $13kmh^{-1}$

D. $\sqrt{13}kmh^{-1}$

Answer: A

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4. A line is drawn through the point (1, 2) to meet the coordinate axes at P and Q such that it forms a triangle OPQ, where O is the origin. If the area of the triangle OPQ is least, then the slope of the line PQ is (1) $-\frac{1}{4}$ (2) -4 (3) -2 (4) $-\frac{1}{2}$

A. $-1/4$

B. -4

C. -2

D. $-1/2$

Answer: C

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5. Rolle's theorem is not applicable for the function $f(x) = |x|$ in the intervel $[-1, 1]$ because

A. $f(x)$ is not continuous on $[-1, 1]$

B. f is not differentiable on $[-1, 1]$

C. $f(-1) \neq f(1)$

D. $f(-1) = f(1) \neq 0$

Answer: B

Watch Video Solution

6. Find the slope of the normal to the curve $y = x^2 - \frac{1}{x^2}$ at (-1, 0)

A. 4

B. $\frac{1}{4}$

C. -4

D. $-\frac{1}{4}$

Answer: B

Watch Video Solution

7. Suppose the cubic $x^3 - px + q$ has three distinct real roots, where $p > 0$ and $q > 0$. Then which one of the following holds?

A. The cubic has maxima at both $\sqrt{\frac{p}{3}}$ and $-\sqrt{\frac{p}{3}}$

B. The cubic has minima at $\sqrt{\frac{p}{3}}$ and maxima at $-\sqrt{\frac{p}{3}}$

C. The cubic has minima st $-\sqrt{\frac{p}{3}}$ and maxima at $\sqrt{\frac{p}{3}}$

D. The cubic has minima at both $\sqrt{\frac{p}{3}}$ and $-\sqrt{\frac{p}{3}}$

Answer: B

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8. $\log_{10}(4.04)$, it being given that $\log_{10} 4 = 0.6021$ and $\log_{10} e = 0.4343$

A. 1.3963

B. 1.2171

C. 1.6021

D. 1.3026

Answer: A

Watch Video Solution

9. The radius of a cylinder is increasing at the rate of $3ms^{-1}$ and its altitude is decreasing at the rate of $4ms^{-1}$. The rate of change of volume when radius is $4m$ and altitude is 6m is

A. $80\pi cums^{-1}$

B. $144\pi cums^{-1}$

C. $80cums^{-1}$

D. $64cums^{-1}$

Answer: A

Watch Video Solution

10. A missile is fired from the ground level rises x metres vertically upwards in t second, where $x = 100t - \frac{25}{2}t^2$. The maximum height reached is

A. $200m$

B. $125m$

C. $160m$

D. $190m$

Answer: A

Watch Video Solution

11. If the radius of a circle be increasing at a uniform rate of $2cms^{-1}$. The rate of increasing of area of circle, at the

instant when the radius is 20 cm is

A. $70\pi cm^2 s^{-1}$

B. $70 cm^2 s^{-1}$

C. $80\pi cm^2 s^{-1}$

D. $80 cm^2 s^{-1}$

Answer: C

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

A. it is at a constant distance from the origin

B. it passes through $\left(\frac{a\pi}{2}, -a\right)$

C. It makes angle $\frac{\pi}{2} - \theta$ with the X-axis

D. It passes through the origin.

Answer: A

Watch Video Solution

13. If ST and SN are the lengths of the subtangent and the subnormal at the point $\theta = \frac{\pi}{2}$ on the curve $x = a(\theta + \sin\theta), y = a(1 - \cos\theta), a \neq 1$ then

A. $ST = SN$

B. $ST = 2SN$

C. $ST^2 = aSN^3$

D. $ST^3 = aSN$

Answer: A

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14. If a and b are positive quantities, $(a > b)$ find minimum positive value of $(a\sec\theta - b\tan\theta)$

