MATHS

BOOKS - HIMALAYA MATHS (KANNADA ENGLISH)

MAXIMA AND MINIMA

Question Bank

1. The value of x for which $2x^3 - 9x^2 + 12x + 2$ is decreasing in

A. $1 < x < 2$

B. $x < 1 \text{ or } x > 2$

C. $x < -1 \text{ or } x > -2$

D. $-1 < x < -2$

Answer: A

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2. y = x/(log x) is increasing for

A. $e < x < \infty$

B. $0 < x < \infty$

C. $0 < x \leq e$

D. $\infty < x < e$

Answer: A

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3. The function defined by $y = x^2$ is

A. increasing for $x < 0$

B. decreasing for $x > 0$

C. maximum at x = 0

D. minimum at x =0

Answer: D

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4. The function f(x) = ((a sin x + b cos c)/(c sin x + d cos x)) is increasing in its domain, if

A. $ad - bc < 0$

B. $ad - bc > 0$

C. $ab - cd < 0$

D. $ab - cd > 0$

Answer: B

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5. If $a > b$ then maximum value of $a\sin^2 + b\cos^2 x$ is

A. a

B. b

C. a+b

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

Answer: A

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6. If $a > b$ miniimum value of $a\sin^2 + b\cos^2 x$ is

A. a

B. b

C. a+b

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

Answer: B

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7. f(x) = sin x + cos 2x has minimum for x =

A. $(2n+1)\frac{\pi}{2}$

B. $n\pi$

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

D. $2n\pi$

Answer: A

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8. Let

$P(x) = a_0 + a_1x^2 + a_2x^4 + a_3x^6 + \ldots\ldots + a_nx^{2n}$

be a polynomial in a real variable x with

$0 < a_0 < a_1 < a_2 < \ldots\ldots\ldots < a_n$. The function

P(x) has :

A. neither maximum nor minimum

B. only one maximum

C. only one minimum

D. only one maximum and only one minimum

Answer: C

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9. IF $f(x) = ax^2 + bx + c$ has minimum value, when

A. $a < 0$

B. $a > 0$

C. $b^2 = 4ac$

D. x = b/(2a)

Answer: B

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10. Minimum value of x log x is

A. (-1/e)

B. 1/e

C. (-e)

D. e

Answer: A

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11. The maximum value of $\left(\frac{1}{x}\right)^x$ is

A. 1/e

B. e

C. $\left(\frac{1}{e}\right)^{e}$

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

Answer: D

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12. Minimum value of $f(x) = 2e^{x} + e^{-x}$ is

A. $2\sqrt{2}$

B. $3\sqrt{2}$

C. e

D. e^2

Answer: A

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13. The maximum value of $\left(\frac{x^2 - x + 1}{x^2 + x + 1}\right)$ is

A. 1

B. 3

C. (1/3)

D. 2

Answer: B

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14. The minimum value $\left(\frac{x^2+2x+9}{x^2-2x+9}\right)$ is

A. 1

B. 2

C. (1/2)

D. (1/3)

Answer: C

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15. The maximum value of $\left(\frac{x^2+x+1}{x^2-x+1}\right)$ is

A. 1

B. 3

C. (1/3)

D. 2

Answer: B

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16. The minimum value $\left(\frac{x^2 - 2x + 9}{x^2 + 2x + 9}\right)$ is

A. 1

B. 2

C. (1/2)

D. (1/3)

Answer: C

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17. If a, b are different positive numbers then maximum value of ((x+a)(x+b))/((x-a)(x-b)) occurs at x =

A. (a-b)/2

B. (a+b)/2

C. $-\sqrt{ab}$

D. $+\sqrt{ab}$

Answer: D

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18. The maximum value of $f(x) = \frac{x}{1 + 4x + x^2}$ on [-1, 1] is :

A. (-1/4)

B. (-1/3)

C. (1/6)

D. (1/5)

Answer: C

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19. Maximum value of the product of two numbers whose sum is 36 is

A. 324

B. 424

C. 288

D. 320

Answer: A

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20. The sum of two positive numbers is p. If the sum of their square is minimum then the numbers are

A. (3p)/4,p/4

B. (2p)/3,p/3

C. p/2,p/2

D. p,0

Answer: C

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21. Among the rectangles of given area with least perimeter will be such that its sides l, b are

