



MATHS

BOOKS - OBJECTIVE RD SHARMA MATHS VOL I (HINGLISH)

DIFFERENTIATION

Illustration

1. Let $f(x) = e^x g(x)$, $g(0) = 4$ and $g'(0) = 2$, then $f'(0)$ equals

A. 1

B. 2

C. 3

D. 6

Answer: D

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2. If $f(x) = (ax + b)\sin x + (cx + d)\cos x$, then the values of a b, c and d such that $f(x) = x \cos x$ for all x, then $(a + b + c + d)$ is

A. $a=0, b=c=1, d=0$

B. $a=b=c=d=1$

C. $a=d=0, b=c=-1$

D. none of these

Answer: A

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3. If $f(x) = x \tan^{-1} x$, then $f'(1)$ is equal to

A. $\frac{1}{2} + \frac{\pi}{4}$

B. $-\frac{1}{2} + \frac{\pi}{4}$

C. $-\frac{1}{2} - \frac{\pi}{4}$

D. $\frac{1}{2} - \frac{\pi}{4}$

Answer: A



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4. If $x = e^y + e^{(y+\infty)}$, where $x > 0$, then $f \in d \frac{dy}{dx}$

A. $\frac{1+x}{x}$

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

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

D. $\frac{x}{1+x}$

Answer: C



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5. If $f(x) = \log|2x|$, $x \neq 0$ then $f'(x)$ is equal to

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

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

C. $\frac{1}{|x|}$

D. none of these

Answer: A

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6. if $x^2 + y^2 = t - \frac{1}{t}$ and $x^4 + y^4 = t^2 + \frac{1}{t^2}$ then prove that

$$\frac{dy}{dx} = \frac{1}{x^3 y}$$

A. $\frac{y}{x}$

B. $-\frac{y}{x}$

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

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

Answer: B

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7. If $y = \{f(x)\}^{\phi(x)}$, then $\frac{dy}{dx}$ is

A. $f^{\phi \log f} \cdot \left. \left\{ \frac{\phi}{f} \frac{df}{dx} + \log f \cdot \frac{d\phi}{dx} \right\}$

B. $\frac{\phi}{f} \left(\frac{df}{dx} \right) + \frac{d\phi}{dx} \log f$

C. $e^{\phi \log f} \cdot \left. \left\{ \phi \frac{f'}{f} + \phi' \log f' \right\}$

D. none of these

Answer: A

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8. If $y = \log_{\cos x} \sin x$, then $\frac{dy}{dx}$ is equal to

A. $\frac{\cot x \log \cos x + \tan x \log \sin x}{(\log \cos x)^2}$

B. $\frac{\tan x \log \cos x + \cot x \log \sin x}{(\log \cos x)^2}$

C. $\frac{\cot x \log \cos x + \tan x \log \sin x}{(\log \sin x)^2}$

D. none of these

Answer: A



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9. If $y = x^{x^{x^{\dots}}}$, then $\frac{dy}{dx}$ is equal to

A. yx^{y-1}

B. $\frac{y^2}{x(1 - y \log x)}$

C. $\frac{y}{x(1 + y \log x)}$

D. none of these

Answer: C



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10. If $x = a \left\{ \cos \theta + \log \tan \frac{\theta}{2} \right\}$ and $y = a \sin \theta$, then $\frac{dy}{dx}$ is equal to

A. $\cot \theta$

B. $\tan \theta$

C. $\sin \theta$

D. $\cos \theta$

Answer: B



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11. If $y = f(x^3)$, $z = g(x^2)$, $f'(x) = \cos x$ and $g'(x) = \sin x$, then $\frac{dy}{dz}$ is

A. $\frac{3x}{2} \cos x^3 \cdot \cos x^2$

B. $\frac{2}{3} \sin x^3 \cdot \sec x^2$

C. $\tan x$

D. *no \neq of these*

Answer: A

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12. Differentiate $\sec^{-1} \frac{1}{2x^2 - 1}$ with respect to $\sqrt{1 - x^2}$

A. -4

B. 4

C. 2

D. -2

Answer: B



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13. Differentiate $\sin^{-1}\left(\frac{2x}{1+x^2}\right)$ with respect to $\tan^{-1}\left(\frac{2x}{1-x^2}\right)$, if $x < 1$

A. 1 for all x

B. 1 for $|x| > 1$ and -1 for $|x| < 1$

C. 1 for $|x| < 1$ and -1 for $|x| > 1$

D. 1 for $|x| \leq 1$ and -1 for $|x| > 1$

Answer: C



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14. The derivative of $\log_{10}x$ with respect to x^2 , is

A. $\frac{1}{2x^2} \log_e 10$

B. $\frac{2}{x^2} \log_{10} e$

C. $\frac{1}{2x^2} \log_{10}^e$

D. none of these

Answer: B



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15. If $f_n(x), g_n(x), h_n(x), n = 1, 2, 3$ are polynomials in x such that

$f_n(a) = g_n(a) = h_n(a), n = 1, 2, 3$ and

$$F(x) = \begin{vmatrix} f_1(x) & f_2(x) & f_3(x) \\ g_1(x) & g_2(x) & g_3(x) \\ h_1(x) & h_2(x) & h_3(x) \end{vmatrix}. \text{ Then, } F'(a) \text{ is equal to}$$

A. 0

B. $f_1(a)g_2(a)h_3(a)$

C. 1

D. none of these

Answer: A

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16. If $f(x) = \begin{vmatrix} \sec \theta & \tan^2 \theta & 1 \\ \theta \sec x & \tan x & x \\ 1 & \tan x - \tan \theta & 0 \end{vmatrix}$, then $f'(\theta)$ is

A. 0

B. -1

C. independent of θ

D. none of these

Answer: B

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17. $y(x) = \begin{vmatrix} \sin x & \cos x & \sin x + \cos x + 1 \\ 23 & 17 & 13 \\ 1 & 1 & 1 \end{vmatrix}$, $x \in \mathbb{R}$, then $\frac{d^2y}{dx^2} + y$ is

equal to :

A. 6

B. 4

C. -10

D. 0

Answer: A



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18. If $y = x + e^x$, then $\frac{d^2x}{dy^2}$ is equal to

A. $\frac{1}{(1 + e^x)^2}$

B. $-\frac{e^x}{(1 + e^x)^2}$

C. $-\frac{e^x}{(1+e^x)^3}$

D. e^x

Answer: C

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19. The second order derivative of $a \sin^3 t$ w.r.t, $a \cos^3 t$ at $t = \frac{\pi}{4}$ is

A. $\frac{4\sqrt{2}}{3a}$

B. 2

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

D. 0

Answer: A

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20. Suppose f and g are functions having second derivatives f' and g' every where, if $f(x) \cdot g(x) = 1$ for all x and f'' , g'' are never zero then $\frac{f''(x)}{f'(x)} - \frac{g'(x)}{g'(x)}$ equals

A. $3\left(\frac{f''}{g} - \frac{g''}{f}\right)$

B. $3\left(\frac{f''}{f} - \frac{g''}{g}\right)$

C. $3\left(\frac{g''}{g} - \frac{f''}{g}\right)$

D. $3\left(\frac{f''}{g} - \frac{g''}{f}\right)$

Answer: B



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21. If $x = \phi(t)$, $y = \Psi(t)$, then $\frac{d^2y}{dx^2}$ is equal to

A. $\frac{\phi' \Psi'' - \Psi' \phi''}{(\phi)^2}$

B. $\frac{\phi' \Psi'' - \Psi' \phi''}{(\phi')^3}$

C. $\frac{\phi''}{\Psi''}$

D. $\frac{\Psi'''}{\phi'''}$

Answer: B

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22. If $y = \sin x + e^x$, then $\frac{d^2x}{dy^2}$ equals

A. $(-\sin x + e^x)^{-1}$

B. $\frac{\sin x - e^x}{(\cos x + e^x)^2}$

C. $\frac{\sin x - e^x}{(\cos x + e^x)^3}$

D. $\frac{\sin x + e^x}{(\cos x + e^x)^3}$

Answer: C

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23. If $y = \left\{ x + \sqrt{x^2 + 1} \right\}^m$, show that $(x^2 + 1)y_2 + xy_1 =$

A. m^2y

B. my^2

C. m^2y^2

D. none of these

Answer: A

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24. if $f(x) = x^n$ then the value of

$$f(1) - \frac{f'(1)}{1!} + \frac{f''(1)}{2!} + \dots + \frac{(-1)^n f^{(n)}(1)}{n!} \times (1)$$

