MATHS

BOOKS - OBJECTIVE RD SHARMA ENGLISH

INCREASING AND DECREASING FUNCTIONS

Illustration

1. The function $f(x) = 2\log(x-2) - x^2 + 4x + 1$ increases on the interval (a) $(1,\ 2)$ (b) $(2,\ 3)$ (c) $(1,\ 3)$ (d) $(2,\ 4)$

A. (1,2)

B. (2,3)

C. (1,3)

D. (2,4)

Answer: B

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

A. increasing on $(-\infty, -1) \cup [1, \infty)$ and decresing on (-1,1)

B. decreasing on $(-\infty, -1] \cup [1, \infty)$ and increasing on (-1,1)

C. increasing on $(0, \infty)$ and decreaing on $(-\infty, 0)$

D. decreasin on $(0, \infty)$ and increasing on $(-\infty, 0)$

Answer: A

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

A. decreasing in for all x

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

C. increasing for all x

D. decreasing in $(-1, \infty)$ and increasing in $(-\infty, 0)$

Answer: B

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4. Let $f(x) = x^3 + ax^2 + bx + 5\sin^2 x$ be an increasing function on the set R. Then find the condition on a and b.

A. $a^2 + 3b + 15 > 0$

B. $a^2 + 3b + 15 < 0$

C. $a^2 - 3b - 15 > 0$

D. $a^2 - 3b - 15 < 0$

Answer: A

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5. Let the function $f(x) = \tan^{1-}(\sin x + \cos x)$ be defined on `[0, 2 pi]

Then f(x) is

A. increasing on $[0, \pi/4) \cup \left[5\frac{\pi}{4}, 2\pi\right]$

B. decreasing on $(\Pi/4, 2\pi)$

C. increasing on $(0, \pi/4,) \cup (3\pi/4, 2\pi)$

D. decreasing on $[\pi/4, 7\pi/4]$

Answer: A

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Section I Solved Mcqs

1. Let $h(x) = f(x) - (f(x))^2 + (f(x))^3$ for every real number x. Then (a) h is increasing whenever f is increasing (b)h is increasing whenever f is decreasing (c)h is decreasing whenever f is decreasing (d) nothing can be said in general

A. h is increasing whenever is increasing

B. h is increasing whenever f is decreasing

C. h is decreasing whenever f is decreasing

D. nothing can be said in general

Answer: A::C

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2. If $f(x) = \frac{x}{\sin x}$ and $g(x) = \frac{x}{\tan x}$, $where$ $0 < x \leq 1$, then in this interval

A. both f(x) and g(x) are increasing functions

B. both f(x) and g(x) decreasing functions

C. f(x) is an increasing function

D. g(x) is an increasing function

Answer: C

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3. Find the interval to which b may belong so that the function f(x) $= \left(1 - \frac{\sqrt{21 - 4b - b^2}}{b + 1}\right) x^3 + 5x + \sqrt{6}$ is increasing at every point of its domain.

A. (-7,-1)

B. (-6,-2)

C. (2,25)

D. all of the above

Answer:

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4. The interval of increase of the function $f(x) = x - e^x + \tan(2\pi/7)$ is

(a) $(0, \infty)$ (b) $(-\infty, 0)$ (c) $(1, \infty)$ (d) $(-\infty, 1)$

A. $(0, \infty)$

B. $(-\infty, 0)$

C. $(1, \infty)$

D. $(5, \infty)$

Answer: B

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5. The function $f(x) = x^x$ decreases on the interval (a) $(0,\ e)$ (b) $(0,\ 1)$ (c) $(0,\ 1/e)$ (d) $(1/e,\ e)$

A. (0,e)

B. (0,1)

C. `90,1//e)

D. none of these

Answer: C

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6. The set of all x for which $\log(1+x) \leq x$ is equal to ..... .

A. $(0, \infty)$

B. $(-1, \infty)$

C. (-1,0)

D. none of these

Answer: B

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7. The function $f(x) = \frac{x}{x \log x}$ increase on the interval

A. $(1, \infty)$

B. (0,e)

C. (e, ∞)

D. none of these

Answer: C

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

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

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

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

Answer: D

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9. The set of all x for which $1 + \log x < x$, is

A. $(1, \infty)$

B. (0,1)

C. $(0, \infty)$

D. none of these

Answer: C

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10. For $x > 1$ and y = lod x which one of the following is not true ?

A. $x - 1 > y$

B. $x^2 - 1 > y$

C. $y > x - 1$

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

Answer: C

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11. If the function $f(x) = 2x^2 - kx + 5$ is increasing on $[1, 2]$, then k lies in the interval (a) $(-\infty, 4)$ (b) $(4, \infty)$ (c) $(-\infty, 8)$ (d) $(8, \infty)$

A. $(-\infty, 4)$

B. $(4, \infty)$

C. $(-\infty, 8)$

D. $(8, \infty)$

Answer: A

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12. Let $f(x) = x^3 + ax^2 + bx + 5\sin^2 x$ be an increasing function on the set R. Then find the condition on a and b.

A. $a^2 - 3b - 15 > 0$

B. $a^2 - 3b + 15 > 0$

C. $a^2 - 3b + 15 < 0$

D. $a > 0$ and $b < 0$

Answer: C

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13. If a, b, c are real numbers, then find the intervals in which $f(x) = \begin{vmatrix} x + a^2 & ab & ac \\ ab & x + b^2 & bc \\ ac & bc & x + c^2 \end{vmatrix}$ is increasing or decreasing.