A. $l = \sqrt{2b}$

B. l =b

C. l = 2b

D. $b = \sqrt{2}l$

Answer: B

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22. The dimensions of a rectangle of maximum area having a perimeter of 24 ft are

A. 6,6

B. 8,4

C. 7,5

D. 6,7

Answer: A

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23. If $x > 0$ and xy = 1 then the minimum value of $x^2 + y^2$ is

A. 0

B. 1

C. 2

D. 3

Answer: C

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24. A quadratic function in x has the value 19 when x=1 and has maximum value 20 when x=2 Then the function is

A. $16 + 4x - x^2$

B. $16 - 4x - x^2$

C. $16 - 4x + x^2$

D. $8 + 12x - x^2$

Answer: A

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25. The point on the curve $y = x^2$ which is nearest to (3,0) is

A. (1,-1)

B. (-1,1)

C. (-1,-1)

D. (1,1)

Answer: D

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26. The nearest point on the curve $y^2 = 4x$ from (2,1) is

A. (0,0)

B. (1,1,)

C. (1,2)

D. (2,2)

Answer: C

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27. The functionf(x) = tan x, for all real values of $x \neq \pm \frac{\pi}{2}, \pm \frac{3\pi}{2}, \ldots\ldots$ is

A. increasing

B. decreasing

C. neither decreasing nor increasing

D. none of these

Answer: A

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28. The function $f(x) = x - \cos x, x \in R$, is

A. a decreasing function

B. an increasing function

C. an odd function

D. none of these

Answer: B

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29. The function $f(x) = \cot^{-1} x + x$ increases in the interval :

A. $(1, \infty)$

B. $(-1, \infty)$

C. (-oo, oo)

D. (0, oo)

Answer: C

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30. The function $f(x) = ax + b$, is strictly decreasing for all $x \in R$ iff :

A. a = 0

B. $a < 0$

C. $a > 0$

D. none of these

Answer: B

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

A. $-\frac{10}{3} < x < 0$

B. $3 < x < 3$

C. $0 < x < \infty$

D. $-\infty < x < -\frac{10}{3}$

Answer: A

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32. If $f(x) = \cos x + a^2 x + b$ is an increasing function for all values of x, then

A. $a \in [-1, 1]$

B. $a \in (-\infty, -1] \cup [1, \infty)$

C. $a \in [-1, \infty)$

D. $a \in (-\infty, 1]$

Answer: B

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33. Let $f(x) = x^3 + \frac{3}{2}x^2 + 3x + 3$, then f(x) is :

A. an increasing function

B. a decreasing function

C. an even function

D. an odd function

Answer: A

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34. If $x > 0$, xy = 1, minimum value of x+y is

A. 2

B. (-2)

C. 1

D. (-1)

Answer: A

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35. If sum of two numbers is 3, then the maximum value of the product of first and square of second is

A. 4

B. 3

C. 2

D. 1

Answer: A

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36. If $y = a\log x + bx^2 + x$ has its extreme values at x = -1 and x = 2, then :

A. a=2, b =-1

B. a = -2, b = 1/2

C. a = 2, b =-1/2

D. a = -2, b =-1/2

Answer: C

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37. The maximum value of the function $f(x) = \sin\left(x + \frac{\pi}{6}\right) + \cos\left(x + \frac{\pi}{6}\right)$ in the interval $\left(0, \frac{\pi}{2}\right)$ occurs at

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

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

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

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

Answer: A

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38. The number of values of x where the function

`f(x) = 2(cos 3x + cos sqrt3 x) attains maximum is

A. 1

B. 2

C. 0

D. infinite

Answer: A

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39. The function f(x) = a cos x + b tan x + x has extreme values at x = 0 and $x = \frac{\pi}{6}$, then

A. a = -2/3, b =-1

B. a = 2/3, b =-1

C. a = -2/3, b =1

D. $a = 2/3, b = 1$

Answer: A

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40. Let $f(x) = (ax+b)/(cx + d)$, then $f(x)$ has

A. a critical point

B. a maximum

C. a minimum

D. no critical point

Answer: D

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41. Let $f(x) = x^3 - \frac{1}{x^3}$, then $f(x) + f\left(\frac{1}{x}\right)$ is equal to :

