MATHS

BOOKS - BODY BOOKS PUBLICATION

APPLICATION OF DERIVATIVES

Exercise

1. The radius of a balloon is increasing at the rate of 10cm/sec. At what rate is the surface area of the balloon increasing when the radius is 15 cm.

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2. Find the equation of the tangent to the curve $(1+x^2)y=2-x$ where it crosses the X-axis.

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

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4. Choose the correct answer from the bracket

The slope of the normal to the curve $y = 2x^2 + 3\sin x$ at x = 0 is.

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5. Find two positive numbers whose sum is 16 and the sum of whose Cubes is minimum.

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6. A manufacture can sell x items at a price of Rs. $\left(5-\frac{x}{100}\right)$ each. The cost price of x items is $c(x)=\left(\frac{x}{5}+500\right)$. Write the selling price S(x) of x items.

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7. Find two positive numbers whose sum is 16 and the sum of whose Cubes is minimum.

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8. A ball is thrown vertically upwards which satisfies the equation $S = 80t - 16t^2$. Find the time required to reach the maximum height.

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9. Show that the function given by

$f(x) = 3x + 17$ is strictly increasing on R.

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10. Find the slope of the tangent to curve

$y = x^3 - x + 1$ at the point

whose x-coordinate is 2.

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11. Find the equation of tangents and normals to the given curves $y = x^3$ at $(1, 1)$

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12. Choose the correct answer from the bracket The slope of the normal to the curve $y = 2x^2 + 3$ sin x at x = 0 is.

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13. Use differentials to find the approximate value of $(0.009)^{\frac{1}{3}}$ up to 3 places of decimals.

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14. Consider the function $f(x) = \frac{-3}{4}x^4 - 8x^3 - \frac{45}{2}x^2 + 105.$ Find f'(x).

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15. Consider the function $f(x) = \frac{-3}{4}x^4 - 8x^3 - \frac{45}{2}x^2 + 105.$ Find points of local maxima & minima and corresponding maximum and minimum values.

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16. Consider the curve $2y = 3 - x^2$ Find the slope of the tangent to this curve at (x_1, y_1).

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17. Consider the curve $2y = 3 - x^2$ Find the points on the curve at which tangent is parallel to the line x+y=0.

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18. Consider the curves $x = y^2$ and $xy = k$ Differentiate both the equations with respect to x.

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19. Prove that the curve $x = y^2$ and $xy = k$ cut at right angles, if $8k^2 = 1$.

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20. The total profit y (in rupee) of a drug company from the manufacture and sale of x bottles of drug is given by $y = \frac{-x^2}{300} + 2x - 50$. How many bottles of drug must the company sell to obtain maximum profit.

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21. The total profit y (in rupee) of a drug company from the manufacture and sale of x bottles of drug is given by $y = \frac{-x^2}{300} + 2x - 50$. What is the maximum profit?

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22. Of all the cylinders with given surface area, show that the volume is maximum when height is equal to the diameter of the base .

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23. A man 160 cm tall, walks away from a source of light situated at the top of a pole 6 m high, at the rate of 1.1 m/sec. How fast is the length of his shadow increasing when he is 1 m away from the pole?

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24. It is given that at x = 1, the function $x^4 - 62x^2 + ax + 9$ attains its maximum value, on the interval [0,2]. Find the value of a ?

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25. The total profit y (in rupee) of a drug company from the manufacture and sale of x bottles of drug is given by $y = \frac{-x^2}{300} + 2x - 50$. How many bottles of drug must the company sell to obtain maximum profit.

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26. The total profit y (in rupee) of a drug company from the manufacture and sale of x bottles of drug is given by $y = \frac{-x^2}{300} + 2x - 50$. What is the maximum profit?

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27. Sand is pouring from a pipe at the rate of $12 \ cm^3$ / s. The falling sand forms a cone on the ground in such a way that the height of the cone is always one-sixth of the radius of the base. How fast if the height of the sand cone increasing when the height is 4 cm ?'