A. $\frac{1}{\sqrt{a^2 - b^2}}$

B. $\frac{1}{\sqrt{a^2 + b^2}}$

C. $\sqrt{a^2 + b^2}$

D. $\sqrt{a^2 - b^2}$

Answer: D

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15. The real number x when added to its inverse given the minimum value of the sum at x equal to 1 (b) -1 (c) -2 (d) 2

A. 2

B. 1

C. -1

D. -2

Answer: B

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16. For which interval, the function $\frac{x^2 - 3x}{x - 1}$ satisfies all the conditions of Rolle's theorem

A. $[0, 3]$

B. $[-3, 0]$

C. $[1.5, 3]$

D. for no interval

Answer: D

Watch Video Solution

17. The value of c in (0,2) satisfying the Mean Value theorem for the function $f(x) = x(x - 1)^2, x\varepsilon[0, 2]$ is equal to

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

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

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

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

Answer: B

Watch Video Solution

18. For what values of x the function $f(x) = x^4 - 4x^3 + 4x^2 + 40$ is monotonic decreasing?

A. $0 < x < 1$

B. $1 < x < 2$

C. $2 < x < 3$

D. $4 < x < 5$

Answer: B

Watch Video Solution

19. If $x \in (0, \pi/2)$, then the function $f(x) = x \sin x + \cos x + \cos^2 x$ is

A. increasing

B. decreasing

C. neither increasing nor decreasing

D. None of the above

Answer: B

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20. Let k and K be the minimum and the maximum values of the function $f(x) = \frac{(1+x)^{0.6}}{1+x^{0.6}}$, and $x \in [0, 1]$ respectively,then the ordered pair (k, K) is equal to

A. $\left(2^{-0.4}, 1\right)$

B. $\left(2^{-0.4}, 2^{0.6}\right)$

C. $\left(2^{-0.6}, 1\right)$

D. $\left(1, 2^{0.6}\right)$

Answer: A

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21. If for a function $f(x), f'(a) = 0, f''(a) = 0, f'''(a) > 0,$ then at $x = a, f(x)$ is

A. minimum

B. maximum

C. not an extreme point

D. extreme point

Answer: C

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22. For the curve $xy = c^2$ the subnormal at any point varies as

A. x^3

B. x^2

C. y^3

D. ∞

Answer: C

Watch Video Solution

23. If $x - 2y = 4$ the minimum value of xy is

A. -2

B. 0

C. 0

D. -3

Answer: A

Watch Video Solution

24. The maximum value of $\frac{\log x}{x}$ d is

A. e

B. $2e$

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

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

Answer: C

Watch Video Solution

25. The sum of two numbers is 6. The minimum value of the sum of their reciprocals is

A. $\frac{6}{5}$

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

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

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

Answer: C

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26. If $f(x) = 2x^3 - 21x^2 + 36x - 30$, then which one of the following is correct?

A. $f(x)$ has minimum at $x = 1$

B. $f(x)$ has maximum at $x = 6$

C. $f(x)$ has maximum at $x = 1$

D. $f(x)$ has no maxima of minima

Answer: C

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27. The function $x^5 - 5x^4 + 5x^3 - 1$ is

A. neither maximum nor minimum at $x = 0$

B. maximum at $x = 0$

C. maximum at $x = 1$ and minimum at $x = 3$

D. minimum at $x = 0$

Answer: A

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28. If there is an error of $k\%$ in measuring the edge of a cube, then the percent error in estimating its volume is k (b) $3k$ $\frac{k}{3}$ (d) none of these

A. k

B. $3k$

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

D. None of these

Answer: B

Watch Video Solution

29. A point on the parabola $y^2 = 18x$ at which the ordinate increases at twice the rate of the abscissa is (2,6) (b) $(2, -6)$ $\left(\frac{9}{8}, -\frac{9}{2}\right)$ (d) $\left(\frac{9}{8}, \frac{9}{2}\right)$

A. $(2, 4)$

B. $(2, -4)$

C. $\left(-\frac{9}{8}, \frac{9}{2}\right)$

D. $\left(\frac{9}{8}, \frac{9}{2}\right)$

Answer: D

Watch Video Solution

30. The maximum real number, which most exceeds its cube, is

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

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

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

D. $\frac{2}{\sqrt{3}}$

Answer: B

Watch Video Solution

31. The two parts of 100 for which the sum of double of first and square of second part is minimum, are a. 50,50 b. 99,1 c. 98,2 d. none of these