A. local maximum at x =0

B. local minimum at x =0

C. point of inflextion at x =0

D. none of these

Answer: B

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42. The function $f(x) = 2 + 4x^2 + 6x^4 + 8x^6$ has

:

A. only one maximum

B. only one minimum

C. no maxima or minima

D. many maxima and minima

Answer: B

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43. The function $f(x) = x^{\frac{1}{x}}, x > 0$ has the maximum value at x = e, then

A. $e^{\pi} \leq \pi^{e}$

B. $e^{\pi} = \pi^{e}$

C. $e^{\pi} < \pi^{e}$

D. $e^{\pi} > \pi^{e}$

Answer: D

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44. Maximum slope of the curve $y = -x^3 + 3x^2 + 9x - 27$ is :

A. 0

B. 12

C. 16

D. 32

Answer: B

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45. The sum of two non zero numbers is 4. The minimum value of the sum of their reciprocals is

A. 0

B. 1

C. (1/4)

D. (1/2)

Answer: B

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46. The point in the interval [0, 2pi] where $f(x) = e^x . \sin x$ has maximum slope is

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

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

C. π

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

Answer: B

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47. The function $f(x) = x^2 + \frac{k}{x}$ has a local minimum at x = 2, then the value of k =

A. 8

B. 16

C. 18

D. 12

Answer: B

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48. For f(x) = x+$\frac{1}{x}$,

A. local minimum $>$ local maximum

B. local maximum $>$ local minumum`

C. local maximum does not exist

D. local minimum does not exist

Answer: A

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49. The maximum value of $f(x) = \frac{x}{4 + x + x^2}$ on [-2,2] is

A. (-1/4)

B. (-1/3)

C. (1/6)

D. (1/5)

Answer: D

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50. AB is a diameter of a circle and C is any point on the circumference of the circle, then :

A. the area of the triangle ABC is maximum, if it is isoceles

B. the area of triangle ABC is minimum when it is isoceles

C. the perimeter of ABC is minimum when it is isoceles

D. none of these

Answer: A

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51. A circle of radius unity is inscribed in an isosceles triangle. The least perimeter of the triangle is :

A. $6\sqrt{3}$

B. 9

C. $2\sqrt{3}$

D. $3\sqrt{3}$

Answer: A

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52. An isosceles triangle of vertical angle 2θ is inscribed in a circle of radius a. The area of the triangle is maximum, if $\theta =$

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

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

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

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

Answer: C

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53. If x is real, the maximum value of $\left(\frac{4x^2+7x+10}{4x^2+7x+4}\right)$ is

A. (3/4)

B. 111/15

C. 211/30

D. (9/8)

Answer: B

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54. If x is real, the minimum value of $\left(\frac{2x^2+4x+5}{2x^2+4x+7}\right)$ is

A. (3/5)

B. (-3/5)

C. (5/3)

D. (-5/3)

Answer: A

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55. The interval in which $y = x^2 e^{-x}$ is increasing in

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

B. (-2, 0)

C. $(2, \infty)$

D. (0,2)

Answer: D

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56. The point on the curve $x^2 = 2y$ which is nearest to the point (0,5) is

A. $(2, \sqrt{2}, 4)$

B. $(2\sqrt{2}, 0)$

C. (0,0)

D. (2,2)

Answer: A

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57. For all real values of x, the minimum value of $\left(\frac{1-x+x^2}{1+x+x^2}\right.$ is

A. 0

B. 1

C. 3

D. (1/3)

Answer: D

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58. The interval on which function $f(x) = 2x^3 + 9x^2 + 12x - 1$ is decreasing is

A. $[-1, \infty)$

B. [-2, -1]

C. $(-\infty, -2]$

D. [-1, 1]

Answer: B

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59. Let, $f: R \to R$ be defined by f(x) = 2x + cos x, then f

A. has a minimum at $x = \pi$

B. has a maximum at x =0

C. is a decreasing function

D. is an increasing function

Answer: D

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60. $y = x(x-3)^2$ decreases for the values of x given by

A. $1 < x < 3$

B. $x < 0$

C. $x > 0$

D. $0 < x < \frac{3}{2}$

Answer: A

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61. The function $f(x) = 4\sin^3 x - 6\sin^2 x + 12\sin x + 100$ is strictly