A. $\left(-\frac{2}{3}(a^2 + b^2 + c^2), 0 \right)$

B. $0, \left(-\frac{2}{3}(a^2 + b^2 + c^2) \right)$

C. $\left(\frac{a^2 + b^2 + c^2}{3} \right)$

D. none of these

Answer: A

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14. Let f(x) be the function given by

$f(x) = 3x^5 - 5x^3 + 21x + 3\sin x + \cos x + 5$. Then ,

A. f(x) is increasing on R and f(x) =0 has exactaly one negative root

B. f(x) is increasing on R and f(x) =0 has excatly one positive root

C. f(x) is an increasing and f(x) =0 has excatly one negative root

D. f(x) is an increasing and f(x) = 0 has excatly one positive root

Answer: A::C

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15. If the function $f(x) = 2\tan x + (2a+1)(\log)_e|\sec x| + (a-2)x$ is increasing on R , then (a) $a \in (1/2,\ \infty)$ (b) $a \in (-1/2,\ 1/2)$ (c)

$a = 1/2$ (d) $a \in R$

A. $(a \in (1/2, \infty)$

B. $(a \in (-1/2, 1/2)$

C. $a = 1/2$

D. $(a \in R)$

Answer: C

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16. If $f'\left(x^2 - 4x + 3\right) > 0$ for all $x \in (2, 3)$then f(sinx) is increasing on

A. $\underset{n \in Z}{\cup} \left(2n \ \pi, (4n+1)\frac{\pi}{2} \right)$

B. $\underset{n \in Z}{\cup} \left((4n-1)\frac{\pi}{2}, \ 2n \ \pi \right)$

C. R

D. none of these

Answer: A

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17. Let $f(x) = \tan^{-1}(g(x))$, where $g(x)$ is monotonically increasing for $0 < x < \frac{\pi}{2}$.

A. increasing on $(0, \pi/2)$

B. decreasing on $(0, \pi/2)$

C. increasing on $(0, \pi/4)$ and decreasing on $(\pi/4, \pi/2)$

D. none of these

Answer: A

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

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

B. (-2,-1)

C. (1,2)

D. $(2, \infty)$

Answer: C

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19. $Assertion$ Consider the following statements in S and RS: Both $\sin x$ and $\cos x$ are decrerasing function in the interval $\left(\frac{\pi}{2}, \pi\right)$ $Reason$ If a differentiable function decreases in an interval (a, b), then its derivative also decrease in (a, b).Which of the following it true? (a) Both S and R are wrong. (b) Both S and R are correct, but R is not the correct explanation of S. (c) S is correct and R is the correct explanation for S. (d) S is correct and R is wrong.

A. Both S and R are wrong

B. Both S and R are correct but R is not correct explanation for S

C. S is correct and R wrong

D. d

Answer: D

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

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

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

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

D. π

Answer: A

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21. If $f(x) = x^3 + 4x^2 + ax + 5$ is a monotonically decreasing function of x in the largest possible interval `(-2,-2//3), then the value of a is

A. 4

B. 2

C. -1

D. none of these

Answer: A

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22. Let $f(x) = 2\sin^3 x - 3\sin^2 + 12\sin x + 5, 0 \leq x \leq \frac{\pi}{2}$ Then f(x)is

A. decreasing on $[0, \pi/2]$

B. increasing on $[0, \pi/2]$

C. increasing on $(0, \pi/4)$ and decreasing on $(\pi/4, \pi/2)$

D. none of these

Answer: B

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23. Let $f'(x) > 0$ and $g'(x) < 0$ for all $x \in R$ Then

A. $f\{g(x) > f(g(X+1)\}$

B. $f\{g(x) > f(g(X-1)\}$

C. $g\{f(x) > g(f(X+1)\}$

D. $g\{f(x) > g(f(X-1)\}$

Answer: A::C

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24. If $f(x) = (ab + b^2 + 1)x + \int_0^x (\cos^4\theta + \sin^4\theta)\ d\theta$ is an incrasing function of x for all $x \in R$ and $b \in R$, b being independent of x then

A. $a \in (0, \sqrt{6})$

B. $a \in (\sqrt{6}, \sqrt{6})$

C. $a \in (-\sqrt{6}, 0)$

D. none of these

Answer: B

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25. If $f(x) = \frac{P^2 - 1}{P^2 + 1}x^3 - 3x + \log 2$ is a decreasing function of x in R then the set of possible values of P (independent of x) is

A. [-1,1]

B. $[1, \infty]$

C. $[-\infty, -1]$

D. none of these

Answer: A

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26. If g(x) is a continous function at x=a such that $g(a) > 0$ and $f'(x) = g(x)\left(x^2 - ax + a^2\right)$ for all $x \in K$ then f(x) is

A. increasing in the nieghbourhod of x=a

B. decreasing in the nieghbourhod of x=a

C. constant in the nieghbourhod of x=a

D. maximum at x=a

Answer: A

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27. Let $g(x) = 2f\left(\frac{x}{2}\right) + f(2-x) and f^x < 0 \forall x \in (0,2)$. Then $g(x)$ increases in $\left(\frac{1}{2}, 2\right)$ (b) $\left(\frac{4}{3}, 2\right)$ $(0,2)$ (d) $\left(0, \frac{4}{3}\right)$

A. increasing on (4/3, 2) and increasing on (0,4/3)

B. decreasing on (0,4/3) and decreasing on (4,3,2)

C. increasing (0,4/3) and decreasing on (4,3,2)

D. non of these

Answer: C

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28. The set of all values of a for which the function

$$f(x) = \left(\frac{a^2-1}{3}\right)x^3 + (a-1)x^2 + 2x + 1$$

increases on R, is

A. $(-3, 1)$

B. $R - [-3, 1]$

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

D. $[1, \infty]$

Answer: B

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29. Let $f(x) = \begin{cases} xe^{ax}, x \leq 0 \\ x + ax^2 - x^3, x > 0 \end{cases}$,where is a positive constant .Then the interval in which f' (x) is increasing is