A. 50,50

B. 99,1

C. 98,2

D. None of these

Answer: B

Watch Video Solution

32. A particle is moving on a straight line and its distance x cms from a fixed point O on the line is given by

$x = \sqrt{t^2 + 1}$ then the velocity of particle at $t = 1$ is

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

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

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

D. $\frac{1}{3\sqrt{2}}$

Answer: A

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33. A stone, vertically thrown upward is moving in a line. Its equation of motion is $s = 294t - 49t^2$, then the maximum height that the stone reaches is

A. 1200

B. 441

C. 120

D. 424

Answer: B

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34. A triangular park is enclosed on two sides by a fence and on the third side by a straight river bank. Two having fence are of same length x. The maximum area enclosed by the park is :-

A. $\sqrt{\frac{x^3}{8}}$

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

C. πx^2

D. $\frac{3}{2}x^2$

Answer: B

Watch Video Solution

35. Find the area of the greatest rectangle that can be inscribed in the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.

A. $\frac{a}{b}$

B. $\sqrt{ab}$

C. ab

D. $2ab$

Answer: D

Watch Video Solution

36. The function f defined by $f(x) = 4x^4 - 2x + 1$ is increasing for

A. $x < 1$

B. $x > 0$

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

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

Answer: D

Watch Video Solution

37. The radius of a cylinder is increasing at the rate 2cm/sec. and its altitude is decreasing at the rate of 3cm/sec. Find the rate of change of volume when radius is 3 cm and altitude 5 cm.

A. $11\pi cm^3 s^{-1}$

B. $44\pi cm^3 s^{-1}$

C. $23\pi cm^3 s^{-1}$

D. $33\pi cm^3 s^{-1}$

Answer: D

Watch Video Solution

38. The function $f(x) = (x-1)^2$ has a minimum at x is equal to

A. 2

B. 0

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

D. 1

Answer: D

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39. एक स्थिर झील में एक पत्थर डाला जाता है ओर तरंगों व्रतों में 5 cm /s की गति से चलती है| जब वृत्ताकार तरंग की त्रिज्या 8 cm है तो उस क्षण घिरा हुआ क्षेत्रफल की दर से बढ़ा रहा है

A. $6\pi cm^2 s^{-1}$

B. $8\pi cm^2 s^{-1}$

C. $\frac{8}{3} cm^2 s^{-1}$

D. $80\pi cm^2 s^{-1}$

Answer: D

Watch Video Solution

40. If the line $ax + by + c = 0$ is a normal to the curve $xy = 1$, then $a > 0, b > 0$ $a > 0, b < 0$ $a\langle 0, b\rangle 0$ (d) $a < 0, b < 0$ none of these

A. $a > 0, b > 0$

B. $a > 0, b < 0$

C. $a < 0, b < 0$

D. Data is insufficient

Answer: B

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41. If the function $f(x) = 2x^3 - 9ax^2 + 12x^2x + 1, wherea > 0,$ attains its maximum and minimum at $pandq$, respectively, such that $p^2 = q,$ then a equal to 1 (b) 2 (c) $\frac{1}{2}$ (d) 3

A. 3

B. 2

C. 1

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

Answer: B

Watch Video Solution

42. For the curve $y^n = a^{n-1}x$ if the subnormal at any point is a constant, then n is equal to

A. 1

B. 2

C. -2

D. -1

Answer: B

Watch Video Solution

43. The maximum value of $\log x$ is

A. 1

B. not define

C. 10

D. 100

Answer: B

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

A. 3

B. 5

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

D. 15

Answer: D

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45. The displacement s of a particle at time t is given by $s = \alpha \sin \omega t + \beta \cos \omega t$ then acceleration at time t is