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28. Water is running into a conical vessel, 15cm deep and 5cm in radius, at the rate of

$0.1cm^3/\sec$. When the water is 6cm deep, find at what rate is The water level rising.

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29. Water is running into a conical vessel, 15cm deep and 5cm in radius, at the rate of $0.1cm^3/\sec$. When the water is 6cm deep, find at what rate isThe water surface area increasing.

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30. Water is running into a conical vessel, 15cm deep and 5cm in radius, at the rate of $0.1cm^3/\text{sec}$. When the water is 6cm deep, find at what rate is The wetted surface of the vessel increasing.

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31. Show that all rectangles with a given perimeter, the square has the maximum area.

Watch Video Solution

32. Show that all rectangles with a given perimeter, the square has the maximum area.

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33. Find the slope of the curve $x^2 + 3y = 3$ at the point (1,2).

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34. Find the equation of the tangent to the curve $x^2 + 3y = 3$ parallel to the line $y - 4x + 5 = 0$. Find also the equation of the normal to the curve at the point of contact.

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35. Show that the following function does not have a local maximum or a local minimum f(x) = $x^3 + x^2 + x + 1.$

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36. Prove that the following functions do not have maxima or minima $f(x) = e^x$

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37. Prove that the following functions do not have maxima or minima $g(x) = \log x$

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38. The combined resistance R of two resistors R_1 and $R_2 (R_1, R_2 > 0)$ is given by $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$. If $R_1 + R_2 = C$ (a constant), show that the maximum resistance R is obtained by choosing $R_1 = R_2$.

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39. Show that all rectangles with a given perimeter, the square has the maximum area.

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40. Show that the height of the cylinder of maximum volume that can be inscribed in a sphere of radius is $\frac{2R}{\sqrt{3}}$. Also find the maximum volume.

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41. An edge of a variable cube is increasing at the rate of 3 cm / s. How fast is the volume of the cube increasing when the edge is 10 cm long?

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42. Find the local maxima and local minima of the following function $g(x) = x^3 - 3x$. Also find the local maximum and the local minimum values.

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43. Choose the correct answer from the bracket. The rate of change of the area of a circle with respect to its radius r at r =10 cm is

A. 10π

B. 20π

C. 30π

D. 40π

Answer:

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44. Find the intervals in which the function f given by $f(x) = x^2 - 6x + 5$ is Strictly increasing.

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45. Find the intervals in which the function f given by $f(x) = x^2 - 6x + 5$ is Strictly decreasing.

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46. Find the local minimum and local maximum value, if any, of the function

$f(x) = x^3 - 6x^2 + 9x + 8.$

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47. Choose the correct answer from the bracket. The slope of the tangent to the curve

$y = x^3 - 2x + 3$ at x=1 is......

A. 0

B. 1

C. 2

D. 3

Answer:

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48. Find points on the curve $\frac{x^2}{25} + \frac{y^2}{9} = 1$ at which the tangents are

Parallel to x-axis.

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49. Find points on the curve $\frac{x^2}{25} + \frac{y^2}{9} = 1$ at which the tangents are

Parallel to y-axis.

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50. Use differential to approximate $\sqrt{25.6}$

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51. Choose the correct answer from the bracket. The function f(x)=cosx is strictly decreasing in the interval ________a)$\left(\frac{-\pi}{2}, \frac{\pi}{2}\right)$ b)$(0, 2\pi)$ c)$(0, \pi)$ d)$(-\pi, \pi)$

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

B. $(0, 2\pi)$

C. $(0, \pi)$

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

Answer:

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52. Find the equation of the tangent to the curve $y = x^2 - 4x + 5$ which is parallel to the line 2x+y+5=0.

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53. Find the absolute maximum and minimum values of a function f given by $f(x) = x^3 - 9x + 8$ on [-4,2].

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54. Prove that the function $f(x) = \log \sin x$ is strictly increasing in $\left(0, \frac{\pi}{2}\right)$ and strictly decreasing in $\left(\frac{\pi}{2}, \pi\right)$

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55. Find the approximate change in volume of a cube of side x meters caused by an increase in the side by 3%.

