MATHS

BOOKS - OBJECTIVE RD SHARMA MATHS VOL I (HINGLISH)

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)

Answer: B

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2. The fucntion $f(x) = x^3 - 3x,$ 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 fucntion 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. Leg $f(x) = x^3 + ax^2 + bx + 5\sin^2 x$ 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 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 increasing

D. nothing can be said in general

Answer: A

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2. If `f(x)=x/(sinx)a n dg(x)=x/(tanx),w h e r e0

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. The interval to which a may belong so that the function $f(x) = \left(1 - \frac{\sqrt{21 - 4a - a^2}}{a + 1}\right)x^3 + 5x + 100$ is increasing for $x \in R$

A. (2,3)

B. (-6,-2)

C. (2,25)

D. all of the above

Answer:

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

A. $(0, \infty)$

B. $(-\infty, 0)$

C. $(1, \infty)$

D. $(5, \infty)$

Answer: B

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5. The function $f(x) = x^x$ decrease on the interval

A. (0,e)

B. (0,1)

C. $(0, 1/e)$

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

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 $y = \log x - (x - 1)$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. $(8, \infty)$

Answer: A

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

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 be real, then $f(x) = \begin{vmatrix} x + a^2 & ab & ab \\ ab & x + b^2 & bc \\ ac & bc & x + c^2 \end{vmatrix}$ is decreasing on

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, the

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

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

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. Consider the following statements in S and R S: Both $\sin x and \cos x$ are decrerasing function in the interval $\left(\frac{\pi}{2}, \pi\right)$ R: If a differentiable function decreases in an interval $(a, b),$ then its derivative also decrease in $a, b)\cdot$ Which of the following it true? Both S and R are wrong. Both S and R are correct, but R is not the correct explanation of S. S is correct and R is the correct explanation for S. 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 $f(x) = \frac{a^2 - 1}{a^2 + 1}x^3 - 3x + 2\log_e 5$ is a decreasing function of x for all $x \in R$ then the set of possible values of a 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. $\left(0, \frac{a}{3}\right)$

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 (x) and g(x) be increasing and decreasing functions respectively from $[0, \infty) to [0, \infty)$ Let h (x) = fog (x) If h(0) =0 then h(x) is

A. always 0

B. always positive

C. always negative

D. strictly increasing

Answer: A

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33. The interval in which $2x^3 + 5$ 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 $f(x) = \begin{cases} 3x^2 + 12, x - 1 \\ 37 - x, 2 < x \leq 3 \end{cases}$ 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 $f(x) > g(x)$ for all $x \in R$ 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 lt beta lt 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 $f(x) = xe^{x(1-x)}$ 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. For all $x \in (0, 1)$

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 $f: R \to R$ be a fucntion such that $f(x) = ax + 3\sin x + 4\cos x$

Then f(x) is invertible if

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

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

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

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

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

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

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 $a \leq 0 f(x) = e^{ax} + e^{-ax}$ and S={x:f(x) is monotonically increasing then S equals

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

A. f(x) is strictly increasing function

B. f(x) has a local maxima

C. f(x) is a strcrly decreasing function

D. f(x) is unbounded

Answer: A

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54. For the fucntion $f(x) = x\cos\frac{1}{x}, x \geq 1$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. Let the function g:$(-\infty, \infty) \to (-\pi/2, \pi/2)$ be 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: $R \to R$ given by

$$f(x) = \frac{x^2 - ax + 1}{x^2 + ax + 1}, 0 \leq a \leq 2.$$

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 $x \in R$

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) and let t=|s|.

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 $f(x) = \log(\sin x + \cos x), x \in x\left(-\frac{\pi}{4}, \frac{3\pi}{4}\right)$ 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 $f(x) = (1-x)^2 \sin^2 x + x^2 \text{for all } x \in R,$ and $\leq tg(X) = \int_1^x \left\{\frac{2(t-1)}{t+1} - \log_e t\right\} f(t) f \text{ or } all x \in (1, \infty)$ Then

which of the following is ture ?

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

A. (e, ∞)

B. $(0, 1/e)$

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

D. (1,e)

Answer: C

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63. Let $F: R - R$ be a thrice differentiable function. Suppose that $F(1) = 0, F(3) = -4$ and $F(x) < 0$ for all $x \in \left(\frac{1}{2}, 3\right)$. Let $f(x) = xF(x)$ for all $x \in R$ The correct statement is

A. $f(1) < 0$

B. $f(2) < 0$

C. $f(x) \neq 0 f \text{ or } all x \in (1, 3)$

D. $f(x) = 0 f \text{ or } some x \in$

Answer: A::B::C

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64. Let $f(x) = 1 - x - x^3$.Find all real values of x satisfying the inequality, $1 - f(x) - f^3(x) > f(1 - 5x)$

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 f$(\sin x) < 0$ and $f(\sin x) < 0$ for all x in

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 monotic ploynomial of degree (2m-1) where $m \in N$ Then the equation

$f(x) - f(3x) + f(5x) + \ldots + f((2m-1)$ has

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

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

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

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

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

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

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

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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 and g are two increasing function such that fog is defined then

A. gor 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 and g are deppcreasing 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 given by $f(x) = x^{100} + \sin x - 1$strictly decreasing ?(A) (0, 1) (B) $\left(\frac{\pi}{2}, \pi\right)$ (C) $\left(0, \frac{\pi}{2}\right)$ (D) None of these

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. If $f'(x) = g(x)(x-a)^2$, 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. If $f(x) = 2x \cot^{-1} x + \log\left(\sqrt{1+x^2} - x\right.$ then f(x)

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. `(-1,0)

B. $(-\infty, 0)$

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

D. none of these

Answer: A

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

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 $f(x) = kx^3 - 9x^2 + 9x + 3$ 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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19. The values of a for which the function $(a+2)x^3 - 3x^2 + 9ax - 1$ decreases monotonically throughout for all real x are :-

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 $6x^2 + 15x + 5$

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 increasing 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 $f''(x)<0, 0 \leq x \leq 1$ Then

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 $f(x) = \dfrac{\ln(\pi + x)}{\ln(e + x)}$ is increasing in $(0, \infty)$ decreasing in $(0, \infty)$ increasing in $\left(0, \dfrac{\pi}{e}\right)$, decreasing in $\left(\dfrac{\pi}{e}, \infty\right)$ decreasing in $\left(0, \dfrac{\pi}{e}\right)$, increasing in $\left(\dfrac{\pi}{e}, \infty\right)$

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. $f(x) = \dfrac{e^{2x} - 1}{e^{2x} + 1}$ is

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

A. $x > 0$

B. $x < 0$

C. $x < 1$

D. $x < 1$

Answer: B

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

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

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. $f(x) < 0 f \text{ or } all x \in R$

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

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,a)

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 $f(x) = \sin^4 x + \cos^4 x \in creases$ if

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. If $f(x) = u \neq rset\left(x^2\right)^{x^{2+1}-t^2} e$ dt then f(x) increases on

A. $(-2, 2)$

B. $(0, \infty)$

C. $(-\infty, 0)$

D. none of these

Answer: C

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10. 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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11. If ϕ(x) is continuous at x= α 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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12. 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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13. If $f(x) = 2x^3 + 9x^2 + \lambda x + 20$ is a decreasing function of 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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14. 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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15. 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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16. 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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17. 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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18. $(1+x)^n \leq 1 + x^n$ where

A. $n > 1$

B. $0 \leq n \leq 1$ and $x > 0$

C. $n < 1$ and $x < 0$

D. $x < 0$

Answer: B

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19. 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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20. 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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