A. $\omega^2 s$

B. ωs

C. $-\omega^2 s$

D. $-\omega s$

Answer: C

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46. Find the point on the curve $y = 2x^2 - 6x - 4$ at which the tangent is parallel to the x-axis

A. $\left(\frac{3}{2}, \frac{13}{2}\right)$

B. $\left(-\frac{5}{2}, -\frac{17}{2}\right)$

C. $\left(\frac{3}{2}, \frac{17}{2}\right)$

D. $\left(\frac{3}{2}, -\frac{17}{2}\right)$

Answer: D

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47. The distance s travelled by a particle moving on a straight line in time t sec is given by $s = 2t^3 - 9t^2 + 12t + 6$ then the initial velocity of the particle is

A. 6

B. -9

C. 12

D. 11

Answer: C

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48. The tangent and the normal drawn to the curve $y = x^2 = x + 4$ at $P(1, 4)$ cut the X=-axis at A and B respectively. If the length of the subtangent drawn to the curve at P is equal to the length of the subnormal, then the area of the triangle PAB (in sq units) is

A. 4

B. 32

C. 8

D. 16

Answer: D

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49. The approximate surface area of a sphere of radius 4.01 cm is

A. $62.23\pi cm^2$

B. $16.62\pi cm^2$

C. $62.32\pi cm^2$

D. $64.32\pi cm^2$

Answer: D

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50. The perimeter of a sector is a constant. If its area is to be maximum, the sectorial angle is

A. $\frac{\pi}{6}$rad

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

C. 4 rad

D. 2 rad

Answer: D

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51. If $x = t^2$ and $y = 2t$ then equation of the normal at $t = 1$ is

A. $x + y - 3 = 0$

B. $x + y - 1 = 0$

C. $x + y + 1 = 0$

D. $x + y + 3 = 0$

Answer: A

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52. The equation of the tangent to the curve $y = (1 + x)^y + \sin^{-1}(\sin^2 x)$ at $x = 0$ is

A. $x - y + 1 = 0$

B. $x + y + 1 = 0$

C. $2x - y + 1 = 0$

D. $x + 2y + 2 = 0$

Answer: A

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53. Let f be a real-valued function defined on the inverval $(-1, 1)$ such that $e^{-x} f(x) = 2 + \int_0^x \sqrt{t^4 + 1} dt$, for all, $x \in (-1, 1) and let f^{-1}$ be the inverse function of f. Then $\left(f^{-1}\right)'(2)$ is equal to 1 (b) $\frac{1}{3}$ (c) $\frac{1}{2}$ (d) $\frac{1}{e}$

A. 1

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

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

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

Answer: B

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54. The radius of a cylinder is increasing at the rate of $5cm\ \min^{-1}$, so that its volume is constant. When its radius is 5 cm and height is 3 cm, then the rate of decreasing of its height is

A. $6cm\ \min^{-1}$

B. $3cm\ \min^{-1}$

C. $4cm\ \min^{-1}$

D. $5cm\ \min^{-1}$

Answer: A

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55. Values of c of Rolle's theorem for $f(x) = \sin x - \sin 2x$ on $[0, \pi]$

A. $\cos^{-1}\left(\frac{1+\sqrt{3}}{8}\right)$

B. $\cos^{-1}\left(\frac{1+\sqrt{35}}{8}\right)$

C. $\cos^{-1}\left(\frac{1-\sqrt{38}}{8}\right)$

D. does not exist

Answer: A

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56. If $f(x) = \frac{1}{4x^2 + 2x + 1}$, then its maximum value is $\frac{4}{3}$ (b) $\frac{2}{3}$ (c) 1 (d) $\frac{3}{4}$

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

B. 1

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

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

Answer: A

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57. $f(x) = \sin + \sqrt{3}\cos x$ is maximum when $x =$ $\frac{\pi}{3}$ (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{6}$ (d) 0

A. 60°

B. 30°

C. 45°

D. 0°

Answer: B

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58. The value of c in Lagranges theorem for the function $f(x) = \log \sin x$ in the interval $\left[\frac{\pi}{6}, \frac{5\pi}{6}\right]$ is $\frac{\pi}{4}$ (b) $\frac{\pi}{2}$ $\frac{2\pi}{3}$