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56. A wire of length 28 m is cut into two pieces. One of the Pieces is be made into a square and the other in to a circle. What should be the length of the two pieces so that combined area of the square and the circle is minimum using differentiation?

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57. Consider the function $y = \frac{\log x}{x}, x > 0$

Find the extreme points of f(x).

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58. Consider the function $y = \frac{\log x}{x}, x > 0$

Find the maximum or minimum values if any.

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59. A rectangle sheet of tin with adjacent sides 45 cm and 24 cm is to be made into a box without top, by cutting off equal squares from the corners the folding up the flaps.

Taking the side of the square cut off as x, express the volume of the box as the function of x.

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60. An rectangle sheet of tin with adjascent sides 45 cm and 24 cm is to be made into a box without top, by cutting off equal squares of side x from the corners the folding up the flaps.

For what value of x, the volume of the box will be maximum.

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61. The slope of the tangent to the curve $y = x^3$ inclined at an angle 60° to x-axis is .....

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62. Consider the function $y^2 = 4x + 5$ Find a point on the curve at which the tangent is parallel to the line $y = 2x + 7$.

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63. Find the approximate value of $\sqrt{0.037}$.

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64. Consider the function $f(x) = x^2$ in [-2,1]

Find the local maximum or minimum if any.

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65. Consider the function $f(x) = x^2$ in [-2,1]

Find the absolute maximum and minimum.

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66. Of all the cylinders with given surface area, show that the volume is maximum when height is equal to the diameter of the base .

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67. Sand is pouring from a pipe at the rate of $12\ cm^3$ / s. The falling sand forms a cone on the ground in such a way that the height of the cone is always one-sixth of the radius of the base. How fast if the height of the sand cone increasing when the height is 4 cm ?'

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

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69. Two equal sides of an isosceles triangle with fixed base 'a' are decreasing at the rate of 9cm/s How fast is the area of the triangle decreasing when the two sides are equal to 'a'.

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70. Consider the function $f(x) = (x+1)^3(x-3)^3$ Find f'(x).

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71. Consider the function $f(x) = (x+1)^3(x-3)^3$ Find critical points of f(x).

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72. Find the intervals in which the function $f(x) = (x+1)^3(x-3)^3$ strictly increasing or decreasing.

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73. Find the point on the curve $y = x^3 - 11x + 5$ at which the tangent is $y = x - 11$

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74. Prove that the volume of the largest cone that can be inscribed in a sphere of radius R is 8/27 of the volume of the sphere.

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75. A ladder 5m long is leaning against a wall. The bottom of the ladder is pulled along the ground, away from the wall, at the rate of 2cm/s. How fast is its height on the decreasing when the foot of the ladder is 4m away from the wall.

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76. An open box is made by removing squares of equal size from the corners of a tin sheet of size $16cm \times 10cm$ and folding up the sides of the box so obtained. With the help of figure, obtain the relation V=x(16-2x)(10-2x).

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77. An open box is made by removing squares of equal size from the corners of a tin sheet of size $16cm \times 10cm$ and folding up the sides of the box so obtained. What is the value of x for which V is maximum?

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78. What is the slope of the tangent and normal at (1,1) on the curve $y = x^3$.

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79. A water tank is in the shape of a right circular cone with its axis vertical and vertex down. Its height and diameter are same. Water is powered into it at a constant rate of $2m^3 / \min ute$. With the help of figure obtain the relation $V = \frac{1}{12}\pi h^3$.

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80. A water tank is in the shape of a right circular cone with its axis vertical and vertex down. Its height and diameter are same. Water is powered into it at a constant rate of $2m^3 / \min ute$. Find the rate at which water level is increasing when depth of water in the tank is 6m.

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81. Find the interval in which the function $x^3 - 6x^2 + 9x + 15$ is increasing.

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82. A window is in the form of a rectangle surmounted by a semicircle as shown in the figure. The perimeter of the window is 5 metres. If r is the radius of the semicircle and x is the length of the larger side of the rectangle, find a relation between r,x.