A. (0,a/3)

B. (-2 /a,0)

C. (-2/a,a/3)

D. non of these

Answer: C

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30. Let f(x) be a function given by $f(x) = \frac{x^2 + 1}{[x]}$ where [] denotes the greatest interger function .Then f(x) is monotonically

A. increasing on [1,4)

B. decreasing [1,4)

C. increasing on [1,2)

D. decreasing on [2,3)

Answer: C

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31. If the function f(x)=3 cos |x| -6 ax +b increases for all $x \in R$ then the range of value of a given by

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

B. $(-\infty, -1/2)$

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

D. $(-2, \infty)$

Answer: B

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32. Let $f and g$ be increasing and decreasing functions, respectively, from $[0, \infty] \to [0, \infty]$. Let $h(x) = f(g(x))$. If $h(0) = 0,$ then $h(x) - h(1)$ is (a)always zero (b) always negative always positive (d) strictly increasing none of these

A. always 0

B. always positive

C. always negative

D. strictly increasing

Answer: A

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33. The interval in which f(x) increases less repidly than g(x), f(x)= $2x^3 + 5$ and $g(x) = 9x^2 - 12x$ is

A. $(-\infty, 1)$

B. (1,2)

C. $(2, \infty)$

D. none of these

Answer: B

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34. If $f(x) = \begin{cases} 3x^2 + 12x - 1, -1 \leq x \leq 2 \\ 37 - x, 2 < x \leq 3 \end{cases}$ then

A. f(X) increasing on [-1,2]

B. f(x) is continuos on [-1,3]

C. f'(2) does not exist

D. all of these

Answer: D

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35. Given that $f(x) > f(x)f \text{ or } allx \in R$ and f(0) =g(0) then

A.

$$f(x) > g(x)f \text{ or } allx \in (0, \infty) \text{ and } f(x) > g(x)f \text{ or } allx \in (- \infty$$

B.

$$f(x) < g(x)f \text{ or } allx \in (0, \infty) \text{ and } f(x) > g(x)f \text{ or } allx \in (- \infty$$

C.

$$f(x) > g(x) > f \text{ or } allx \in (- \infty, 0) \text{ and } f(x) < g(x)f \text{ or } allx \in$$

D. none of these

Answer: A

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36. The fucntion f(x) $= \frac{\sin x}{x}$ is decreasing in the interval

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

B. $(0, \pi/2)$

C. $(0, \pi)$

D. none of these

Answer: B

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37. [If $0 < x < \frac{\pi}{2}$ then 1) $\frac{2}{\pi} > \frac{\sin x}{x}$ (2)$(\pi) < \frac{\sin x}{x}$ 3) $\frac{\sin x}{x} > 1$, 4) $2 < \frac{\sin x}{x}$

A. $\frac{2}{\pi} < \frac{\sin x}{x}$

B. $\frac{\sin x}{x} < 1$

C. $\frac{\sin x}{x} > 1$

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

Answer: B::C

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38. $If 0 < \alpha < \beta < \frac{\pi}{2}$ then

A. $\frac{\tan \beta}{\tan \alpha} < \frac{\alpha}{\beta}$

B. $\frac{\tan \beta}{\tan \alpha} > \frac{\alpha}{\beta}$

C. $\frac{\tan \beta}{\tan \alpha} > \frac{\alpha}{\beta}$

D. $\frac{\tan \alpha}{\tan \beta} \leq \frac{\alpha}{\beta}$

Answer: B

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39. $If 0 \leq x \leq \frac{\pi}{2} then$

A. $2\sin x + \tan x < 3x$

B. $2\sin x + \tan x < 2x$

C. $2\sin x + \tan x \leq 3x$

D. $2\sin x + \tan x \leq 3x$

Answer: C

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

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

B. decresing on R

C. increcasing on R

D. decreasing on [-1/2 ,1]

Answer: A

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41. If $f(x) = \int_0^x e^{t^2}(t-2)(t-3)dt$ for all $x \in (0, \infty)$, then

A. $e^x < 1 + x$

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

C. $\sin x > x$

D. $\log x > x$

Answer: B

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42. If $0 < x < \frac{\pi}{2}$ then

A. $\cos x > 1 - \frac{2x}{\pi}$

B. $\cos x < -\frac{2x}{\pi}$

C. $\cos x > \frac{2x}{\pi}$

D. $\cos x < \frac{2x}{x}$

Answer: A

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43. $If 0 < x < \frac{\pi}{2}$ then

A. $\tan x < x < \sin x$

B. $x < \sin x < \tan x$

C. $\sin x < \tan x < x1$

D. none of these

Answer: D

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44. Let $f: R \overrightarrow{R}$ be a function such that $f(x) = ax + 3\sin x + 4\cos x$. Then $f(x)$ is invertible if $a \in (-5, 5)$ (b) $a \in (-\infty, 5)$ $a \in (-5, +\infty)$ (d) none of these

A. $a \in (-5, 5)$

B. $a \in (-\infty, -5)$

C. $a \in (5, \infty)$

D. none of these

Answer: B

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45. if the function $f: R \to R$ given be $f(x) = x^3 + ax^2 + 5x + \sin 2x$ is invertible then

A. $a \in (-\infty, -3)$

B. $a \in (-3, 3)$

C. $a \in (3, \infty)$

D. none of these

Answer: C

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46. If f(x)=sin x,x in$[-\pi/2, \pi/2]$ then which one of the following is not correct ?