(d) none of these

A. 0

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

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

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

Answer: C

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59. For the function $f(x) = x + \frac{1}{x}, x \in [1, 3]$, the value of c for mean value therorem is

A. 1

B. $\sqrt{3}$

C. 2

D. None of these

Answer: B

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60. The value of c in Rolle's theorem for the function $f(x) = x^3 - 3x$ in the interval $[0, \sqrt{3}]$ is

A. 1

B. -1

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

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

Answer: A

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61. If $y = x^4 - 6x^3 + 13x^2 - 11x + 4$, then approximate valueof y when $x = 2.01$ is

A. 2.12

B. 2.01

C. 2.31

D. 2.21

Answer: B

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62. The function $f(x) = 2x^3 - 15x^2 + 36x + 4$ is maximum at $x =$ (a) 3 (b) 0 (c) 4 (d) 2

A. $x = 2$

B. $x = 4$

C. $x = 0$

D. $x = 3$

Answer: A

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63. Divide 20 into two parts such that the product of the cube of one and the square of the other shall be maximum

A. 6,14

B. 12,8

C. 10,10

D. 5,15

Answer: B

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64. The function $f(x) = x^{-x}, (x \varepsilon R)$ attains a maximum value at x which is

A. 2

B. 3

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

D. 1

Answer: C

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65. in $[0, 1]$, lagrange mean value theorem is NOT applicable to

A. $f(x) = \begin{cases} \frac{1}{2} - x & x < \frac{1}{2} \\ \left(\frac{1}{2} - x\right)^2 & x \geq \frac{1}{2} \end{cases}$

B. $f(x) = \begin{cases} \frac{\sin x}{x} & x \neq 0 \\ 1 & x = 0 \end{cases}$

C. $f(x) = x|x|$

D. $f(x) = |x|$

Answer: A

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66. The maximum slope of the curve $y = -x^3 + 3x^2 + 9x - 27$ is 0 (b) 12 (c) 16 (d) 32

A. 0

B. 12

C. 16

D. 32

Answer: B

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67. Find local minimum value of the function f given by $f(x) = 3 + |x|, x \in R.$

A. -1

B. 3

C. 1

D. 0

Answer: A

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68. The maximum value of $y = a\cos x + b\sin x$ is

A. ab

B. $\frac{1}{\sqrt{a^2 + b^2}}$

C. $a^2 + b^2$

D. $\sqrt{a^2 + b^2}$

Answer: D

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69. The function $f(x) = \sin^4 x + \cos^4 x$ increases, if

A. $0 < x < \frac{\pi}{8}$

B. $\frac{\pi}{4} < x < \frac{3\pi}{8}$

C. $\frac{3\pi}{8} < x < \frac{5\pi}{8}$

D. $\frac{5\pi}{8} < x < \frac{3\pi}{4}$

Answer: B

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70. For all $x\varepsilon(0, 1)$

A. $e^x < 1 + x$

B. $\log_e(1+x) < x$

C. $\sin x > x$

D. $\log_e x > x - 1$

Answer: B

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71. The length of x of a rectangle is decreasing at the rate of $3cms^{-1}$ and the widty y is increasing at the rate of $3cms^{-1}$ when $x = 10cm$ and $y = 6cm$ then the rate of change of the area of rectangle is

A. $10cm^2s^{-1}$

B. $11cm^2s^{-1}$

C. $12cm^2s^{-1}$

D. $3cm^2s^{-1}$

Answer: C

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72. The radius of a soap bubble is increasing at the rate of $0.2cms^{-1}$ then the rate of increases of its surface area when radius 4 cm is

A. $7.3\pi cm^2s^{-1}$

B. $7.4\pi cm^2s^{-1}$

C. $6.4\pi cm^2s^{-1}$

D. $8.6\pi cm^2s^{-1}$

Answer: C

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73. If $ax^2 + \frac{b}{x} \geq c,\ \forall x > 0$, where $a > 0, b > 0$ then