A. increasing in $\left(\pi, \frac{3\pi}{2}\right)$

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

C. decreasing in $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$

D. increasing in $\left[0, \frac{\pi}{2}\right]$

Answer: B

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62. Which of the following function is decreasing on $\left(0, \frac{\pi}{2}\right)$

A. sin 2x

B. tan x

C. cos x

D. cos 3x

Answer: C

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63. The function $f(x) = 1 + |\sin x|$ is :

A. A. always increases

B. B. always decreases

C. C. never increases

D. D. sometimes increases and sometime decreases

Answer: A

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64. If x is real, the minimum value of $x^2 - 8x + 17$ is :

A. (-1)

B. 0

C. 1

D. 2

Answer: C

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65. The smallest value of the polynomial $x^3 - 18x^2 + 96x$ is [0,9] is

A. 126

B. 0

C. 135

D. 160

Answer: B

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66. The function $f(x) = 2x^3 - 3x^2 - 12x + 4$ has

:

A. two points of local maximum

B. two points of local minimum

C. one maxima and one minima

D. no maxima or minima

Answer: C

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67. The maximum value of sin x. cos x is

A. (1/4)

B. (1/2)

C. $\sqrt{2}$

D. $2\sqrt{2}$

Answer: B

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68. Maximum slope of the curve $y = -x^3 + 3x^2 + 9x - 27$ is :

A. 0

B. 12

C. 16

D. 32

Answer: B

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69. $f(x) = x^x$ has a stationary point at :

A. x = e

B. x = 1/e

C. x = 1

D. $x = \sqrt{e}$

Answer: B

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70. The maximum value of $\left(\frac{1}{x}\right)^x$ is

A. e

B. e^e

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

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

Answer: C

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71. For $f(x) = \sqrt{3}\sin x + 3\cos x$, the point $x = \frac{\pi}{6}$ is

A. local minimum

B. local maximum

C. point of inflextion

D. none of these

Answer: B

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72. The maximum value of $\frac{\log x}{x}$ in $(2, \infty)$ is

A. 2/e

B. 1/e

C. $\sqrt{e}$

D. e

Answer:

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73. The maximum value of $\sin x + \cos x$ is :

A. $\sqrt{2}$

B. $-\sqrt{2}$

C. $\sqrt{3}$

D. 2

Answer: A

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74. The maximum value of $\left(\frac{1}{x}\right)^x$ is

A. 2/e

B. e

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

D. 1/e

Answer: C

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75. The point on the curve $y^2 = 4x$ which is nearest to the point (2,1) is

A. (1, -2)

B. (-2, 1)

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

D. (1,2)

Answer: D

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76. The function $f(x) = 2x^3 - 15x^2 + 36x + 4$ is maximum at

A. x =3

B. x =0

C. x = 4

D. x = 2

Answer: D

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77. The perimeter of a sector is p. the area of the sector is maximum when it radius is

A. p/2

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

C. $\sqrt{p}$

D. p/4

Answer: D

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78. Let the function f:$R \to R$ be defined by $f(x) = 2x + \cos x$. Then f

A. has a minimum at $x = \pi$

B. has a maximum at x =0

C. is a decreasing function

D. is an increasing function

Answer: D

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79. The maximum of $4\sin^2 x + 3\cos^2 x$ is

A. 4

B. 3

C. 7

D. 5

Answer: A

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80. The maximum of the function 3 cos x - 4 sinx is

A. 2

B. 3

C. 4

D. 5

Answer: D

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81. A population p(t) of 1000 bacteria introduced into nutrient medium grows according to the relation $p(t) = 1000 + \frac{1000t}{100 + t^2}$ The maximum size of this bacterial population is...

A. 1050

B. 5250

C. 1100

D. 1250

Answer: A

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82. A circular sector of perimeter 60 metre with maximum area is to be constructed. The radius of the circular arc in metre must be

A. 10

B. 15

C. 5

D. 20

Answer: B

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83. The range in which $y = -x^2 + 6x - 3$ is increasing is

A. $x > 3$

B. $x < 3$

C. $5 < x < 6$

D. $7 < x < 8$

Answer: B

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84. The function $f(x) = \cot^{-1} x + x$ increases in the interval :

A. $(1, \infty)$

B. $(-1, \infty)$

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

D. $(0, \infty)$

Answer: C

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85. The greatest value of $f(x) = (x+1)^{1/3} - (x-1)^{1/3}$ on [0, 1] is :