A. n

B. 2^n

C. 2^{n-1}

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

Answer: B



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Section I Solved Mcqs

1. If $f(x) = \sqrt{x^2 + 9}$, then $\lim_{x \rightarrow 4} \frac{f(x) - f(4)}{x - 4}$ has the value

A. $5/4$

B. $-4/5$

C. $4/5$

D. none of these

Answer: C



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2. Let f be a twice differentiable function such that

$$f''(x) = -f(x) \text{ and } f'(x) = g(x). \text{ If } h'(x) = [f(x)]^2 + [g(x)]^2,$$

$$h(a) = 8 \text{ and } h(0) = 2, \text{ then } h(2) =$$

A. 1

B. 2

C. 3

D. none of these

Answer: D



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3. If $f(x) = \log|x|$, $x \neq 0$ then $f'(x)$ equals

A. $\frac{1}{|x|}$

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

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

D. none of these

Answer: B

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4. If $f(x) = |\log x|$, then for $x \neq 1$, $f'(x)$ equals

A. $1/x$

B. $1/|x|$

C. $-1/x$

D. none of these

Answer: D

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5. If $f(9) = 9$ and $f'(9) = 4$, then $\lim_{x \rightarrow 9} \frac{\sqrt{f(x)} - 3}{\sqrt{x} - 3}$ equals

A. 9

B. 4

C. 36

D. none of these

Answer: B

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6. If $f(x) = |\log_e |x||$, then $f'(x)$ equals

A. $\frac{1}{|x|}$, $x \neq 0$

B. $\frac{1}{x}$ for $|x| > 1$ and $-\frac{1}{x}$ for $|x| < 1$

C. $-\frac{1}{x}$ for $|x| > 1$ and $\frac{1}{x}$ for $|x| < 1$

D. $\frac{1}{x}$ for $x > 0$ and $-\frac{1}{x}$ for $x < 0$

Answer: B



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7. If $f(x)$ is given by

$$f(x) = (\cos x + i \sin x)(\cos 3x + i \sin 3x) \dots\dots$$

$$\dots\dots[\cos(2n - 1)x + i \sin(2n - 1)x],$$

then $f''(x)$ is equal to

A. $n^2 f(x)$

B. $-n^4 f(x)$

C. $-n^2 f(x)$

D. $n^4 f(x)$

Answer: B



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8. If $y = (\log_{\cos x} \sin x)(\log_{\sin x} \cos x) + \sin^{-1} \frac{2x}{1+x^2}$,

then $\frac{dy}{dx}$ at $x = \frac{\pi}{2}$ is equal to

A. $\frac{8}{\pi^2 + 4}$

B. 0

C. $\frac{-8}{\pi + 4}$

D. 1

Answer: C



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9. Let $f(x)$ be a polynomial. Then, the second order derivative of $f(e^x)$

is $f^{e^x} e^{2x} + f'(e^x) e^x f^{e^x} e^x + f'(e^x) f^{e^x} e^{2x} + f^{e^x} e^x$ (d) f^{e^x}

A. $f''(e^x) \cdot e^x + f'(e^x)$

B. $f''(e^x) \cdot e^{2x} + f'(e^x) \cdot e^{2x}$

C. $f''(e^x) e^{2x}$

D. $f''(e^x)e^{2x} + f'(e^x) \cdot e^x$

Answer: D



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10. Let $f(x) = x^n$ n being a non negative integer. The value of n for which the equality $f'(a + b) = f'(a) + f'(b)$ is valid for all $a, b > 0$ is

A. 0,1

B. 1,2

C. 2,4

D. none of these

Answer: D



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11. Let $f(x) = \sin x$, $g(x) = x^2$ and $h(x) = \log_e x$.

If $F(x) = (\text{hog of } \quad)(x)$, then $F''(x)$ is equal to

A. $2 \cos ec^3 x$

B. $2 \cot x^2 - 4x^2 \cos ec^2 x^2$

C. $2x \cot x^2$

D. $-2 \cos ec^2 x$

Answer: D



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12. If $f(x) = \sin\left\{\frac{\pi}{3}[x] - x^2\right\}$ for $2 < x < 3$ and $[x]$ denotes the greatest integer less than or equal to x , then $f'(\sqrt{\pi/3})$ is equal to

A. $\sqrt{\pi/3}$

B. $-\sqrt{\pi/3}$

C. $-\sqrt{\pi}$

D. none of these

Answer: B

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13. If $f(x) = \cot^{-1}\left(\frac{x^x - x^{-x}}{2}\right)$ then $f'(1)$ equals

A. -1

B. 1

C. $\log_e 2$

D. $-\log_e 2$

Answer: A

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14. The function $u = e^x$; $v = e^x \cos x$ satisfy the equation

$v \frac{du}{dx} - u \frac{dv}{dx} = u^2 + v^2$ b. $\frac{d^2u}{dx^2} = 2v$ c. $\frac{d^2v}{dx^2} = -2u$ d.

$\frac{du}{dx} + \frac{dv}{dx} = 2v$

A. $v \frac{du}{dx} u \frac{dv}{dx} = u^2 + v^2$

B. $\frac{d^2u}{dx^2} = 2v$

C. $\frac{d^2v}{dx^2} = -2u$

D. all the above

Answer: D



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15. If $f(x) = |x - 2|$ and $g(x) = f(f(x))$, then for $x > 20$, $g'(x)$

equals



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16. If $f(x) = |x - 2|$ and $g(x) = f(f(x))$, then for $2 < x < 4$, $g'(x)$ equals

A. -1

B. 1

C. 0

D. none of these

Answer: B



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17. If $f(x) = \log_x(\ln x)$ then $f'(x)$ at $x=e$ is

A. e

B. $-e$

C. e^2

D. e^{-1}

Answer: D



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18. Let $f(t) = \ln(t)$. Then, $\frac{d}{dx} \left(\int_{x^2}^{x^3} f(t) \, dt \right)$

A. has value 0 when $x=0$

B. has value 0 when $x = 1$ and $x = 4/9$

C. has value $9e^2 - 4e$ when $x=e$

D. has differential coefficient $27e - 8$ for $x=e$

Answer: A



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19. If g is the inverse of f and $f'(x) = \frac{1}{1+x^n}$, prove that $g'(x) = 1 + (g(x))^n$

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20. If $f(x) = |x|^{|\sin x|}$, then $f'\left(\frac{\pi}{4}\right)$ equals

A. $\left(\frac{\pi}{4}\right)^{1/\sqrt{2}} \left(\frac{\sqrt{2}}{2} \ln \frac{4}{\pi} - \frac{2\sqrt{2}}{\pi} \right)$

B. $\left(\frac{\pi}{4}\right)^{1/\sqrt{2}} \left(\frac{\sqrt{2}}{2} \ln \frac{4}{\pi} + \frac{2\sqrt{2}}{\pi} \right)$

C. $\left(\frac{\pi}{4}\right)^{1/\sqrt{2}} \left(\frac{\sqrt{2}}{2} \ln \frac{\pi}{4} - \frac{2\sqrt{2}}{\pi} \right)$

D. $\left(\frac{\pi}{4}\right)^{1/\sqrt{2}} \left(\frac{\sqrt{2}}{2} \ln \frac{\pi}{4} + \frac{2\sqrt{2}}{\pi} \right)$

Answer: A

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21. If $y = (1+x)(1+x^2)(1+x^4)\dots(1+x^{2^n})$ then $\frac{dy}{dx}$ at $x=0$ is

A. 1

B. -1

C. 0

D. none of these

Answer: A



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22. If $f(x) = |\cos x - \sin x|$, then $f'\left(\frac{\pi}{4}\right)$ is equal to

A. $\sqrt{2}$

B. $-\sqrt{2}$

C. 0

D. none of these

Answer: D





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23. If $f(x) = |\cos x - \sin x|$, then $f' \left(\frac{\pi}{2} \right)$ is equal to

A. 1

B. -1

C. 0

D. none of these

Answer: A



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24. If $y = |x - x^2|$, then $\frac{dy}{dx}$ at $x = 1$.