A. $27ab^2 \geq 4c^3$

B. $27ab^3 \leq 4c^3$

C. $ab^2 \geq c^3$

D. $ab^3 \leq c^3$

Answer: A

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74. A bullet is shot horizontally and its distance s cms at time t sec is given by $s = 1200t - 15t^2$ then the distance covered with which the bullet is shot when it comes to the rest is

A. $1200cm$

B. $24000cm$

C. $40cm$

D. 0

Answer: B

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75. If the sum of the squares of the roots of the equation $x^2 - (a-2)x - (a+1) = 0$ is least, then the value of a, is

A. 2

B. 1

C. 3

D. 0

Answer: B

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76. If $P = (1, 1), Q = (3, 2)$ and R is a point on x-axis then the value of $PR + RQ$ will be minimum at

A. $\left(\frac{5}{3}, 0\right)$

B. $\left(\frac{1}{3}, 0\right)$

C. $(3, 0)$

D. $(1, 0)$

Answer: A

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77. The time T of oscillation of as simple pendulum of length l is given by $T = 2\pi\sqrt{\frac{l}{g}}$. The percentage error in T corresponding to an error of 2% in the value of l is

A. 0.02

B. 0.01

C. 0.03

D. 0.012

Answer: B

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78. Oil is leaking at the rate of 16 mL/s from a vertically kept cylindrical drum containing oil. If the radius of the drum is 7 cm and its height is 60 cm, find the rate at which the level of the oil is changing when the oil level is 18 cm

A. $\frac{-16}{49\pi} cms^{-1}$

B. $\frac{-16}{48\pi} cms^{-1}$

C. $\frac{16}{49}\pi cms^{-1}$

D. $\frac{-16}{47\pi}cms^{-1}$

Answer: A

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79. The points on the curve $y = x^3 - x^2 - x + 3$, where the tangents are parallel to the X-axis, are $\left(+\frac{1}{3}, \frac{-88}{27}\right)$ and (1,2)

A. $\left(-\frac{1}{3}, \frac{86}{27}\right)$ and (1,2)

B. $\left(\frac{-1}{3}, \frac{86}{27}\right)$ and $(-1, -2)$

C. $\left(\frac{-1}{3}, \frac{88}{27}\right)$ and $(-1, 2)$

D.

Answer: B

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80. The maximum and minimum values of $f(x) = \sec x + \log \cos^2 x, 0 < x < 2\pi$ are respectively

A. $(1, -1)$ and $2(1 - \log 2), 2(1 + \log 2)$

B. $(1, -1)$ and $\{2(1 - \log 2), 2(1 - \log 2)\}$

C. $(1, -1)$ and $(2, -3)$

D. None of the above

Answer: B

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Mht Cet Corner

1. If the Rolle's theorem for $f(x) = e^x(\sin x - \cos x)$ is verified on $\left[\frac{\pi}{4}, \frac{5\pi}{4}\right]$ then the value of C is

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

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

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

D. π

Answer: B

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2. The approximate value of $f(x) = x^3 + 5x^2 - 7x + 9$ at $x = 1.1$ is

A. 8.6

B. 8.5

C. 8.4

D. 8.3

Answer: A

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3. एक कण वक्र $6y = x^3 + 2$ के अनुगत गति कर रहा है वक्र पर उन बिंदुओं को ज्ञात कीजिए जबकि x-निर्देशांक की तुलना में y-निर्देशांक 8 गुना तीव्रता से बदल रहा है

A. (4,11)

B. (4,-11)

C. (-4,11)

D. (-4,-11)

Answer: A

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4. 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. straight line

D. None of these

Answer: B

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5. The length of normal at any point to the curve, $y = c\cosh\left(\frac{x}{c}\right)$ is

A. fixed

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

C. c

D. c^2

Answer: C

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6. The height of right circular cylinder of maximum volume in a sphere of diameter $2a$ is