A. 1

B. 2

C. 3

D. (1/3)

Answer: B

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86. The real number x when added to its inverse gives the minimum value of the sum at x equal to :

A. 1

B. (-1)

C. (-2)

D. 2

Answer: A

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87. If the function $f(x) = 2x^3 - 9ax^2 + 12a^2x + 1$, where $a > 0$ attains its maximum and minimum at p and q respectively such their $p^2 = q$, then a equals :

A. 1

B. 2

C. (1/2)

D. 3

Answer: B

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88. The function $f(x) = \frac{x}{2} + \frac{2}{x}$ has a local minimum at :

A. x = 2

B. x = -2

C. x = 0

D. x = 1

Answer: A

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89. A triangular park is enclosed on two sides by a fence and on the third side of straight river bank. The two sides having fence 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

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90. If x is real, the maximum value of $\frac{3x^2+9x+17}{3x^2+9x+7}$ is

A. 41

B. 1

C. (17/7)

D. (1/4)

Answer: A

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91. Let x and y be two variables such that $x > 0$ and xy =1. Then the minimum value of x+y is

A. 0

B. 1

C. 3

D. 2

Answer: D

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92. The maximum value of the function $f(x) = \sin\left(x + \frac{\pi}{6}\right) + \cos\left(x + \frac{\pi}{6}\right)$ in the interval $\left(0, \frac{\pi}{2}\right)$ occurs at

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

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

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

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

Answer: A

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

A. A. decreasing for all x

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

C. C. increasing for all x

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

Answer: D

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

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

B. $\frac{\pi}{4} < x < \frac{\pi}{2}$

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

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

Answer: B

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95. Consider the following statements S and R S : Both sin x and cos x are decreasing function in $\left(\frac{\pi}{2}, \pi\right)$ R: If a differentiable function decreases in (a,b) then its derivative also decreases in (a,b) Which of the following is true?

A. A. Both S and R are wrong

B. B. Both S and R are correct by R is not the correct explantation for S

C. C. S is correct and R is the correct explanation for S

D. D. S is correct and R is wrong

Answer: D

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96. Let f(x) = {(|x|, for 0 <|x| < 2)= 1,for x =0 }` Then at x = 0, f (x) has

A. A. a local maximum

B. B. no local maximum

C. C. a local minimum

D. D. no extremum

Answer: D

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97. The length of the largest 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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98. If $f(x) = x^3 + bx^2 + cx + d$ and $0 < b^2 < c$, then in $(-\infty, \infty)$, $f(x)$:

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

A. is increasing

B. has real maximum

C. is decreasing

D. is bounded

Answer: A

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100. The minimum $2x^3 - 3x^2 - 12x + 8$ occurs at

x =

A. (-1)

B. 2

C. $\sqrt{6}$

D. $-\sqrt{6}$

Answer: B

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101. If x is real, the minimum value of $x^2 - 8x + 17$ is :

A. 17

B. (-1)

C. 1

D. 2

Answer: C

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102. The maximum value of $f(x) = 2x^3 - 21x^2 + 36x + 20$ in $0 \leq x \leq 2$

A. 37

B. 44

C. 32

D. 30

Answer: A

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103. The minium distance from the point (4,2) to the curve $y^2 = 8x$, is equal to

A. $\sqrt{2}$

B. $2\sqrt{2}$

C. $3\sqrt{2}$

D. $4\sqrt{2}$

Answer: B

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104. If x and y are strictly positive such that x+y =1, then the minimum value of x log x + y log y is

A. log 2

B. (-log 2)

C. 2 log 2

D. 0

Answer: B

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105. If x+y = 12, then the minimum value of $x^2 + y^2$ is

A. 72

B. 144

C. 48

D. 36

Answer: A

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106. If $l^2 + m^2 = 1$, then the maximum value of l+m is

A. 1

B. $\sqrt{2}$

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

D. 2

Answer: B

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107. The minimum value of x^x is

A. e

B. e^e

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

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

Answer: C

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108. The maximum value of xy subjects to x+y =7 is

A. 12

B. 10

C. (49/4)

D. (55/4)

Answer: C

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109. The minimum value of $(x-\alpha)(x-\beta)$ is

A. 0

B. $\alpha\beta$

C. $\frac{1}{4}(\alpha-\beta)^2$

D. $-\frac{1}{4}(\alpha-\beta)^2$

Answer: D

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110. Show that $y=\log(1+x)-\frac{2x}{2+2x}, x>-1,$ is an increasing function of x throughout its domain.