A. f(x) is increasing on the $[-\pi/2, \pi/2]$

B. fof (x) is increasing on $[-\pi/2, \pi/2]$

C. fof (x) is increasing on $[-\pi/2, \pi/2]$

D. fof (x) is decreasing on $[-\pi/2, 0]$ and is increasing on $[-\pi/2, \pi/2]$

Answer: A

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47. If f: $R \to R$ defined by f(x) = 3x+2a cos x -5 is invertible then 'a' belongs to

A. [-3/2, 3/2]

B. $(-\infty, 3/2] \cup [3/2, \infty]$

C. `(-4,4)

D. R

Answer: A

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48. Let f(x) be a function defined by

$$f(x) = (ab - a^2 - 2)x - \cos^4 t + \int_0^x \sin^2 t - 2dt$$

If (x) is a decreasing function for all $x \in R$ and a in R where a is independent of x, then

A. a. $be \in (1, \infty)$

B. b. $b \in (-1, 1)$

C. c. $b \in (-\infty,]$

D. d. non of these

Answer: C

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49. Let f(x) and g(x) be defined and differntiable for all $x \geq x_0$ and $f(x_0) = g(x_0) f(x) \geq (x) f$ or $x > x_0$ then

A. $f(x) < g(x) n x > x_0$

B. $f(x) = g(x) x = x_0$

C. $f(x) > g(x), x \leq x_0$j

D. none of these

Answer: C

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50. If $a < 0$ and $f(x) = e^{ax} + e^{-ax}$ is monotonically decreasing . Find the interval to which x belongs.

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

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

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

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

Answer: A

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51. If $f(x) = \int_x^{x^2} \frac{1}{(\log t)^2} dt, x \neq 1$ then f(x)is monotomically

A. increasing on $(2, \infty)$

B. incrasing on (1,2)

C. decreasing on $2(\infty)$

D. decreasing on (0,3)

Answer: A

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52. The interval in which the function

$f(x) = \int_0^x \left(\frac{t}{t+2} - \frac{1}{t}\right) dt$will be non- increasing is

A. $(-2, -1] \cup (0, 3]$

B. $(-2, -1] \cup [0, 3]$

C. `(-2,-1]cup [0,2]

D. $(-2, -1] \cup (0, 2]$

Answer: D

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53. If $f(x) = x^3 + bx^2 + cx + d$ and $0<b^2<c$, then

A. f(x) is strictly increasing function

B. f(x) has a local maxima

C. f(x) is a strcrly decreasing function

D. f(x) is unbounded

Answer: A

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54. For the function $f(x) = x\cos\frac{1}{x}, x \geq 1$which one of the following is incorrect ?

A. for at least one x in the interval $[1, \infty)$, $f(x+2) - f(x) < 2$

B. $\lim_{x \to \infty} f'(x) = 1$

C. for all x in the interval $[1, \infty)$, $f(x+2) - f(x) > 2$

D. f(x) is strictly decreasing in the interval $[1, \infty)$

Answer: A

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55. If the function $g: (-\infty, \infty) \to \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ is given by $g(u) = 2\tan^{-1}(e^u) - \frac{\pi}{2}$. Then g is

A. even and is strictly increasing in $(0, \infty)$

B. odd and is strictly decreasing $(-\infty, \infty)$

C. odd and is strictly increasing in $(-\infty, \infty)$

D. neither even nor odd , but is stictly increasing in $(-\infty, \infty)$

Answer: C

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56. Consider the function $f:(-\infty,\infty)\to(-\infty,\infty)$ defined by $f(x)=\frac{x^2-ax+1}{x^2+ax+1};0<a<2$. Which of the following is true ?

A. g'(x) is postitive on $(-\infty,0)$ and negative on $(0,\infty)$

B. f'(x) is negative on $(-\infty,0)$ and postive on $(0,\infty)$

C. g'(x) chages sing on both $(-\infty,0)$ and $(0,\infty)$

D. g'(x) does not change not change sign on $(-\infty,\infty)$

Answer: B

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57. Consider the polynomial $f(x)=1+2x+3x^2+4x^3$ for all $x\in R$ So f(x) has exactly one real root in the interval

A. $(-1/4,0)$

B. $(-11,-3/4)$

C. $(-3/4,-1/2)$

D. $(0, 1/4)$

Answer: C

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58. Consider the polynomial

$f(x) = 1 + 2x + 3x^2 + 4x^3$

Let s be the sum of all distinct real roots of $f(x)$ end let $t = |s|$

The real number s lies in the interval.

A. increasing in (-t,-1/4)and decreasing in (-1 /4 t)

B. decreasing (-t ,-1 /4) and increasing in (-1/4,t)

C. incresing in (-t ,t)

D. decreasing (-t, t)

Answer: B

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59. If $f(x) = x^{\frac{3}{2}}(3x - 10), x \geq 0,$ then $f(x)$ is increasing in ___.

A. $(-\infty, -1) \cup (1, \infty)$

B. $[2, \infty)$

C. $(-\infty, -1) \cup [1, \infty)$

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

Answer: B

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60. Let f(x) = log (sin x+ cos x), x in x (-pi/4,(3pi)/(4))`

Then f is stricly increasing in the interval

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

B. $\left(0, \frac{3\pi}{8}\right)$

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

D. $\left(-\frac{\pi}{8}, \frac{\pi}{8}\right)$

Answer: A

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61. Let $f(x) = (1-x)^2 \sin^2 x + x^2$ for all $x \in IR$ and let $g(x) = \int_1^x \left(\frac{2(t-1)}{t+1} - \ln t \right) f(t)\, dt$ for all $x \in (1, \infty)$.