A. $2\sqrt{3}a$

B. $\sqrt{3}a$

C. $\frac{2a}{\sqrt{3}}$

D. $\frac{a}{\sqrt{3}}$

Answer: C

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7. x,के सभी वास्तविक मानों के लिए $\frac{1-x+x^2}{1+x+x^2}$ का न्यूनतम मान है :

A. 0

B. $1/3$

C. 1

D. 3

Answer: B

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8. If $x + y = k$ is normal to $y^2 = 12x,$ then k is 3 (b) 9 (c) -9 (d) -3

A. 3

B. 9

C. -9

D. -3

Answer: B

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9. A particle moves along a straight line according to the law $s = 16 - 2t + 3t^3$, where s metres is the distance of the particle from a fixed point at the end of t second. The acceleration of the particle at the end of $2s$ is

A. $3.6ms^{-2}$

B. $36ms^{-2}$

C. $36kms^{-2}$

D. $360ms^{-2}$

Answer: B

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10. The equation of the tangent at (2,3) on the curve $y^2 = ax^3 + b$ is $y = 4x - 5$. Find the values of $aandb$.

A. 3,-5

B. 6,-5

C. 6,15

D. 6,-15

Answer: D

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11. The equation of motion of a particle moving along a straight line is $s = 2t^3 - 9t^2 + 12t$, where the units of s and t are centrimetre and second. The acceleration of the particle will be zero after

A. $\frac{3}{2}s$

B. $\frac{2}{3}s$

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

D. $1s$

Answer: A

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12. The equation of the tangent to the curve $y = 4xe^x$ at $\left(-1, \frac{-4}{e}\right)$ is

A. $y = -1$

B. $y = -\frac{4}{e}$

C. $x = -1$

D. $x = \frac{-4}{e}$

Answer: B

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13. The abscissa of the points, where the tangent to curve $y = x^3 - 3x^2 - 9x + 5$ is parallel to X-axis are

A. $x = 0$ and 0

B. $x = 1$ and -1

C. $x = 1$ and -3

D. $x = -1$ and 3

Answer: D

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14. The point of the curve $y^2 = 2(x - 3)$ at which the normal is parallel to the line $y - 2x + 1 = 0$ is

A. $(5, 2)$

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

C. $(5, -2)$

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

Answer: C

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15. Maximum area of a reactangle which can be inscribed in a circle of a given radius R is

A. πr^2

B. r^2

C. $\pi r^2 / 4$

D. $2r^2$

Answer: D

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16. If the function $f(x) = 2x^3 - 9ax^2 + 12x^2x + 1, wherea > 0,$ attains its maximum and minimum at $pandq$, respectively, such that $p^2 = q,$ then a equal to 1 (b) 2 (c) $\frac{1}{2}$ (d) 3

A. 0

B. 1

C. 2

D. None of these

Answer: C

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17. If f(x)= kx-sin x is monotonically increasing then

A. $k > 1$

B. $k > -1$

C. $k < 1$

D. $k < -1$

Answer: A

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18. If a particle moves such that the displacement is proportional to the square of the velocity acquired, then it acceleration is

A. proportional to s^2

B. proportional to $\frac{1}{s^2}$

C. proportiona to $\frac{1}{s}$

D. a constant

Answer: D

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19. $f(x) = \tan^{-1}(\sin x + \cos x), x > 0$ is always and increasing function on the interval

A. $(0, \pi)$

B. $\left(0, \frac{\pi}{2}\right)$

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

D. $\left(0, \frac{3\pi}{4}\right)$

Answer: C

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20. A ladder 10 m long rests against a vertical wall with the lower end on the horizontal ground. The lower end of the ladder is pulled along the ground away from the wall at the rate of 3 m/s. The height of the upper end while it is descending at the rate of 4 m/s, is

A. $4\sqrt{3}m$

B. $5\sqrt{3}m$

C. $5\sqrt{2}m$

D. $6m$

Answer: D

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21. If $x + y = 8$, then maximum valueof x^2y is

A. $\frac{2048}{9}$

B. $\frac{2048}{81}$

C. $\frac{2048}{3}$

D. $\frac{2048}{27}$

Answer: D

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