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83. A window is in the form of a rectangle surmounted by a semicircle as shown in the figure. If r is the radius of the semicircle and x is the length of the larger side of the rectangleThe perimeter of the window is 5 metres Find the area of the window in terms of r.

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84. A window is in the form of a rectangle surmounted by a semicircle as shown in the figure. The perimeter of the window is 5 metres. Find the dimensions of the window so that the greatest possible light may be admitted.

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85. A rectangle sheet of tin with adjacent sides 45 cm and 24 cm is to be made into a box without top, by cutting off equal squares from the corners the folding up the flaps.

Taking the side of the square cut off as x, express the volume of the box as the function of x.

86. An rectangle sheet of tin with adjascent sides 45 cm and 24 cm is to be made into a box without top, by cutting off equal squares of side x from the corners the folding up the flaps.

For what value of x, the volume of the box will be maximum.

87. What is the slope of the tangent and normal at (1,1) on the curve $y = x^3$.

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88. A wire of length 28 m is cut into two pieces. One of the Pieces is be made into a square and the other in to a circle. What should be the length of the two pieces so that combined area of the square and the circle is minimum using differentiation?

89. A car starts from a point P at time t=0 seconds and stops at point Q. The distance x, in metres, covered by it, in t seconds is given by $x = t^2\left(2 - \frac{t}{3}\right)$ Find the time taken by it to reach Q and also find distance between P and Q.

90. Show that the function given by $f(x) = \sin x$ is

a) strictly increasing in $\left(0, \frac{\pi}{2}\right)$

b) Strictly decreasing in $\left(\frac{\pi}{2}, \pi\right)$

c) Neither increasing nor decreasing in $(0, \pi)$.

91. Show that the function given by $f(x) = \sin x$ is

a) strictly increasing in $\left(0, \frac{\pi}{2}\right)$

b) Strictly decreasing in $\left(\frac{\pi}{2}, \pi\right)$

c) Neither increasing nor decreasing in $(0, \pi)$.

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92. Prove that the function given by $f(x) = \cos x$ is

(a) Strictly decreasing in $(0, \pi)$

(b) Strictly increasing in $(\pi, 2\pi)$ and

(c) neither increasing nor decreasing in $(0, 2\pi)$

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

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94. Consider parametric forms given by $x = a \sin^3 t, y = b \cos^3 t$ Find $\frac{dy}{dx}$.

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95. Consider parametric forms given by $x = a\sin^3 t, y = b\cos^3 t$ Find the equation of tangent at $t = \frac{\pi}{2}$.

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

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

b) perpendicular to the line $5y - 15x = 13$

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

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

b) perpendicular to the line $5y - 15x = 13$

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98. Use differentials to find the approximate value of $(15)^{\frac{1}{4}}$ up to 3 places of decimals.

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99. Prove that the following functions do not have maxima or minima $g(x) = \log x$

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100. Show that all rectangles with a given perimeter, the square has the maximum area.

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101. The slope of the tangent to the curve $y = e^{2x}$ at (0,1) is.....a)1 b)2 c)0 d)-1

A. 1

B. 2

C. 0

D. -1

Answer:

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102. Find the intervals in which the function $f(x) = x^2 + 2x - 5$ strictly increasing or decreasing.

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103. Find the equation of tangents and normals to the given curves $y = x^3$ at $(1, 1)$

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104. Find local maximum and local minimum if any for the function. $h(x) = \sin x + \cos x$.

$0 < x < \left(\frac{\pi}{2}\right)$

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105. Find the slope of tangent line to the curve

$y = x^2 - 2x + 1$

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106. f(x) is a strictly increasing function, if f'(x) is........a)Positive b)Negative c)0 d)None of these

A. positive

B. negative

C. 0

D. None of these

Answer:

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107. Show that the function F given by

$f(x) = x^3 - 3x^2 + 4x, x \in R$

is strictly increasing

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108. Find the slope of the tangent to the curve

$y = (x - 2)^2$ at x=1

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109. Find a point at which the tangent to the curve $y = (x - 2)^2$ is parallel to the chord joining the point A (2,0) and B(4,4)

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110. The slope of the normal to the curve, $y^2 = 4x$ at (1,2) is

A. 1

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

C. 2

D. -1

Answer:

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111. Find the intervals in which the function $2x^3 + 9x^2 + 12x - 1$ is strictly increasing.