A. $0<x<\infty$

B. $-\infty<x<0$

C. $-\infty < x < \infty$

D. $1 < x < 2$

Answer: A

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111. The function $f(x) = xe^{-x}(x \in R)$ attains a maximum value at x =

A. 2

B. 1/e

C. 1

D. 3

Answer: C

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112. Observe the following statements: $A: f(x) = 2x^3 - 9x^2 + 12x - 3$ is increasing outside (1,2) $R: f'(x) < 0$ for $x \in (1, 2)$ Then which of the following is true?

A. Both A and R true and R is not the correct reason for A

B. Both A and R are true and R is the correct reasong for A

C. A is true but B is false

D. A is false but R is true

Answer: B

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113. If x is real then the minimum value of $\frac{x^2 - x + 1}{x^2 + x + 1}$ is

A. (1/3)

B. 3

C. (1/2)

D. 1

Answer: A

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114. The perimeter of a sector is a constant . If its area is to be maximum , then the sectional angle is

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

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

C. 4^c

D. 2^c

Answer: D

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115. In the interval (-3,3) the function f(x) = x/3 + 3/x, $x \neq 0$ is

A. increasing

B. decreasing

C. neither decreasing nor increasing

D. partly increasing and partly decreasing

Answer: B

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116. The function $f(x) = 1 - x^3 - x^5$ is decreasing for

A. $1 \leq x \leq 5$

B. $x \leq 1$

C. $x \geq 1$

D. all values of x

Answer: D

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117. If PQ and PR are the two sides of a triangle, then the angle between them which gives maximum area of the triangle is

A. π

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

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

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

Answer: D

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118. The function y = a(1-cosx) is maximum when x is equal to

A. π

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

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

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

Answer: A

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119. Twenty metres are available to fence a flower bed in the form of a circular sector. If the flower bed should have the greatest possible surface area, the radius of the circle must be

A. 4 metres

B. 3 metres

C. 6 metres

D. 5 metres

Answer: D

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

A. (0, (5pi)/4)`

B. (0,pi/2)`

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

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

Answer: C

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121. The maximum value of xy, when x+2y = 8 is

A. 20

B. 16

C. 24

D. 8

Answer: A

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

A. (-1/4)

B. (-1/8)

C. (1/12)

D. (1/16)

Answer: D

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123. If $xy = c^2$, then minimum value of ax + by is

A. $c\sqrt{ab}$

B. $2c\sqrt{ab}$

C. $-c\sqrt{ab}$

D. $2c\sqrt{ab}$

Answer: B

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124. If $a^2x^4 + b^2y^4 = c^6$, then maximum value of xy is

A. $\frac{c^2}{\sqrt{ab}}$

B. $\frac{c^3}{ab}$

C. $\frac{c^3}{2\sqrt{ab}}$

D. `c^(3)/(2ab)

Answer: B

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125. If $f(x) = \frac{1}{4x^2 + 2x + 1}$, then its maximum value

A. (4/3)

B. (2/3)

C. 1

D. (3/4)

Answer: D

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126. Let $f(x) = \frac{x}{1+x} - \log(1+x)$, when $x > 0$, then f is :

A. an increasing function

B. a decreasing function

C. both increasing and decreasing function

D. none of these

Answer: C

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127. If $f(x) = x^3 - 6x^2 + 9x + 3$ be a decreasing function, then x lies in

A. $(-\infty, -1) \cap (3, \infty)$

B. (1,3)

C. $(3, \infty)$

D. none of these

Answer: B

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128. If $y = a\log x + bx^2 + x$ has its extreme values at x = -1 and x = 2, then :

A. (1, 1/2)

B. (1/2, 2)

C. (2, -1/2)

D. (-2/3, -1/6)

Answer: C

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129. The function $f(x) = (\log x)/(x)$ is increasing in the interval

A. $(1, 2e)$

B. $(0,e)$

C. $(2, 2e)$

D. $(1/e, 2e)$

Answer: B

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130. $2x^3 - 6x + 5$ is an increasing function, if

A. $0 < x < 1$

B. $-1 < x < 1$

C. $x < -1$ or $x > 1$

D. $-1 < x < -\frac{1}{2}$

Answer: C

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131. If x-2y = 4, then the minimum value of xy is