Consider the statements :

P : There exists some $x \in IR$ such that $f(x) + 2x = 2\left(1 + x^2\right)$

Q : There exist some $x \in IR$ such that $2f(x) + 1 = 2x(1+x)$

Then

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62. $f(x) = x|\log_e x|, x > 0$ is monotonically decreasig in

A. (e, ∞)

B. $(0, 1/e)$

C. $(1/e, 1)$

D. (1,e)

Answer: C

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63. Let $F: R \to R$ be a thrice differntiable function. Suppose that $F(1) = 0, F(3) = -4$ and $F'(x) < 0$ for all $x\varepsilon(1/2, 3)$. Let $f(x) = xF(x)$ for all $x \in R$. Then the correct statement(s) is (are)

A. $f(1) < 0$

B. $f(2) < 0$

C. $f(x) \neq 0 f$ or $allx \in (1, 3)$

D. $f(x) = 0 f$ or $somex \in$

Answer: A::B::C

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64. Let $f(x) = 1 - x - x^3$. Then, the real values of x satisfying the inequality,

$1 - f(x) - f^3(x) > f(1 - 5x)$, are

A. (0,2)

B. (-2,2)

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

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

Answer: D

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65. Let g(x)=f(sin x)+ f(cosx), then g(x) is decreasing on:

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

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

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

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

Answer: B

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66. Let f(x) be a monotonic polynomial of (2m-1) degree where $m \in N$, then the equation

f(x)+f(3x)+f(5x)+...+f(2m-1)x=(2m-1) has ..... . roots.

A. at least one real root

B. (2m - 1) real roots

C. exactly one real root

D. none of these

Answer: C

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67. Let $f(x) = \sin^4 x + \cos^4 x$. Then f is increasing function in the interval

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

B. $\left(\frac{5\pi}{8}, \frac{3\pi}{4}\right)$

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

D. $\left(\frac{\pi}{2}, \frac{5\pi}{8}\right)$

Answer: A

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68. If $f: R \to R$ is a twice differentiable function such that $f''(x) > 0$ for all $x \in R$, and $f\left(\frac{1}{2}\right) = \frac{1}{2}$ and $f(1) = 1$, then

A. $f(1) \leq 0$

B. $0 \leq f'(1) \leq \frac{1}{2}$

C. $\frac{1}{2} < f'(1) \leq 1$

D. $f(1) > 1$

Answer: D

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69. If f:R is a differentiable fucntion such that f(x) $>$ 2f(x) for all x $\in$ R and f(0) =1 then

A. f(x) is incresing in $(0, \infty)$

B. f(x) is decereasing in $(0, \infty)$

C. $f(x) < e^{2x}$ in $(0, \infty)$

D. $f(x) < e^{2x} \in (0, \infty)$

Answer: A::C

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Section Ii Assertion Reason Type

1. Statement-1 $e^{\pi} > \pi^{e}$

Statement -2 The function $x^{1/x}(x > 0)$ is strictly decreasing in $[e, \infty)$

A. Statement-1 True statement -1 is True,Statement -2 is True statement -2 is a correct explanation for Statement-1

B. Statement-1 True statement -1 is True,Statement -2 is True statement -2 is not a correct explanation for Statement-1

C. Statement-1 True statement -1 is True,Statement -2 is False

D. Statement-1 is False ,Statement -2 is True

Answer: A

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2. $Let f(x) = \tan^{-1} x - x + \frac{x^3}{6}$

Statement -1: $f(x) < g(x) f \text{ or } 0 < x \leq 1$

Statement -2:$h(X) = \tan^{-1} x - x + \frac{x^3}{6}$ decreases on [-1,1]

A. Statement-1 True statement -1 is True,Statement -2 is True statement -2 is a correct explanation for Statement-2

B. Statement-1 True statement -1 is True,Statement -2 is True statement -2 is not a correct explanation for Statement-2

C. Statement-1 True statement -1 is True,Statement -2 is False

D. Statement-1 is False ,Statement -2 is True

Answer: A

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3. Statement-1 $e^x + e^{-x} > 2 + x^2$ is an increasing function on R.

A. Statement-1 True statement -1 is True,Statement -2 is True statement -2 is a correct explanation for Statement-3

B. Statement-1 True statement -1 is True,Statement -2 is True statement -2 is not a correct explanation for Statement-3

C. Statement-1 True statement -1 is True,Statement -2 is False

D. Statement-1 is False ,Statement -2 is True

Answer: A

View Text Solution

4. Statement-1 $f(x) = \frac{\sin x}{x} < 1 f \text{ or } 0 < x < \frac{\pi}{2}$

Statement -2 $f(x) = \frac{\sin x}{x}$ is decreasing function on $(0, \pi/2)$

A. Statement-1 True statement -1 is True,Statement -2 is True statement -2 is a correct explanation for Statement-4

B. Statement-1 True statement -1 is True,Statement -2 is True statement -2 is not a correct explanation for Statement-4

C. Statement-1 True statement -1 is True,Statement -2 is False

D. Statement-1 is False ,Statement -2 is True

Answer: A

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5. Let $f(x) = 2\tan^{-1}\left(\frac{1-x}{1+x}\right)$