A. -1

B. 1

C. does not exist

D. none of these

Answer: C



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25. If $y = |\cos x| + |\sin x|$, then $\frac{dy}{dx}$ at $x = \frac{2\pi}{3}$ is

A. $\frac{1 - \sqrt{3}}{2}$

B. 0

C. $\frac{\sqrt{3} - 1}{2}$

D. none of these

Answer: C



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26. If $f(x) = |\cos x|$, then $f' \left(\frac{3\pi}{4} \right)$ equal to -

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

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

C. 1

D. none of these

Answer: B



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27. If $f(x) = |x|^{\tan x}$ then $f' \left(-\frac{\pi}{6} \right)$ is equal to

A. $\left(\frac{\pi}{6} \right)^{1/\sqrt{3}} \left\{ \frac{2\sqrt{3}}{\pi} - \frac{4}{3} \log \frac{6}{\pi} \right\}$

B. $\left(\frac{\pi}{6} \right)^{1/\sqrt{3}} \left\{ \frac{-2\sqrt{3}}{\pi} + \frac{4}{3} \log \frac{6}{\pi} \right\}$

C. $\left(\frac{\pi}{6} \right)^{1/\sqrt{3}} \left\{ \frac{2\sqrt{3}}{\pi} + \frac{4}{3} \log \frac{6}{\pi} \right\}$

D. none of these

Answer: B

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28. If $x^2 + y^2 = 1$ then

A. $yy'' - 2(y') + 1 = 0$

B. $yy'' + (y')^2 + 1 = 0$

C. $yy'' + (y')^2 - 1 = 0$

D. $yy'' + 2(y')^2 + 1 = 0$

Answer: B

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29. If $y = \cos^{-1}(\cos x)$, then $\frac{dy}{dx}$ is equal to $\frac{x}{y}$ (b) $\frac{y}{x^2} \frac{x^2 - y^2}{x^2 + y^2}$ (d) $\frac{y}{x}$

A. 1

B. -1

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

D. none of these

Answer: B

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30. If $y = \sin^{-1}(\sin x)$, then $\frac{dy}{dx}$ at $x = \frac{\pi}{2}$ is

A. 1

B. -1

C. non-existent

D. none of these

Answer: C

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31. If $y = \sec(\tan^{-1} x)$, then $(\tan^{-1} x)$, then $\frac{dy}{dx}$ at $x = 1$ is equal

to

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

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

C. 1

D. none of these

Answer: A



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32. Let f be a differentiable function satisfying

$$[f(x)]^n = f(nx) \text{ for all } x \in R.$$

Then, $f'(x)f(nx)$

A. $f(x)$

B. 0

C. $f(x)f'(nx)$

D. none of these

Answer: C

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33. If $f(x) = |x - 1|$ and $g(x) = f(f(f(x)))$, then for $x > 2$, $g'(x)$ is equal to

A. 1 for all $x > 2$

B. 1 for $2 < x < 3$

C. -1 for $2 < x < 3$

D. none of these

Answer: C

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34. Let $F(x) = f(x)g(x)h(x)$ for all real x , where $f(x)$, $g(x)$, and $h(x)$ are differentiable functions. At some point x_0 , $F'(x_0) = 21F(x_0)$, $f'(x_0) = 4f(x_0)$, $g'(x_0) = -7g(x_0)$, then the value of $g'(1)$ is _____

A. 12

B. 12

C. 24

D. -24

Answer: C

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35. If g is inverse of function f and $f'(x) = \sin x$, then $g'(x) =$

A. $\cos ec\{g(x)\}$

B. $\sin\{g(x)\}$

C. $\frac{1}{\sin\{g(x)\}}$

D. none of these

Answer: C



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36. Let $f(x)$ be a second degree polynomial function such that $f(-1) = f(1)$ and α, β, γ are in A.P. Then, $f'(\alpha), f'(\beta), f'(\gamma)$ are in

A. AP

B. GP

C. HP

D. none of these

Answer: A



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37. Find the derivative of $f(\tan x)$ w.r.t. $g(\sec x)$ at $x = \frac{\pi}{4}$, where $f'(1) = 2$ and $g'(\sqrt{2}) = 4$.

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

B. $\sqrt{2}$

C. 1

D. 0

Answer: A



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38. The derivative of $\cos ec^{-1}\left(\frac{1}{2x^2 - 1}\right)$ with respect to $\sqrt{1 - x^2}$ at $x = \frac{1}{2}$, is

A. -4

B. 4

C. -1

D. none of these

Answer: A

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39. The derivative of $\sin^{-1}(3x - 4x^3)$ with respect to $\sin^{-1}x$, is

A. 3, for $|x| < 1$

B. 3, for $|x| < \frac{1}{2}$ and -3 for $\frac{1}{2} < |x| < 1$

C. -3 , for $|x| < 12$

D. -3 , for $|x| \leq \frac{1}{2}$ and 3 for $\frac{1}{2} < |x| < 1$

Answer: B

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40. If $f(x) = \cos\left\{\frac{\pi}{2}[x] - x^3\right\}$, $1 < x < 2$, and $[x]$ denotes the greatest integer less than or equal to x , then the value of

$$f'\left(\sqrt[3]{\frac{\pi}{2}}\right), \text{ is}$$

A. 0

B. $3\left(\frac{\pi}{2}\right)^{2/3}$

C. $-3\left(\frac{\pi}{2}\right)^{2/3}$

D. none of these

Answer: A



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41. Let $f(x) = \sin x$, $g(x) = 2x$ and $h(x) = \cos x$. If

$\phi(x) = [g \circ (f \circ h)](x)$, then $\phi''\left(\frac{\pi}{4}\right)$ is equal to

A. 4

B. 0

C. -4

D. none of these

Answer: C



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42. Let $f(x)$ be a polynomial function satisfying

$$f(x) + f\left(\frac{1}{x}\right) = f(x)f\left(\frac{1}{x}\right) \text{ for all } x \neq 0. \quad \text{If}$$

$f(5) = 126$ and a, b, c are in G.P., then $f'(a), f'(b), f'(c)$ are in

A. AP

B. GP

C. HP

D. none of these

Answer: B



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43. If $f(x) = \begin{vmatrix} x^n & \sin x & \cos x \\ n! & \sin \frac{n\pi}{2} & \cos \frac{n\pi}{2} \\ a & a^2 & a^3 \end{vmatrix}$, then the value of $\frac{d^n}{dx^n}(f(x))$ at $x = 0$ for $n = 2m + 1$ is

A. -1

B. 0

C. 1

D. independent of a

Answer: B



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44. If $y = f\left(\frac{2x-1}{x^2+1}\right)$ and $f'(x) = \sin x^2$, then $\frac{dy}{dx}$ is equal to

A. $\sin\left(\frac{2x-1}{x^2+1}\right)^2 \left\{ \frac{x^2+2x+2}{(x^2+1)} \right\}$

B. $\sin\left(\frac{2x-1}{x^2+1}\right)^2 \left\{ \frac{2+2x-2x^2}{(x^2+1)^2} \right\}$

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

D. none of these

Answer: B



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45. Let f be a differentiable function defined for all $x \in \mathbb{R}$ such that $f(x^3) = x^5$ for all $x \in \mathbb{R}, x \neq 0$. Then the value of $f'(8)$, is

A. 20

B. $\frac{20}{3}$

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

D. none of these

Answer: B



46. If $f(x) = \cos x \cos 2x \cos 4x \cos 8x \cos 16x$, then $f'\left(\frac{\pi}{4}\right)$ is

A. $\sqrt{2}$

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

C. 1

D. none of these

Answer: A



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47. If $f(x) = \cos x \cos 2x \cos 2^2 x \cos 2^3 x \dots \cos 2^{n-1} x$ and $n > 1$, then $f'\left(\frac{\pi}{2}\right)$ is

A. 1

B. 0

C. -1

D. none of these

Answer: A

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48. $f'(x) = \varphi'(x) = f(x)$ for all x . Also, $f(3) = 5$ and $f'(3) = 4$.

Then the value of $[f(10)]^2$ is _____

A. 0

B. 9

C. 41

D. none of these

Answer: B

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49. if $f'(x) = \sqrt{2x^2 - 1}$ and $y = f(x^2)$ then $\frac{dy}{dx}$ at $x = 1$ is:

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50. Let f be a one-one function satisfying $f'(x) = f(x)$ then $(f^{-1})''(x)$ is equal to

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

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

C. $f(x)$

D. $f^{-1}(x)$

Answer: B

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51. Differentiate $\sec^{-1} \frac{1}{2x^2 - 1}$ with respect to $\sqrt{1 - x^2}$

A. -4

B. 4

C. 2

D. -2

Answer: B



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52. The derivative of $\sec^{-1}\left(\frac{1}{2x^2 - 1}\right)$ with respect to $\sqrt{1 - x^2}$ at $x = 1$, is

A. 2

B. -2

C. non-existent

D. none of these

Answer: C



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53. The derivative of $\sec^{-1}\left(\frac{1}{2x^2 - 1}\right)$ with respect to $\sqrt{1 - x^2}$ at $x = 0$, is

A. 2

B. -2

C. 1

D. none of these

Answer: D



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54. If $f(x) = \tan^{-1}\left(\frac{3x - x^3}{1 - 3x^2}\right)$ then $\frac{d}{dx}(f(x))$ is equal to

A. $\frac{3}{1 + 9x^2}$ for all $x \in R$

B. $\frac{3}{1 + x^2}$ for all $x \in R$

C. $\frac{3}{1 + x^2}$ for all $x \in R - \left\{ -\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}} \right\}$

D. $\frac{1}{9 + x^2}$

Answer: C



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55. If $5f(x) + 3f\left(\frac{1}{x}\right) = x + 2$ and $y = xf(x)$, then find $\frac{dy}{dx}$ at $x = 1$.