A. A. (-2)

B. B. 2

C. C. 0

D. D. (-3)

Answer: A

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

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

B. (1/4)

C. (-1/2)

D. (1/2)

Answer: D

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133. If ab = 2a + 3b, $a > 0, b > 0$, then the minimum value of ab is

A. A. 12

B. B. 24

C. C. (1/4)

D. D. none of these

Answer: B

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134. Maximum slope of the curve $y = -x^3 + 3x^2 + 9x - 27$ is :

A. 0

B. 12

C. 16

D. 32

Answer: B

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135. Function $f(x) = \frac{\lambda \sin x + 6 \cos x}{2 \sin x + 3 \cos x}$ is monotonic increasing if

A. $\lambda > 1$

B. $\lambda < 1$

C. $\lambda < 4$

D. $\lambda > 4$

Answer: D

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136. The function f(x) = a sin x + 1/3 sin 3x has a maximum value of $x = \frac{\pi}{3}$. The value of a is

A. A.3

B. B. (1/3)

C. C. 2

D. D. (1/2)

Answer: C

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137. If $a < 0$, the function $f(x) = e^{ax} + e^{-ax}$ is decreasing for all values of x, where

A. A. $x > 0$

B. B. $x < 0$

C. C. $x > 1$

D. D. $x < 1$

Answer: B

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138. If p and q are positive real numbers such that $p^2 + q^2 = 1$ then the maximum value of (p+q) is

A. (1/2)

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

C. $\sqrt{2}$

D. 2

Answer: C

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

A. 0

B. (1/4)

C. (1/2)

D. (1/3)

Answer: B

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140. Let

$P(x) = a_0 + a_1x^2 + a_2x^4 + a_3x^6 + \ldots\ldots + a_nx^{2n}$

be a polynomial in a real variable x with

$0 < a_0 < a_1 < a_2 < \ldots\ldots\ldots < a_n$. The function

P(x) has :

A. neither maximum nor minimum

B. only one maximum

C. only one minimum

D. none of these

Answer: C

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141. The function $f(x) = \int_1^x \left[2(t-1)(t-2)^3 + 3(t-1)^2(t-2)^2\right] dt$ attains its maximum at x =

A. 1

B. 2

C. 3

D. 4

Answer: A

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142. Let, $f(x) = \int e^x (x-1)(x-2)dx$, then f(x) decreases in the interval

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

B. (-2, -1)

C. (1,2)

D. $(2, \infty)$

Answer: C

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143. If $f(x) = xe^{x(1-x)}$, then f(x) is

A. increasing on [-1/2,1]

B. decreasing on R

C. increasing on R

D. decreasing on [-1/2.1]

Answer: A

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144. The number of values of x where the function $f(x) = \cos x + \cos\left(\sqrt{2}x\right)$ attains its maximum is

A. A. 0

B. B. 1

C. C. 2

D. D. infinite

Answer: B

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145. If $f: R \to R$ is defined by $f(x) = \frac{x}{x^2 + 1}$

find f(f(2))

A. f(x) is decreasing on (-1, 1) and has a local minimum at x =1

B. f(x) is increasing on (-1, 1) and has local maximum at x =1

C. f(x) is increasing on (-1, 1) and has neither a local maximum nor a local minimum at x =1

D. f(x) is decreasing on (-1,1) but has neither a local maximum nor a local minimum at x =1

Answer: A

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146. The function $f(x) = \tan^{-1}(\sin x + \cos x)$ is an increasing function in :

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

B. (-pi/4, pi/2)`

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

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

Answer: D

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147. 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 minimum at both $\sqrt{\frac{p}{3}}$ and $-\sqrt{\frac{p}{3}}$

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

C. The cubic has minimum at $\sqrt{\frac{p}{3}}$, maximum at $-\sqrt{\frac{p}{3}}$

D. The cubic has minimum at $-\sqrt{\frac{p}{3}}$, maximum at $\sqrt{\frac{p}{3}}$

Answer: C

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148. The condition $f(x) = x^3 + px^2 + qx + r(x \in R)$ to have no extreme value is