A. Statement-1 True statement -1 is True,Statement -2 is True statement -2 is a correct explanation for Statement-5

B. Statement-1 True statement -1 is True,Statement -2 is True statement -2 is not a correct explanation for Statement-5

C. Statement-1 True statement -1 is True,Statement -2 is False

D. Statement-1 is False ,Statement -2 is True

Answer: A

View Text Solution

6. Let $f(x) = \frac{20}{4x^2 - 9x^2 + 6x}$

Statement -1 : Range of f=[6,20]

Statement -2 f(x) increases (1/2,1) and decrease on $(1, \infty) \cup (-\infty, 0) \cup (0, 1/2)$

A. Statement-1 True statement -1 is True,Statement -2 is True statement -2 is a correct explanation for Statement-6

B. Statement-1 True statement -1 is True,Statement -2 is True statement -2 is not a correct explanation for Statement-6

C. Statement-1 True statement -1 is True,Statement -2 is False

D. Statement-1 is False ,Statement -2 is True

Answer: D

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7. Statement-1 : For $0 \leq p < 1$ and for any positive a and b the intequality $(a+b)^p < a^p + b^p$ is valid

Staement - 2: F or $0 \leq p \leq 1$ the function $f(x) = 1 + x^p - (1+x)^p$ decreases on $[0, \infty)$

A. Statement-1 True statement -1 is True,Statement -2 is True statement -2 is a correct explanation for Statement-7

B. Statement-1 True statement -1 is True,Statement -2 is True statement -2 is not a correct explanation for Statement-7

C. Statement-1 True statement -1 is True,Statement -2 is False

D. Statement-1 is False ,Statement -2 is True

Answer: C

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8. Statement-1: Let f(x) and g(x) be two real functions connected by the relation

$g(x) = f(x) - 2(f(x))^2 + 4(f(x))^3$

Then f(x) and g(x) increase or decrease together .

Statement-2: if

$b^2 - 4ac < 0$ and $a > 0 then ax^2 + bx + c > 0$ for all statement -2 $x \in R$

A. Statement-1 True statement -1 is True,Statement -2 is True statement -2 is a correct explanation for Statement-8

B. Statement-1 True statement -1 is True,Statement -2 is True statement -2 is not a correct explanation for Statement-8

C. Statement-1 True statement -1 is True,Statement -2 is False

D. Statement-1 is False ,Statement -2 is True

Answer: A

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Exercise

1. If f and g are two increasing function such that fog is defined then

A. gof is an increasing functions

B. gof is a decreasing function

C. gof is neither inceasing nor decreasing

D. none of these

Answer: A

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2. If f is decreasing and g is increasing functions such that gof exists then gof is

A. an increasing function

B. a decreasing function

C. neither increasing nor decreasing

D. none of these

Answer: A

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3. If f is an increasing function and g is a decreasing function on an interval I such that fog exists, then :

A. fog is an incresing function on I

B. fog is a decreasing function on I

C. fog is neither increasing nor decreasing on I

D. none of these

Answer: B

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4. Let $y = x^2 e^{-x}$ then the interval in which y increases with respect to x is

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

B. $(-2, 0)$

C. $(2, \infty)$

D. $(0, 2)$

Answer: D

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5. The interval in which the function $f(x) = x^{e^{2-x}}$ increases is

A. $(-\infty, 0)$

B. $(2, \infty)$

C. $(0, 2)$

D. none of these

Answer: D

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6. The function $f(x) = \cos\left(\frac{\pi}{x}\right), (x \neq 0)$ is increasing in the interval

A. $(2n+1, 2n), n \in N$

B. $\left(\frac{1}{2n+1}, 2n\right), n \in N$

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

D. none of these

Answer: D

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7. The value of b for which the function f(x)=sin x-bx+c is decreasing in the interval $(-\infty, \infty)$ is given by

A. $b < 1$

B. $b \geq 1$

C. $b > 1$

D. $b \leq 1$

Answer: C

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8. For what values of a, the function $f(x) = \left\{\left(\frac{\sqrt{a+4}}{1-a}\right)x^5 - 3x + \log(5)\right.$ decreases for all real x.

A. (∞, ∞)

B. $\left[-4, \frac{3-\sqrt{21}}{2}\right] \cup [1, \infty)$

C. $\left(-3, 5 - \frac{\sqrt{27}}{2}\right) \cup (2, \infty)(d)[1, \infty)$

D. $(1, \infty)$

Answer: B

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9. Find the least value of $'a'$ such that the function $f(x) = x^2 + ax + 1$ is increasing on $[1,\ 2]$. Also, find the greatest value of $'a'$ for which $f(x)$ is decreasing on $[1,\ 2]$.

A. $(-2, \infty)$

B. $[-4, \infty)$

C. $[-\infty,\ -2)$

D. $(-\infty, 2]$

Answer: A

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10. On which of the following intervals is the function $f(x) = x^{100} + \sin x - 1$ increasing? (i) $(0,\ \pi/2)$ (ii) $(\pi/2,\ \pi)$ (iii) $(0,\ 1)$ (iv) $(-1,\ 1)$.

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

B. $(0, 1)$

C. $(\pi/2, \pi)$

D. none of these

Answer: D

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11. Which of the following functions is not decreasing on $(0, \pi/2)$?

A. cos x

B. cos 2 x

C. $\cos^2 x$

D. tan x

Answer: D

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12. Let $f'(x) = f(x)(x-a)^2$, where $g(a) \neq 0$ and g is continuous at x=a then

A. f is increasing in the nbd of a

B. f is decreasing in the nbd

C. f increases of decreases in the nbd of a according as $g(a) > 0$ or $g(a) < 0$

D. none of these

Answer: C

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13. Show that $f(x) = 2x + \cot^{-1} x + \log\left(\sqrt{1+x^2} - x\right)$ is increasing in R.