A. 14

B. $\frac{7}{8}$

C. 1

D. none of these

Answer: B



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56. Let f and g be differentiable functions satisfying $g(a) = b$, $g'(a) = 2$ and $f \circ g = I$ (identity function). then $f'(b)$ is equal to

A. 2

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

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

D. none of these

Answer: C



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57. If $y = f(x)$ is an odd differentiable function defined on $(-\infty, \infty)$ such that $f'(3) = -2$, then $|f'(-3)|$ equals _____.

A. 1

B. 2

C. -2

D. 0

Answer: C



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58. If $P(x)$ is a polynomial such that

$P(x^2 + 1) = \{P(x)\}^2 + 1$ and $P(0)=0$, then $P'(0)$ is equal to

A. 1

B. 0

C. -1

D. none of these

Answer: A

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59. Let $f(x)$ be a differentiable function such that

$f'(x) = \sin x + \sin 4x \cos x$. Then $f'\left(2x^2 + \frac{\pi}{2}\right)$ at $x = \sqrt{\frac{\pi}{2}}$ is

equal to

A. 0

B. -1

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

D. none of these

Answer: C

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60. Let $f(x) = \frac{x^2 - x}{x^2 + 2x}$ then $d \frac{f^{-1}x}{dx}$ is equal to

A. $\frac{-3}{(1-x)^2}$

B. $\frac{3}{(1-x)^2}$

C. $\frac{1}{(1-x)^2}$

D. none of these

Answer: D



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61. Let $f(x)$ be polynomial function of degree 2 such that $f(x) > 0$ for all $x \in \mathbb{R}$. If $g(x) = f(x) + f'(x) + f''(x)$ for all x , then

A. $g(x) < 0$ for all x

B. $g(x) > 0$ for all x

C. $g(x) = 0$ for all x

D. $g(x) \geq 0$ for all x .

Answer: B

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62. If f is a bijection satisfying $f'(x) = \sqrt{(1 - \{f(x)\}^2)}$, then $(f^{-1})'(x)$

A. is equal to $\frac{1}{\sqrt{1 - x^2}}$

B. may not exist for every $x \in \mathbb{R}$

C. may not be known explicitly

D. is equal $\sin^{-1}(f(x))$

Answer:

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63. If $f(x) = \cos^{-1} \left\{ \frac{1 - (\log_e x)^2}{1 + (\log_e x)^2} \right\}$, then $f' \left(\frac{1}{e} \right)$ is equal to

A. e

B. $-e$

C. 1

D. $2e$

Answer: B



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64. If $f(x) = x^n$, n being a non-negative integer, then the values of n for which $f'(\alpha + \beta) = f'(\alpha) + f'(\beta)$ for all $\alpha, \beta > 0$ is

A. 1,2

B. 0,2

C. 0,1

D. none of these

Answer: B



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65. Let f be a differentiable function satisfying

$$f(x) + f(y) + f(z) + f(x)f(y)f(z) = 14 \text{ for all } x, y, z \in \mathbb{R} \text{ Then,}$$

A. $f'(x) < 0$ for all $x \in \mathbb{R}$

B. $f'(x) = 0$ for all $x \in \mathbb{R}$

C. $f'(x) > 0$ for all $x \in \mathbb{R}$

D. none of these

Answer: B



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66. If $f(x) = 2 \tan^{-1} x + \sin^{-1} \left(\frac{2x}{1+x^2} \right)$, $x > 1$. Then, $f(5)$ is equal to

A. $f'(2) = f'(3)$

B. $f'(2) = 0$

C. $f' \left(\frac{1}{2} \right) = \frac{16}{5}$

D. all the above

Answer: D

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67. Let $f(x)$ be polynomial of degree 3 such that

$f(3) = 1$, $f'(3) = -1$, $f''(3) = 0$ and $f'''(3) = 12$ Then, the equal of $f'(1)$ is

A. 12

B. 23

C. -13

D. none of these

Answer: B



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68. If $f(x) = \tan^{-1} x + \cos^{-1} \left(\frac{1 - x^2}{1 + x^2} \right)$, then

A. $f'(-2) = \frac{4}{5}$

B. $f'(-1) = -1$

C. $f'(x) = 0$ for all $x < 0$

D. none of these

Answer: C



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69.

Let

$$f(x) = x^2 + xg^2(1) + g''(2) \text{ and } g(x) = f(1) \cdot x^2 + xf'(x) + f''(x),$$

then find $f(x)$ and $g(x)$.

A. $f'(1) = 4 + f'(2)$

B. $g'(2) = 8 + g(1)$

C. $g''(2) + f''(3) = 4$

D. all the above

Answer: D



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70.

$$f: R \rightarrow R, f(x) = x^3 + x^2 f'(1) + x f''(2) + f'''(3) \text{ for all } x \in R.$$

The value of $f(1)$ is

A. $f(0) + f(2) = f(1)$

B. $f(0) + f(3) = 0$

C. $f(1) + f(3) = f(2)$

D. all the above

Answer: D



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71. Let $y = \frac{x^8 + x^4 + 1}{x^4 + x^2 + 1}$. If $\frac{dy}{dx} = ax^3 + bx$. Then,

A. $a = 4, b = 2$

B. $a = 4, b = -2$

C. $a = -2, b = 4$

D. none of these

Answer: B



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72. Let f be a real function such that $f(x - y)$, $f(x)f(y)$ and $f(x + y)$ are in A.P. for all $x, y \in \mathbb{R}$. If $f(0) \neq 0$, then

A. $f(1) + f(-1) = 0$

B. $f(2) + f(-2) = 0$

C. $f'(3) + f'(-3) = 0$

D. $f'(2) = f'(-2)$

Answer: C

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73. Let $f(x) = 3x^2 + 4xg'(1) + g''(2)$

and, $g(x) = 2x^2 + 3xf'(2) + f''(3)$ for all $x \in \mathbb{R}$. Then,

A. $f'(1) = 22 + 12f'(2)$

B. $g(2) = 44 + 12g'(1)$

C. $f''(3) + g''(2) = 10$

D. all the above

Answer: D

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74. if $f(x) = x^n$ then the value of $f(1) - \frac{f'(1)}{1!} + \frac{f''(1)}{2!} + \dots + \frac{(-1)^n f^{(n)}(1)}{n!} \times (1)$

A. 1

B. 2^n

C. 2^{n-1}

D. 0

Answer: D

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75. Let $f(x)$ be a polynomial function of second degree. If $f(1) = f(-1)$ and a, b, c are in A.P, the $f'(a)$, $f'(b)$ and $f'(c)$ are in

- A. Arithmetic-Geometric Progression
- B. AP
- C. GP
- D. HP

Answer: B

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76. Let $f(x) = \sqrt{x-1} + \sqrt{x+24-10\sqrt{x-1}}$, $1 < x < 26$

be a real valued function, then $f'(x)$ for $1 < x < 26$, is

- A. 0

B. $\frac{1}{\sqrt{x-1}}$

C. $2\sqrt{x-1}$

D. none of these

Answer: A

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77. $\frac{d^2x}{dy^2}$ equals

A. $\left(\frac{d^2x}{dy^2}\right)^{-1}$

B. $\left(\frac{d^2x}{dy^2}\right)\left(\frac{dy}{dx}\right)^{-3}$

C. $\left(\frac{d^2x}{dy^2}\right)\left(\frac{dy}{dx}\right)^{-2}$

D. $-\left(\frac{d^2x}{dy^2}\right)\left(\frac{dy}{dx}\right)^{-3}$

Answer: D

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78. $f(x)$ and $g(x)$ are two differentiable functions in $[0, 2]$ such that $f(0) = g(0) = 0$, $f'(1) = 2$, $g'(1) = 4$, $f(2) = 3$, $g(2) = 9$ then $f(x) - g(x)$ at $x = \frac{3}{2}$ is

A. 0

B. 2

C. 10

D. 5

Answer: D

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79. If $f(1) = 3$, $f'(1) = -\frac{1}{3}$, then the derivative of $\{x^{11} + f(x)\}^{-2}$ at $x = 1$, is

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

B. -1

C. 1

D. $f'(1)$

Answer: D



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80. If y is a function of x and $\log(x + y) - 2xy = 0$ then the value of $y(0)$ is equal to (a) 1 (b) -1 (c) 2 (d) 0

A. 1

B. -1

C. 2

D. 0

Answer: A



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81. Let y be an implicit function of x defined by $x^{2x} - 2x^x \cot y - 1 = 0$. Then $y'(1)$ equals:

A. -1

B. 1

C. $\log 2$

D. $-\log 2$

Answer: A



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82. If the function $f(x) = x^3 + e^{\frac{x}{2}}$ and $g(x) = f^{-1}(x)$, then the value of $g'(1)$ is

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

B. 2

C. 1

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

Answer: B

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83. Let $g(x) = \ln f(x)$ where $f(x)$ is a twice differentiable positive function on $(0, \infty)$ such that $f(x+1) = xf(x)$. Then for $N = 1, 2, 3$

$$g''\left(N + \frac{1}{2}\right) - g''\left(\frac{1}{2}\right) =$$

A. $-4\left\{1 + \frac{1}{9} + \frac{1}{25} + \dots + \frac{1}{(2N-1)^2}\right\}$

B. $4\left\{1 + \frac{1}{9} + \frac{1}{25} + \dots + \frac{1}{(2N-1)^2}\right\}$

C. $-4\left\{1 + \frac{1}{9} + \frac{1}{25} + \dots + \frac{1}{(2N+1)^2}\right\}$

D. $4\left\{1 + \frac{1}{9} + \frac{1}{25} + \dots + \frac{1}{(2N+1)^2}\right\}$

Answer: A



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84. If $f: R \rightarrow R$ is defined by

$f(x) = \frac{x^2 - ax + 1}{x^2 + ax + 1}$, $0 < a < 2$, the which of the following is true:

A. $(2 + a)^2 f''(1) + (2 - a)^2 f''(-1) = 0$

B. $(2 - a)^2 f''(1) - (2 + a)^2 f''(-1) = 0$

C. $f'(1)f'(-1) = (2 - a)^2$

D. $f'(1)f'(-1) = -(2 + a)^2$

Answer: A



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85. If $f(x) = \frac{x}{1 + |x|}$ for $x \in R$, then $f'(0) =$

86. If $f(x) = \frac{1}{1-x}$, then the derivative of the composite function $f[f(x)]$ is equal to

- A. 0
- B. $1/2$
- C. 1
- D. 2

Answer: C

87. If $f(\theta) = \sin\left(\tan^{-1}\left(\frac{\sin \theta}{\sqrt{\cos 2\theta}}\right)\right)$, where $-\frac{\pi}{4} < \theta < \frac{\pi}{4}$, then the value of $\frac{d}{d(\tan \theta)} f(\theta)$ is

A. 1

B. 2

C. 3

D. 4

Answer: A



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88. if $y^x - x^y = 1$ then the value of $\frac{dy}{dx}$ at $x = 1$ is

A. $2(1 - \log 2)$

B. $2(1 + \log 2)$

C. $2 - \log 2$

D. $2 + \log 2$

Answer: A



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89. If $y = \sec(\tan^{-1}x)$, then $\frac{dy}{dx}$ at $x = 1$ is equal to

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

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

C. 1

D. $\sqrt{2}$

Answer: A

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90. Let $y(x) = \cos(3 \cos^{-1} x)$, $x \in [-1, 1]$, $x \neq \pm \frac{\sqrt{3}}{2}$. Then

$$\frac{1}{y(x)} \left\{ (x^2 - 1) \frac{d^2 y(x)}{dx^2} + x \frac{dy(x)}{dx} \right\} \text{ equals}$$

A. 1

B. 2

C. 8

D. 9

Answer: D



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91. If a curve is represented parametrically by the equations $x = 4t^3 + 3$ and $y = 4 + 3t^4$ and $\frac{d^2x}{dy^2} / \left(\frac{dx}{dy}\right)^n$ is constant then the value of n , is

A. 3

B. 4

C. 5

D. 6

Answer: C

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92. If for $x \left(0, \frac{1}{4} \right)$, the derivative of $\tan^{-1} \left(\frac{6x\sqrt{x}}{1-9x^3} \right)$ is $\sqrt{x}g'(x)$,

then $g(x)$ equals: $\frac{3x}{1-9x^3}$ (2) $\frac{3}{1+9x^3}$ (3) $\frac{9}{1+9x^3}$ (4) $\frac{3x\sqrt{x}}{1-9x^3}$

A. $\frac{9}{1+9x^3}$

B. $\frac{3x\sqrt{x}}{1-9x^3}$

C. $\frac{3x}{1-9x^3}$

D. $\frac{3}{1+9x^3}$

Answer: A

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1. If $y = \cos^{-1}\left(\frac{2x}{1+x^2}\right)$, then $\frac{dy}{dx}$ is $\frac{-2}{1+x^2}$ for all x (b) $\frac{-2}{1+x^2}$ for all $|x| < 1$ $\frac{2}{1+x^2}$ for $|x| > 1$ (d) none of these

A. $\frac{-2}{1+x^2}$ for all x

B. $\frac{-2}{1+x^2}$ for all $|x| > 1$

C. $\frac{2}{1+x^2}$ for $|x| < 1$

D. none of these

Answer: D



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2. If $x = \int_0^y \frac{1}{\sqrt{1+4t^2}} dt$, then $\frac{d^2y}{dx^2}$, is

A. $2y$

B. $4y$

C. $8y$

D. $6y$

Answer: B



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3. If $f(x) = \sqrt{x^2 - 2x + 1}$, then $f'(x)$?

A. $f'(x) = 1$ for all x

B. $f'(x) = -1$ for all $x \leq 1$

C. $f'(x) = 1$ for all $x > 1$

D. none of these

Answer: D



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4. If $f(x) = \sqrt{1 - \sin 2x}$, then $f'(x)$ equals

A. $-(\cos x + \sin x)$, for $x \in (\pi/4, \pi/2)$

B. $\cos x + \sin x$, for $x \in (0, \pi/4)$

C. $-(\cos x + \sin x)$, for $x \in (0, \pi/4)$

D. $\cos x - \sin x$, for $x \in (\pi/4, \pi/2)$

Answer: C



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5. If $f(x) = |x^2 - 5x + 6|$, then $f'(x)$ equals $2x - 5$ for $2 < x < 3$

A. $2x - 5$ for $2 < x < 3$

B. $5 - 2x$ for $2 < x < 3$

C. $2x - 5$ for $2 \leq x \leq 3$

D. $5 - 2x$ for $2 \leq x \leq 3$

Answer: B



6. If $x^2 + y^2 = a^2$ and $k = 1/a$ then k is equal to

A. $\frac{y''}{\sqrt{1+y'}}$

B. $(1)/y(\text{sqrt}(1+yy''))$

C. $\frac{2y''}{\sqrt{1+y'^2}}$

D. $\frac{y''}{2\sqrt{(1+y'^2)^3}}$

Answer: B

7. If $f(x) = \sin x$ and $g(x) = \text{sgn} \sin x$, then $g'(1)$ equals

A. 0

B. $-\cos 1$

C. $\cos 1$

D. none of these

Answer: C

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8. If $y = \sin^{-1}\left(\frac{x}{2}\right) + \cos^{-1}\left(\frac{x}{2}\right)$ then $\frac{dy}{dx} =$

A. 1

B. -1

C. 0

D. 2

Answer: C

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9. If $y = \cos^{-1}\left(\frac{2 \cos x - 3 \sin x}{\sqrt{13}}\right)$, then $\frac{dy}{dx}$, is

A. zero

B. constant=1

C. constant $\neq 1$

D. none of these

Answer: B

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10. If $y = x + e^x$, then $\frac{d^2x}{dy^2}$ is equal to

A. e^x

B. $-\frac{e^x}{(1 + e^x)^3}$

C. $-\frac{e^x}{(1 + e^x)^2}$

D. $\frac{1}{(1 + e^x)^2}$

Answer: B

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11. If $F(x) = \frac{1}{x^2} \int_4^x (4t^2 - 2F'(t)) dt$, then $F'(4)$ equals

A. $\frac{32}{9}$

B. $\frac{64}{3}$

C. $\frac{64}{9}$

D. $\frac{32}{3}$

Answer: A

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12. If $y^2 = P(x)$ is polynomial of degree 3, then $2 \left(\frac{d}{dx} \right) \left(y^3 \cdot d^2 \frac{y}{dx^2} \right)$

is equal to

A. $P(x) + P''(x)$

B. $P(x)$

C. $P(x)P'''(x)$

D. a constant

Answer: C



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13. if $2^x + 2^y = 2^{x+y}$ then the value of $\frac{dy}{dx}$ at $x = y = 1$

A. 0

B. -1

C. 1

D. 2

Answer: B



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14. The derivative of $\tan^{-1}\left(\frac{\sqrt{1+x^2}-1}{x}\right)$ with respect to $\tan^{-1}\left(\frac{2x\sqrt{1-x^2}}{1-2x^2}\right)$ at $x = 0$ is (a) $\frac{1}{8}$ (b) $\frac{1}{4}$ (c) $\frac{1}{2}$ (d) 1