A. A. $p^2 < 3q$

B. B. $2p^2 < q$

C. C. $p^2 < \frac{q}{4}$

D. D. $p^2 > 3$

Answer: A

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149. If m and M respectively the minimum and maximum of $f(x) = (x-1)^2 + 3$ for $x \in [-3, 1]$ then the ordered pair (m, M) is equal to

A. A. (-3, 19)

B. B. (3, 19)

C. C. (-19, 3)

D. D. (-19, -3)

Answer: B

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150. Let, $f(x) = \int_0^x \frac{\cos t}{t} dt.$ Then $x = (2n+1)\frac{\pi}{2}$, f(x) has

A. maximum when, n = -2, -4, -6, ... and minimum when n = -1, -3, -5,....

B. maximum when n = -1, -3, -5, and minimum when n = 1,3,5, ...

C. minimum when x = 0, 2, 4, ... And maximim when n = 1,3,5, ...

D. none of these

Answer: B

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151. The point of extremum of the function $\phi(x) = \int_1^x e^{\frac{t^2}{2}}\left(1 - t^2\right)dt$ are

A. x = 0,1

B. x =1, -1

C. x =1/2

D. x = -1/2

Answer: B

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152. If $f'(x) = (x-a)^{2n}(x-b)^{2p+1}$, when n and p are positive integers, then :

A. x = b is a point of minimum

B. x = b is point of maximum

C. x = b is a point of inflexion

D. none of these

Answer: A

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153. If $f(x) = kx^3 - 9x^2 + 9x + 3$ is increasing on R then

A. $k < 3$

B. $k > 3$

C. $k \leq 3$

D. none of these

Answer: B

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154. If h(x) = f(x) + f(-x) then h(x) has got an extreme value at a point where $f'(x)$ is

A. an even function

B. an odd function

C. zero

D. none of these

Answer: A

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155. If $a < 0$, the function $f(x) = e^{ax} + e^{-ax}$ is decreasing for all values of x, where

A. $x > 0$

B. $x < 0$

C. $x > 1$

D. $x < 1$

Answer: B

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156. If $a < 0$, $f(x) = e^{ax} + e^{-ax}$ and S = {x: f(x) is monotonically increasing}` then S equals,

A. $\{x : x > 0\}$

B. $\{x : x < 0\}$

C. $(x : x > 1\}$

D. $\{x : x < 1\}$

Answer: A

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157. If $y = a\log x + bx^2 + x$ has its extremum value at $x = -1$ and $x = 2$, then

A. a = 2, b = -1

B. a = 2, b = -1/2

C. a = -2, b = 1/2

D. none of these

Answer: B

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

A. an increasing function on R

B. a decreasing function on R

C. an even function on R

D. none of these

Answer: A

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159. If $f(x) = 2x^3 - 21x^2 + 36x - 30$, then for f(x) 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 maximum and minimum

Answer: C

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160. The value of k in order that $f(x) = \sin x - \cos x - kx + b$ decrease for all real values is given by :

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

B. $a \geq 1$

C. $a < \sqrt{2}$

D. $a < 1$

Answer: A

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161. The maximum area of a rectangle that can be inscribed in a circle of radisu 2 units is

A. 8π

B. 4

C. 5

D. 8

Answer: D

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162. The maximum value of $\frac{\log x}{x}$ in $(2, \infty)$ is

A. 2/e

B. 1

C. 1/e

D. e

Answer: C

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163. The minimum value of $26^{\cos 2x} 81^{\sin 2x}$ is

A. (1/243)

B. (1/27)

C. (-5)

D. (1/5)

Answer: A

164. A wire of lenggth 20 cm is bent in the form of a sector of a circle. The maximum area that can be snclosed by the wire is

A. 30 sq.cm

B. 10 sq.cm

C. 25 sq. cm

D. 20 sq. cm

Answer: C

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165. The set of real values of x for which $f(x) = \frac{x}{\log x}$ is increasing is :

A. {1}

B. $\{x \in x < e\}$

C. empty

D. $\{x : x \geq e\}$

Answer: D

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166. Let x be a number which exceeds its square by the greatest possible quantity, then x =

A. (1/2)

B. (1/4)

C. (3/4)

D. (1/3)

Answer: A

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167. The maximum value of $\left(\frac{1}{x}\right)^{2x^2}$ is :

A. $e^{-\frac{1}{2}}$

B. $\sqrt[e]{e}$

C. 1

D. e^2

Answer: B

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