A. increases on R

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

C. neither increasing nor decreasing in $(0, \infty)$

D. none of these

Answer: A

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14. The function $f(x) = \log(1+x) - (2+x)$ is increasing in

A. $(0, \infty)$

B. $(-\infty, 0)$

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

D. none of these

Answer: D

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15. On which of the following intervals in the function $f(x) = 2x^2 - \log|x|, x \neq 0$ increasing ?

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

B. $(-\infty, -1/2) \cup (0, 1/2)$

C. $(-\infty, -1/2) \cup (1/2, \infty)$

D. $(-1/2, 0) \cup (1/2, \infty)$

Answer: D

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16. If the function $f(x) = \frac{K \sin x + 2 \cos x}{\sin x + \cos x}$ is strictly increasing for all values of x, then $K < 1$ (b) $K > 1$ $K < 2$ (d) $K > 2$

A. $K < 1$

B. $K > 1$

C. $K < 2$

D. $K > 2$

Answer: D

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17. The function $f(x) = \frac{a \sin x + b \cos x}{c \sin x + d \cos x}$ is decreasing, if

A. $ad - bc > 0$

B. $ad - bc < 0$

C. $ab - cd > 0$

D. $ab - cd < 0$

Answer: B

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18. If $f(x) = kx^3 - 9x^2 + 9x + 3$ monotonically increasing in R, then $k < 3$ (b) $k \leq 2$ $k \geq 3$ (d) none of these

A. $K < 3$

B. $K > 3$

C. $k \leq 3$

D. none of these

Answer: B

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19. Find the value of a for which the function $(a + 2)x^3 - 3ax^2 + 9ax - 1$ decreases montonically for all real x.

A. $a < -2$

B. $a > -2$

C. $-3 < a < 0$

D. $-\infty < a \leq -3$

Answer: D

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20. The function $y = x^3 - 3x^2 + 6x - 17$

A. increases everywhere

B. decreases everywhere

C. increases for positive x and decreases for negative x

D. increases for negative x and decreases for positive x

Answer: A

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21. The interval in which the function x^3 increases less rapidly than $6x^2 + 15x + 5$ is :

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

B. $(-5, 1)$

C. $(-1, 5)$

D. $(5, \infty)$

Answer: C

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22. The interval in which the function f(x)=sin x-cos x -ax +b decreases for all real values of x is given by

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

B. $a \leq 1$

C. $a < \sqrt{2}$

D. $a < 1$

Answer: A

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23. The function $y = \cot^{-1} x - \log\left(x + \sqrt{x^2 + 1}\right)$ is decreasing in

A. $(-\infty, 0)$

B. $(-\infty, 0)$

C. $(0, \infty)$

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

Answer: D

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24. the function $\frac{|x-1|}{x^2}$ is monotonically decreasing at the point

A. $(2, \infty)$

B. $(0, 1)$

C. $(-\infty, 1)$

D. (∞, ∞)

Answer: C

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25. 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. $a \leq 1$

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

D. $a < \sqrt{2}$

Answer: B

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26. 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.

	interval	Function
(a)	$(-\infty, -4]$	$f(x) = x^3 + 6x^2 + 6$

B.

	interval	Function
(a)	$(-\infty, 1/3]$	$g(x) = 3x^3 - 2x + 1$

C.

	interval	Function
(a)	$(2, \infty]$	$h(x) = 2x^3 - 3x^2 + 12x + 6$

D.

	interval	Function
(a)	$(-\infty, \infty]$	$q(x) = x^3 - 3x^2 + 3x + 3$

Answer: B

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27. A condition for a function y=f(x) to have an inverse is that it should be

A. defined for all x

B. continuous for all x

C. strictly monotone and continuous in the domain

D. an even function

Answer: C

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28. Let $g(x) = f(x) + f(1-x)$ and $f''(x) < 0$, when $x \in (0, 1)$. Then $f(x)$ is

A. g(x) increases on [0,1]

B. g(x) increases on [0,1]

C. g(x) increases on [0,1]

D. g(x) increases on [0,1/2] and decreases on [1/2,1]

Answer: B

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

A. increasing function on $[0, \infty)$

B. decreases on [1/2,1]

C. increasing on $[0, \pi/e]$ and increasing on $[\pi/e, \infty)$

D. decreasing on $[0, \pi/e)$ and increasing on $[\pi/e, \infty)$

Answer: B

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30. Column I, Column II $\int \frac{e^{2x} - 1}{e^{2x} + 1} dx is equa < o$, p. $x - \log\left[1 + \sqrt{1 - e^{2x}}\right] + c$ $\int \frac{1}{(e^x + e^{-x})^2} dx is equa < o$, q. $\log(e^x + 1) - x - e^{-x} + c$ $\int \frac{e^{-x}}{1 + e^x} dx is equa < o$, r. $\log(e^{2x} + 1) - x + c$ $\int \frac{1}{\sqrt{1 - e^{2x}}} dx is equa < o$, s. $-\frac{1}{2(e^{2x} + 1)} + c$

A. an increasing function R

B. a decreasing function on R

C. an even function on R

D. none of these

Answer: A

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31. $y = \left\{x(x-3)^2$ increases for all values of x lying in the interval

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

B. $0 < x < \infty$

C. $-\infty < x < 0$

D. $1 < x < 3$

Answer: A

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32. If $a < 0$ and $f(x) = e^{ax} + e^{-ax}$ is monotonically decreasing . Find the interval to which x belongs.