A. $1/8$

B. $1/4$

C. $1/2$

D. 1

Answer: B

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15. If $y = \tan^{-1}\left\{\frac{(\log)_e(e/x^2)}{(\log)_e(ex^2)}\right\} + \tan^{-1}\left(\frac{3 + 2(\log)_e x}{1 - 6(\log)_e x}\right)$, then $\frac{d^2y}{dx^2} =$ (a) 2 (b) 1 (c) 0 (d) -1

A. 2

B. 1

C. 0

D. -1

Answer: C



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16. The expression of $\frac{dy}{dx}$ of the function $y = a^{x^{a^x \dots \infty}}$, is

A. $\frac{y^2}{x(1 - y \log x)}$

B. $\frac{y^2 \log y}{x(1 - y \log x)}$

C. $\frac{y^2 \log y}{x(1 - y \log x \log y)}$

D. $\frac{y^2 \log y}{x(1 + y \log x \log y)}$

Answer: C



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17. If $\sqrt{1-x^2} + \sqrt{1-y^2} = a(x-y)$, then $\frac{dy}{dx}$ equals

A. $\sqrt{(1-x^2)(1-y^2)}$

B. $\sqrt{\frac{1-y^2}{1-x^2}}$

C. $\sqrt{\frac{1-x^2}{1-y^2}}$

D. none of these

Answer: B

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18. If $y = e^{1+\log_e x}$, then the value of $\frac{dy}{dx}$ is equal to

A. e

B. 1

C. 0

D. $\log_e x e \log_e e^x$

Answer: A

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19. If $x^y = e^{x-y}$, then $\frac{dy}{dx}$ is equal to

A. $(1 + \log x)^{-1}$

B. $(1 + \log x)^{-2}$

C. $\log x (1 + \log x)^{-2}$

D. none of these

Answer: C

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20. Let $f(x) = \frac{x^2}{1-x^2}$, $x \neq 0, \pm 1$, then derivative of $f(x)$ with respect to x , is

A. $\frac{2x}{(1-x^2)^2}$

B. $\frac{1}{(2+x^2)^3}$

C. $\frac{1}{(1-x^2)^2}$

D. $\frac{1}{(2-x^2)^2}$

Answer: A

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21. If $y = e^{\sin^{-1} x}$ and $u = \log x$, then $\frac{dy}{du}$, is

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

B. $xe^{\sin^{-1} x}$

C. $\frac{xe^{\sin^{-1} x}}{\sqrt{1-x^2}}$

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

Answer: C

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22. The differential coefficient of $f(x) = \log(\log x)$ with respect to x is

A. $\frac{x}{\log x}$

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

C. $(x \log x)^{-1}$

D. $x \log x$

Answer: C

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23. If $y = (\tan^{-1}) \frac{\sqrt{1+x^2} - 1}{x}$, then $y'(1)$ is equal to

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

B. 0

C. 1

D. -1

Answer: A

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24. The derivative of $\sin^{-1}\left(\frac{\sqrt{1+x} + \sqrt{1-x}}{2}\right)$ with respect to x is

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

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

C. $\frac{2}{\sqrt{1-x^2}}$

D. $\frac{-2}{\sqrt{1-x^2}}$

Answer: A

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25. If $f(x) = \log_a(\log_a x)$, then $f'(x)$, is

A. $\frac{\log_a e}{x \log_e x}$

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

C. $\frac{\log_e a}{x}$

D. $\frac{x}{\log_e a}$

Answer: A



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26. The differential coefficient of $f(\log x)$ with respect to x , where

$f(x) = \log x$, is

A. $\frac{x}{\log x}$

B. $(x \log x)^{-1}$

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

D. $x \log x$

Answer: B

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27. If $x^p y^q = (x + y)^{(p+q)}$ then $\frac{dy}{dx} = ?$

A. $\frac{y}{x}$

B. $\frac{py}{qx}$

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

D. $\frac{qy}{px}$

Answer: A

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28. The value of $\frac{d}{dx}(|x - 1| + |x - 5|)$ at $x = 3$, is

A. -2

B. 0

C. 2

D. 4

Answer: B

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29. If $y = \sec^{-1}\left(\frac{x+1}{x-1}\right) + \sin^{-1}\left(\frac{x-1}{x+1}\right)$, $x > 0$. Find $\frac{dy}{dx}$.

A. 1

B. $\frac{x-1}{x+1}$

C. 0

D. $\frac{x+1}{x-1}$

Answer: C

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30. If $f'(x) = \sin(\log x)$ and $y = f\left(\frac{2x+3}{3-2x}\right)$, then $\frac{dy}{dx}$ equals

A. $\sin(\log x) \cdot \frac{1}{x \log x}$

B. $\frac{12}{(3-2x)^2} \sin\left\{\log\left(\frac{2x+3}{3-2x}\right)\right\}$

C. $\sin\left\{\log\left(\frac{2x+3}{3-2x}\right)\right\}$

D. none of these

Answer: B

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31. If $f(x) = (\log_{\cot x} \tan x)(\log_{\tan x} \cot x)^{-1}$
 $+ \tan^{-1}\left(\frac{4x}{\sqrt{4-x^2}}\right)$, then $f'(0)$ is equal to

A. 2

B. 0

C. $1/2$

D. -2

Answer: A



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32. If $y = x^{x^{x^{\dots\infty}}}$, then $x(1 - y \log x) \frac{dy}{dx}$

A. x^2

B. y^2

C. xy^2

D. xy

Answer: B



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33. If $\sin^{-1}\left(\frac{x^2 - y^2}{x^2 + y^2}\right) = \log a$ then $\frac{dy}{dx}$ equals

A. $\frac{x}{y}$

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

C. $\frac{x^2 - y^2}{x^2 + y^2}$

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

Answer: D

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34. If $y = \sec^{-1}\left(\frac{\sqrt{x} + 1}{\sqrt{x} - 1}\right) + \sin^{-1}\left(\frac{\sqrt{x} - 1}{\sqrt{x} + 1}\right)$, then $\frac{dy}{dx}$ is equal to?

A. 1

B. 0

C. $\frac{\sqrt{x} + 1}{\sqrt{x} - 1}$

D. $\frac{\sqrt{x} - 1}{\sqrt{x} + 1}$

Answer: B

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35. If $x^2 + y^2 = \left(t + \frac{1}{t}\right)$ and $x^4 + y^4 = t^2 + \frac{1}{t^2}$, then $x^3y \frac{dy}{dx} =$

A. 0

B. 1

C. -1

D. none of these

Answer: B

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36. $y = \frac{\tan^{-1}(\sqrt{1+x^2} + \sqrt{1-x^2})}{\sqrt{1+x^2} - \sqrt{1-x^2}}$ then $\frac{dy}{dx}$

A. $\frac{1}{\sqrt{1-x^4}}$

B. $-\frac{1}{\sqrt{1-x^4}}$

C. $\frac{x}{\sqrt{1-x^4}}$

D. $-\frac{x}{\sqrt{1-x^4}}$

Answer: D



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37. If $y = \int_0^x f(t) \sin\{k(x-t)\} dt$, then $\frac{d^2y}{dx^2} + k^2 y$ equals

A. 0

B. y

C. $kg(x)$

D. $k^2 f(x)$

Answer: C



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38. If $f(x) = \begin{vmatrix} x^3 & x^4 & 3x^2 \\ 1 & -6 & 4 \\ p & p^2 & p^3 \end{vmatrix}$, where p is a constant, then $\frac{d^3}{dx^3}(f(x))$,

is

A. proportional to x^2

B. proportional to x

C. proportional to x^3

D. a constant

Answer: B



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39. If $f(x) = x + 2$, then $f'(f(x))$ at $x = 4$, is

A. 8

B. 1

C. 4

D. 5

Answer: B



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40. If $y^2 = ax^2 + bx + c$, then $y^3 \frac{d^2y}{dx^2}$ is (a) a constant (b) a function of x only (c) a function of y only (d) a function of x and y

A. a constant

B. a function of x

C. a function of y

D. a function of x and y both

Answer: A



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41. If $x = a \cos \theta$, $y = b \sin \theta$, then $\frac{d^3y}{dx^3}$ is equal to

A. $-\frac{3b}{a^3} \operatorname{cosec}^4 \theta \cot^4 \theta$

B. $\frac{3b}{a^3} \operatorname{cosec}^4 \theta \cot \theta$

C. $-\frac{3b}{a^3} \operatorname{cosec}^4 \theta \cot \theta$

D. none of these

Answer: C



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42. If $f(1) = 1$ and $f'(1) = 2$, then $\lim_{x \rightarrow 1} \frac{\sqrt{f(x)} - 1}{\sqrt{x} - 1}$ equals