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112. The rate of change of volume of a sphere with respect to its radius when radius is 1 unit.

A. 4π

B. π

C. π

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

Answer:

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113. Find two positive numbers whose sum is 16 and the sum of whose Cubes is minimum.

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114. The slope of the tangent to the curve given

$x = 1 - \cos\theta, y = \theta - \sin\theta$ by at $\theta = \frac{\pi}{2}$

A. 0

B. -1

C. 1

D. Not defined

Answer:

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115. Find the intervals in which the function $f(x) = x^2 - 4x + 6$ is strictly decreasing.

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116. Find the minimum and maximum value, if any, of the function $f(x) = (2x - 1)^2 + 3$

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117. Which of the following function has neither local maxima nor local minima?

a) $f(x) = x^2 + x$ b) $f(x) = \log x$ c) $f(x) = x^3 - 3x + 3$

d) $f(x) = 3 + |x|$

A. $f(x) = x^2 + x$

B. $f(x) = \log x$

C. $f(x) = x^3 - 3x + 3$

D. $f(x) = 3 + |x|$.

Answer:

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118. Find the equation of the tangent to the curve $y = 3x^2$ at (1,1)

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119. Use differentiation to approximate $\sqrt{36.6}$.

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120. Which of the following function is always increasing? a)$x + \sin 2x$

b)$x - \sin 2x$ c)$2x + \sin 3x$ d)$2x - \sin x$

A. x+sin 2x

B. x-sin 2x

C. 2x+sin 3x

D. 2x-sin x

Answer:

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121. The radius of a cylinder increases at a rate of 1 cm/s and its height decreases at a rate of 1cm/s. Find the rate of change of its volume when the radius is 5 cm and the height is 15 cm. If the volume should not change even when the radius and height are changed, what is the relation between the radius and height?

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122. Write the equation of tangent at (1,1) on the curve $2x^2 + 3y^2 = 5$.

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123. Which of the following function is increasing for all values of x in its domain? a)

$\sin x$ b)$\log x$ c)x^2 d)$|x|$

A. Sin x

B. log x

C. x^2

D. |x|

Answer:

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124. Find a point on the curve $y = (x - 2)^2$ at which the tangent is parallel to the chord joining the points (2,0) and (4,4).

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125. Find the maximum profit that a company can make, if the profit function is given by $p(x) = 41 - 24x - 6x^2$

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126. Find the slope of the normal to the curve

$y = \sin\theta$ at $\theta = \frac{\pi}{4}$

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127. Show that the function

$x^3 - 6x^2 + 15x + 4$

is strictly increasing in R.

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128. Show that all rectangles with a given perimeter, the square has the maximum area.

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129. Show that the function $x^3 - 3x^2 + 6x - 5$ is strictly increasing on R.

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130. Find the interval in which the function $f(x) = \sin x + \cos x, 0 \leq x \leq 2\pi$ is strictly increasing or strictly decreasing.

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131. The slope of the tangent to the curve $y = x^3 - 1$ at x=2 is.........

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132. Use differentiation to approximate $\sqrt{36.6}$.

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133. Find two numbers whose sum is 24 and whose product as large as possible.

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134. Find the equation of the tangentto the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \text{at} (x_1, y_1)$

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135. Find the intervals in which the function

f(x)= $2x^3 - 15x^2 + 36x + 1$ is increasing

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136. Find the intervals in which the function

f(x)=2x^3-15x^2+36x+1 is increasing

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137. Find the approximate value of $(626)^{1/4}$.

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138. Find two positive numbers x and y such that $x + y = 60$ and xy^3 is maximum.

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

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