A. $x > 0$

B. $x < 0$

C. $x < 1$

D. $x < 1$

Answer: B

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33. The function f(x) = tanx - x

A. always increases

B. always decreases

C. neverdecreases

D. some times increases and some time decreases

Answer: A

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34. 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: A

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35. The function $f(x) = (\log)_e\left(x^3 + \sqrt{x^6 + 1}\right)$ is of the following types: (a) even and increasing (b) odd and increasing (c) even and decreasing (d) odd and decreasing

A. even and increasing

B. odd and increasing

C. even and decreasing

D. odd and decreasing

Answer: B

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36. Let $f(x) = x^3 - 6x^2 + 15x + 3$. Then, (a) $f(x) > 0$ for all $x \in R$ (b) $f(x) > f(x+1)$ for all $x \in R$ (c) $f(x)$ is invertible (d) $f(x) < 0$ for all $x \in R$

A. $f(x) < 0 f$ or $all x \in R$

B. $f(x) > f(x+1) f \text{ or } allx \in R$

C. f(x) is invertible

D. none of these

Answer: C

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Chapter Test

1. the function $f(x) = \frac{\log x}{x}$ is increasing in the interval

A. $(1, 2e)$

B. $(0, e)$

C. (2,2e)

D. (1/e,2e)

Answer: B

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2. If the function $f(x) = \cos|x| - 2ax + b$ increases along the entire number scale, then (a) $a = b$ (b) $a = \frac{1}{2}b$ (c) $a \leq -\frac{1}{2}$ (d) $a \succ \frac{3}{2}$

A. $a \leq b$

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

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

D. $a > -\frac{3}{2}$

Answer: C

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3. 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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4. The function $f(x) = x\sqrt{ax - x^2}, a < 0$

A. increases on the interval (0,3a/4)

B. decreases on the interval (,3a/4)

C. decreases on the interval (0,3a/4)

D. increases on the inteval (3a/4,a)

Answer: A

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5. The function $f(x) = \sin^4 x + \cos^4 x$ increasing if `0

A. $0 < x < \pi/8$

B. $\pi/4 < x < 3\pi/8$

C. $3\pi/8 < x < 5\pi/8$

D. $5\pi/8 < x < 3\pi/4$

Answer: B

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6. Let $f(x) = \cot^{-1} g(x)]$ where g(x) is an increasing function on the interval $(0, \pi)$ Then f(x) is

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

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

C. increasing on $(0, \pi/2)$ and decreasing on $(\pi/2, \pi)$

D. none of these

Answer: B

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7. The valuses of x for which

$1 + x \log_e \left(x + \sqrt{x^2 + 1} \right) \leq \sqrt{x^2 + 1}$ are

A. $x \leq 0$

B. $0 \leq x \leq 1$

C. $x \geq 0$

D. none of these

Answer: C

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8. Let g(x) $= f(x) - 2\{f(x)\}^2 + 9\{f(x)\}^3$ for all $x \in R$ Then

A. g(x) and f(x) increase and decrease together

B. g(x) increases whenever f(x) decreases and vice-versa

C. g(x) increases for all $x \in R$

D. g(x) decreases for all $x \in R$

Answer: A

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9. The function $f(x) = x^{1/x}$ is increasing in the interval

A. (e, ∞)

B. $(-\infty, e)$

C. $(-e, e)$

D. none of these

Answer: B

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10. If ϕ(x) is continuous at x= a such that

$f(x) = \left(ax - a^2 - x^2\right)\phi(x)$for all x, then f(x) is

A. increasing in the neighbourhood of $x = \alpha$

B. decresing in the neighbourhood of $x = apha$

C. constant in the neighbourhood of $x = \alpha$

D. minimum at $x = \alpha$

Answer: A

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11. The function f(x) given by $f(x) = \begin{vmatrix} x+1 & 1 & 1 \\ 1 & x+1 & 1 \\ 1 & 1 & x+1 \end{vmatrix}$ is increasing on

A. R

B. (-2,0)

C. R-[-2,0]

D. none of these

Answer: C

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12. If $f(x) = 2x^3 + 9x^2 + \lambda x + 20$ is a decreasing function fo x in the largest possible interval (-2,-1) then λ =

A. 12

B. -12

C. 6

D. none of these

Answer: A

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13. The set of values of a for which the function

$f(x) = 2e^x - ae^{-x} + (2a+1)x - 3)$ is increasing on R,is

A. $[0, \infty)$

B. $(-\alpha, 0)$

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

D. none of these

Answer: A

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14. The function $f(x) = xe^{1-x}$ stricly

A. increases in interval $(0, \infty)$

B. decreases in the interval (0,2)

C. increases in the interval (1/2,2)

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

Answer: D

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15. The function $f(x) = \tan^{-1} x - x$ is decreasing on the set

A. R

B. $(0, \infty)$

C. R-[0]

D. none of these

Answer: A

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16. If $0 < x < \frac{\pi}{2}$ then

A. $\cos(\sin x) > \cos x$

B. $\cos(\sin x) < \cos x$

C. $\cos(\sin x) = \sin(\cos x)$

D. $\cos(\sin x) < \sin(\cos x)$

Answer: A

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17. If f is real-valued differentiable function such that $f(x)f'(x) < 0$ for all real x, then

A. f(x) is increasing

B. f(x) is decereasing

C. |f (x)|is increasing

D. |f(x)| is decreasing

Answer: D

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18. For what value of a, $f(x) = -x^3 + 4ax^2 + 2x - 5$ decreasing for all x .

A. (1,2)

B. (3,4)

C. R

D. no value of a

Answer: D

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