A. 2

B. 4

C. 1

D. 1/2

Answer: C



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43. If variables x and y are related by the equation

$$x = \int_0^y \frac{1}{\sqrt{1 + 9u^2}} du, \text{ then } \frac{dy}{dx} \text{ is equal to}$$

A. $\frac{1}{\sqrt{1 + 9y^2}}$

B. $\sqrt{1 + 9y^2}$

C. $1 + 9y^2$

D. $\frac{1}{1 + 9y^2}$

Answer: B



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44. If Q. 43, $\frac{d^2y}{dx^2}$ is equal to

A. $\sqrt{1 + 9y^2}$

B. $\frac{1}{\sqrt{1 + 9y^2}}$

C. $9y$

D. $\frac{1}{9}y$

Answer: C



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45. The differential coefficient of $a^{\log_{10} \operatorname{cosec}^{-1} x}$, is

$$A. \frac{a^{\log_{10}(\operatorname{cosec}^{-1}x)}}{\operatorname{cosec}^{-1}x} \cdot \frac{1}{x\sqrt{x^2-1}} \log_{10} a$$

$$B. -\frac{a^{\log_{10}(\operatorname{cosec}^{-1}x)}}{\operatorname{cosec}^{-1}x} \cdot \frac{1}{|x|\sqrt{x^2-1}} \log_{10} a$$

$$C. \frac{-a^{\log_{10}(\operatorname{cosec}^{-1}x)}}{\operatorname{cosec}^{-1}x} \cdot \frac{1}{|x|\sqrt{x^2-1}} \log_a 10$$

$$D. \frac{a^{\log_{10}\operatorname{cosec}^{-1}x}}{\operatorname{cosec}^{-1}x} \cdot \frac{1}{x\sqrt{x^2-1}} \log_a 10$$

Answer: B



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46. $f(x) = \tan^{-1} \left\{ \frac{\log\left(\frac{e}{x^2}\right)}{\log(ex^2)} \right\} + \tan^{-1} \left(\frac{3 + 2 \log x}{1 - 6 \log x} \right)$ then find

$$\frac{d^n y}{dx^n}$$

A. $\tan^{-1} \{(\log x)^n\}$

B. .

C. $1/2$

D. none of these

Answer: B

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47. If $y = \sin^2 \alpha + \cos^2(\alpha + \beta) + 2 \sin \alpha \sin \beta \cos(\alpha + \beta)$, then $\frac{d^3 y}{d\alpha^3}$,
is

A. $\frac{\sin^3(\alpha + \beta)}{\cos \alpha}$

B. $\cos(\alpha + 3\beta)$

C. 0

D. none of these

Answer: C

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48. If $y = \cos 2x \cos 3x$, then y_n is equal to

A. $6^n \cos\left(2x + \frac{n\pi}{2}\right) \cos\left(3x + \frac{n\pi}{2}\right)$

B. $6^n \sin\left(2x + \frac{n\pi}{2}\right) \cos\left(\frac{3x + n\pi}{2}\right)$

C. $\frac{1}{2} \left\{ 5^n \sin\left(5x + \frac{n\pi}{2}\right) + \sin\left(x + \frac{n\pi}{2}\right) \right\}$

D. none of these

Answer: D

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49. If $f(x) = (x + 1)\tan^{-1}(e^{-2x})$, then $f'(0)$ is

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

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

C. $\frac{\pi}{6} + 5$

D. $\frac{\pi}{4} + 1$

Answer: B



50. if $f(x) = 3e^{x^2}$ then $f'(x) - 2xf(x) + \frac{1}{3}f(0) - f'(0)$

A. 0

B. 1

C. $\left(\frac{7}{3}\right)e^{x^2}$

D. e^{x^2}

Answer: B

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51. If $y = ce^{x/(x-a)}$, then $\frac{dy}{dx}$ equals

A. $a(x-a)^2$

B. $-\frac{ay}{(x-a)^2}$

C. $a^2(x - a)^2$

D. $a(x - a)$

Answer: B

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52. If a curve is given by $x = a \cos t + \frac{b}{2} \cos 2t$ and $y = a \sin t + \frac{b}{2} \sin 2t$, then the points for which $\frac{d^2y}{dx^2} = 0$, are given by

A. $\sin \theta = \frac{2a^2 + b^2}{5ab}$

B. $\tan \theta = \frac{3a^2 + 2b^2}{4ab}$

C. $\cos \theta = -\frac{a^2 + 2b^2}{3ab}$

D. none of these

Answer: C

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53. If $y = \sin^{-1} \left(\frac{\sin \alpha \sin x}{1 - c\alpha \sin x} \right)$, then $y'(0)$, is

A. 1

B. $2 \tan \alpha$

C. $(1/2) \tan \alpha$

D. $\sin \alpha$

Answer: D



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54. If $y = \log_{x^2+4}(7x^2 - 5x + 1)$, then $\frac{dy}{dx}$ is equal to

A. $\log_e(x^2 + 4) \cdot \left\{ \frac{14x - 5}{7x^2 - 5x + 1} - \frac{2xy}{x^2 + 4} \right\}$

B. $\frac{1}{\log_e(x^2 + 4)} \left\{ \frac{14x - 5}{7x^2 - 5x + 1} - \frac{2xy}{x^2 + 4} \right\}$

C. $\log_e(7x^2 - 5x + 1) \left\{ \frac{2x}{x^2 + 4} - \frac{(14x - 5)y}{7x^2 - 5x + 1} \right\}$

D. $\frac{1}{\log_e(7x^2 - 5x + 1)} \left\{ \frac{2x}{x^2 + 4} - \frac{(14x - 5)y}{7x^2 - 5x + 1} \right\}$

Answer: B



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55. If a curve is given by $x = a \cos t + \frac{b}{2} \cos 2t$ and $y = a \sin t + \frac{b}{2} \sin 2t$, then the points for which $\frac{d^2y}{dx^2} = 0$, are given by

A. $\sin t = \frac{2a^2 + b^2}{3ab}$

B. $\cos t = -\frac{a^2 + 2b^2}{3ab}$

C. $\tan t = a/b$

D. none of these

Answer: B



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56. If $y = \sqrt{x + \sqrt{y + \sqrt{x + \sqrt{y + \dots \infty}}}}$, then $\frac{dy}{dx}$ is equal to

A. $\frac{y + x}{y^2 - 2}$

B. $\frac{y^3 - x}{2y^2 - 2xy - 1}$

C. $\frac{y^3 + x}{2y^2 - x}$

D. none of these

Answer: D



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57. If $x = e^{\tan^{-1}\left(\frac{y - x^2}{x^2}\right)}$ then $\frac{dy}{dx} =$

A. $\{2x + \tan(\log_e x)\} + x \sec^2(\log_e x)$

B. $x\{1 + \tan(\log_e x)\} + \sec^2(\log_e x)$

C. $2x\{1 + \tan(\log_e x)\} + x^2 \sec^2(\log_e x)$

D. $2x\{1 + \tan(\log_e x)\} + \sec^2(\log_e x)$

Answer: A

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58. $\frac{d}{dx} \left[\sin^2 \cot^{-1} \sqrt{\frac{1-x}{1+x}} \right]$ is

A. -1

B. $1/2$

C. $-1/2$

D. 1

Answer: B

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59. If $\sin y + e^{-x \cos y} = e$, then $\frac{dy}{dx}$ at $(1, \pi)$, is

A. $\sin y$

B. $-x \cos y$

C. e

D. $\sin y - x \cos y$

Answer: C

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60. If $\sqrt{1 - x^6} + \sqrt{1 - y^6} = a(x^3 - y^3)$, then prove that

$$\frac{dy}{dx} = \frac{x^2}{y^2} \sqrt{\frac{1 - y^6}{1 - x^6}}$$

A. $\frac{y}{x}$

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

C. $\frac{2y^2}{x^2}$

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

Answer: B

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Chapter Test

1. If $f(x) = \log_e [\log_e x]$, then what is $f'(e)$ equal to?

A. 0

B. 1

C. $1/e$

D. $e/2$

Answer: C



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2. If $e^y + xy = e$ then the value of $\frac{d^2y}{dx^2}$ for $x = 0$ is

A. $1/e$

B. $1/e^2$

C. $1/e^3$

D. e

Answer: B

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3. $\sqrt{x+y} + \sqrt{y-x} = c$, then $\frac{d^2y}{dx^2}$ equals

A. $2/c$

B. $-2/c^2$

C. $2/c^2$

D. $-2/c$

Answer: C

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4. If $ax^2 + 2hxy + by^2 = 1$, then $\frac{d^2y}{dx^2}$ is $\frac{h^2 - ab}{(hx + by)^2}$ (b) $\frac{ab - h^2}{(hx + by)^2}$
 $\frac{h^2 + ab}{(hx + by)^2}$ (d) none of these

A. $\frac{h^2 + ab}{(hx + by)^3}$

B. $\frac{h^2 - ab}{(hx + by)^2}$

C. $\frac{h^2 + ab}{(hx + by)^3}$

D. $\frac{h^2 - ab}{(hx + by)^3}$

Answer: D



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5. If $f(x) = \sin\left\{\frac{\pi}{2}[x] - x^5\right\}$, $1 < x < 2$ and $[.]$ denotes the greatest integer function, then $f'\left(5\sqrt{\frac{\pi}{2}}\right)$ is equal to

A. 0

B. $5(\pi/2)^{4/5}$

C. $-5(\pi/2)^{4/5}$

D. none of these

Answer: C

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6. If $f(x)$ is a polynomial of degree n (> 2) and $f(x) = f(\alpha - x)$,
(where α is a fixed real number), then the degree of $f'(x)$ is

A. n

B. $n - 1$

C. $n - 2$

D. none of these

Answer: B

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7. If $y = \sin(\log_e x)$, then $x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx}$ is equal to

A. $\sin(\log_e x)$

B. $\cos(\log_e x)$

C. y^2

D. $-y$

Answer: D



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8. If $f(x) = (1 - x)^n$, then the value of

$$f(0) + f'(0) + \frac{f''(0)}{2!} + \dots + \frac{f^n(0)}{n!}, \text{ is}$$

A. $2n$

B. 0

C. 2^{n-1}

D. none of these

Answer: B

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9. $x\sqrt{1+y} + y\sqrt{1+x} = 0$ then $\frac{dy}{dx} =$

A. $\frac{y - 2x(1+y)}{x^2 - 2y(1+x)}$

B. $\frac{y^2 - 2x(1+y)}{x^2 - 2y(1+x)}$

C. $\frac{y^2 - 2x(1+y)}{x - 2y(1+x)}$

D. None of these

Answer: B

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10. If $8f(x) + 6f\left(\frac{1}{x}\right) = x + 5$ and $y = x^2(f(x))$, then $\frac{dy}{dx}$ at $x = -1$ is equal to 0 (b) $\frac{1}{14}$ (c) $-\frac{1}{14}$ (d) None of these

A. 0

B. $\frac{1}{14}$

C. $-\frac{1}{14}$

D. $\frac{1}{7}$

Answer: C

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11. If $y = \sin^{-1}\left\{\frac{5x + 12\sqrt{1-x^2}}{13}\right\}$, find $\frac{dy}{dx}$.

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

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

C. $\frac{3}{\sqrt{1-x^2}}$

D. $\frac{1}{\sqrt{1+x^2}}$

Answer: A

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12. If $f(x) = \cos^{-1} \left\{ \frac{1 - (\log_e x)^2}{1 + (\log_e x)^2} \right\}$, then $f'(e)$

A. does not exist

B. is equal to $\frac{2}{e}$

C. is equal to $\frac{1}{e}$

D. is equal to 1

Answer: C

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13. $y = \sin^{-1}[\sqrt{x - ax} - \sqrt{a - ax}]$

A. $\frac{1}{\sin \sqrt{a - ax}}$

B. $\sin \sqrt{x} \sin \sqrt{a}$

C. $\frac{1}{2\sqrt{x(1-x)}}$

D. 0

Answer: C



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14. Let $f(x) = (x^3 + 2)^{30}$ If $f^n(x)$ is a polynomial of degree 20 where $f^n(x)$ denotes the n^{th} derivative of $f(x)$ w.r.t x then the value of n is

A. 60

B. 40

C. 70

D. 50

Answer: C



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15. If $f(x) = \cos^2 x + \cos^2\left(x + \frac{\pi}{3}\right) + \sin x \sin\left(x + \frac{\pi}{3}\right)$ and $g\left(\frac{5}{4}\right) = 3$, then $\frac{d}{dx}(g \circ f(x)) =$

A. 1

B. 0

C. -1

D. none of these

Answer: B



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16. If $f(x) = 10 \cos x + (13 + 2x)\sin x$ then $f'(x) + f(x) =$

- A. $\cos x$
- B. $4 \cos x$
- C. $\sin x$
- D. $4 \sin x$

Answer: B



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17. If a real valued function $f(x)$ satisfies the equation $f(x + y) = f(x) + f(y)$ for all $x, y \in R$ then $f(x)$ is

- A. $f'(x) = 0$ for all $x \in R$
- B. $f'(0) < f'(1)$
- C. $f'(x)$ does not exist

D. none of these

Answer: A



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18. If $f(x) = \log \left\{ \frac{u(x)}{v(x)} \right\}$, $u(1) = v(1)$ and $u'(1) = v'(1) = 2$, then find the value of $f'(1)$.

A. 0

B. 1

C. -1

D. none of these

Answer: A



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19. If $f'(x) = \arctan\left(\frac{x^x - x^{-x}}{2}\right)$, then $f'(1)$ is equal to

A. 1

B. -1

C. $\log 2$

D. none of these

Answer: D



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20. Let $f(x) = 2^{2x-1}$ and $g(x) = -2^x + 2x \log 2$. Then the set of points satisfying $f'(x) > g'(x)$, is

A. $(0, 1)$

B. $[0, 1)$

C. $(0, \infty)$

D. $[0, \infty)$

Answer: C

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21. If $y = \log_u |\cos 4x| + |\sin x|$, where $u = \sec 2x$ find $\frac{dy}{dx}$ at $x = -\frac{\pi}{6}$

A. $\frac{-6\sqrt{3}}{\log_e 2} - \frac{\sqrt{3}}{2}$

B. $\frac{-6\sqrt{3}}{\log_e 2} + \frac{\sqrt{3}}{2}$

C. $\frac{6\sqrt{3}}{\log_e 2} + \frac{\sqrt{3}}{2}$

D. none of these

Answer: A

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22. If $f(4) = 4$, $f'(4) = 1$, then $\lim_{x \rightarrow 4} \frac{2 - \sqrt{f(x)}}{2 - \sqrt{x}}$ is equal to

A. -1

B. 1

C. 2

D. -2

Answer: B



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23. If $2x^2 - 3xy + y^2 + x + 2y - 8 = 0$ then $\frac{dy}{dx}$

A. $\frac{3y - 4x - 1}{2y - 3x + 2}$

B. $\frac{3y + 4x + 1}{2y + 3x + 2}$

C. $\frac{3y - 4x + 1}{2y - 3x - 2}$

D. $\frac{3y - 4x + 1}{2y + 3x + 2}$

Answer: A

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24. If $y = \log \left\{ \left(\frac{1+x}{1-x} \right)^{1/4} \right\} - \frac{1}{2} \tan^{-1} x$, then $\frac{dy}{dx} =$

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

B. $\frac{x^2}{1-x^4}$

C. $\frac{x}{1+x^4}$

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

Answer: B

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25. If $x = \cos \theta$, $y = \sin 5\theta$, then $(1-x^2) \frac{d^2y}{dx^2} - x \frac{dy}{dx} =$

A. $-5y$

B. $5y$

C. $25y$

D. $-25y$

Answer: D



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26. If $f : \mathbb{R} \rightarrow \mathbb{R}$ is an even function which is twice differentiable on \mathbb{R} and

$f''(\pi) = 1$, then $f''(-\pi)$

A. -1

B. 0

C. 1

D. 2

Answer: C

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27. Observe the following statements:

I. If $f(x) = ax^{41} + bx^{-40}$, then $\frac{f''(x)}{f(x)} = 1640x^2$

II. $\frac{d}{dx} \left\{ \tan^{-1} \left(\frac{2x}{1-x^2} \right) \right\} = \frac{1}{1+x^2}$

Which of the following is correct ?

A. I is true, but II is false

B. Both I and II true

C. Neither I nor II is true

D. I is false, but II is true

Answer: A

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28. If $x = e^t \sin t$, $y = e^t \cos t$ then $\frac{d^2y}{dx^2}$ at $x = \pi$ is

A. $2e^\pi$

B. $\frac{1}{2}e^\pi$

C. $\frac{1}{2e^\pi}$

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

Answer: D



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29. The value of $\frac{dy}{dx}$ at $x = \frac{\pi}{2}$, where y is given by

$y = x^{\sin x} + \sqrt{x}$, is

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

B. 1

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

D. $1 - \frac{1}{\sqrt{2\pi}}$

Answer: A



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30. If $2^x + 2^y = 2^{x+y}$, then $\frac{dy}{dx}$ is equal to

A. $\frac{2^x + 2^y}{2^x - 2^y}$

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

C. $2^{x-y} \left(\frac{2^y - 1}{1 - 2^x} \right)$

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

Answer: C



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