MATHS

BOOKS - BITSAT GUIDE

DIFFERENTIAL COEFFICIENTS

Practice Exercise

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

A. 0

B. 1

C. 2

D. 4

Answer: C

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2. If $x^2 + y^2 = t - \frac{1}{t} and x^4 + y^4 = t^2 + \frac{1}{t^2}, then x^3 y \frac{dy}{dx} =$

0 (b) 1 (c) -1 (d) none of these

A. 1

B. 2

C. 3

D. 4

Answer: A

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

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

B. $\sqrt{2}$

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

D. $2\sqrt{2}$

Answer: A

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

A. 1

B. -1

C. 0

D. None

Answer: A

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5. If $f'(x) = \varphi(x)$ and $\varphi'(x) = f(x)$ for all x. Also, $f(3) = 5$ and $f'(3) = 4$. Then the value of

$[f(3)]^2 - [\varphi(3)]^2$ is

A. 0

B. 9

C. 41

D. None of these

Answer: B

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6. If $f(x) = x^n, \text{n}\varepsilon N,$ then the value of $f(1) - \frac{f'(1)}{1!} + \frac{f(1)}{2!} - (f'''')\frac{1}{3!} + \ldots + (-1)^n \frac{f^n(1)}{n!}$ is

A. 2^n

B. 0

C. 2^{n-1}

D. None of these

Answer: B

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7. Let $f(x) = x^2 + xg'(1) + g''(2)$ and $g(x) = x^2 + xf'(2) + f''(3)$, then

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

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

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

D. None of these

Answer: C

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8. 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. $2^{x-y}\frac{2^y - 1}{1 - 2^x}$

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

Answer: C

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9. The solution set of $f'(x) > g'(x)$, where $f(x) = \frac{1}{2}(5)^{2x+1}$ and $g(x) = 5^x + 4x \log_e 5$, is

A. $(1, \infty)$

B. (0,1)

C. $(\infty, 0)$

D. $(0, \infty)$

Answer: D

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10. If $y = \sec^{-1}\frac{\sqrt{x}+1}{\sqrt{x}-1} + \sin^{-1}\frac{\sqrt{x}-1}{\sqrt{x}+1}$, then $\frac{dy}{dx}$ is equal to

A. 0

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

C. 1

D. 3

Answer: A

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11. If $Y = \tan^{-1}\frac{4x}{1+5x^2} + \tan^{-1}\frac{2+3x}{3-2x}$, then $\frac{dy}{dx} =$

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

B. $\frac{5}{1+25x^2}$

C. 1

D. 2

Answer: B

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12. Let g(x) be the inverse of the function f(x) ,and $f'(x)\frac{1}{1+x^3}$ then g(x) equals

A. $\frac{1}{1+[g(x)]^3}$

B. $\frac{1}{1+[f(x)]^3}$

C. $1 + [g(x)]^3$

D. $1 + [f(x)]^3$

Answer: C

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13. If $f(x) = e^x g(x), g(0) = 2, g'(0) = 1, then f'(0)$ is

A. 1

B. 3

C. 2

D. 0

Answer: B

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14. if $y = \log x \cdot e^{(\tan x + x^2)}$, then $\frac{dy}{dx}$ is equal to

A. $e^{(\tan x + x^2)} \frac{1}{x} + \left(\sec^2 x + x\right) \log x$

B. $e^{(\tan x + x^2)} \frac{1}{x} + \left(\sec^2 x - x\right) \log x$

C. $e^{(\tan x + x^2)} \frac{1}{x} + \left(\sec^2 x + 2x\right) \log x$

D. $e^{(\tan x + x^2)} \frac{1}{x} + \left(\sec^2 x - 2x\right) \log x$

Answer: C

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15. If

$f(x) = \cos x \cos 2x \cos 4x \cos 8x \cos 16x, \quad \text{then} \quad f'\left(\frac{\pi}{4}\right)$

is

A. $\sqrt{2}$

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

C. 1

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

Answer: A

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16. The derivative of $y = (1 - x)(2 - x)(n - x) at x = 1$ is (b) $(-1)(n-1)!\, n! - 1$ (d) $(-1)^{n-1}(n-1)!$

A. 0

B. $(-1)(n-1)!$

C. $n! - n!$

D. $(-1)^{n-1}(n-1)!$

Answer: B

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17. f and g are two differentiable functions which satisfy the condition $g'(a) = 2, g(a) = b$ and $(fog) = I$

identity function , then f'(b) is equal to

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

B. 2

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

D. None

Answer: A

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18. If $f(x) = \sqrt{1 + \cos^2(x^2)}$, then $f'\left(\frac{\sqrt{\pi}}{2}\right)$ is

A. $\sqrt{\pi}/6$

B. $-\sqrt{\pi/6}$

C. $1/\sqrt{6}$

D. $\pi/\sqrt{6}$

Answer: B

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19. If $y = (1-x)(1+x^2)(1+x^4).....(1+x^{2n})$, then $\frac{dy}{dx}$ at x=0 is equal to

A. -1

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

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

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

Answer: A

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20. If $f(x) = \frac{x^2 - x}{x^2 + 2x}$, where $x \neq 0, -2$, then $\frac{d}{dx}\left[f^{-1}(x)\right]$ (wherever it is defined) is equal to

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

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

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

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

Answer: B

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21. If $y = \sin\left[\cos\left(x^2\right)\right]$ then $\frac{dy}{dx}$ is equal to

A. $-2x\sin x^2.\cos\left(\cos x^2\right)$

B. $-2x\sin x^2.\cos x^2$

C. $2x^2\sin x^2.\cos x^2$

D. None of these

Answer: A

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22. If $F(x) = f(x).g(x)$ and $f'(x).g'(x) = c$, then

A. $F' = c\frac{f}{f'} + \frac{g}{g'}$

B. $F' = c\frac{f}{f'} - \frac{g}{g'}$

C. $\frac{F''}{F} = \frac{f''}{f} + \frac{g''}{g} + \frac{2c}{fg}$

D. None of these

Answer: A

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23. If $y\cos x + x\cos y = \pi$, then $\frac{dy}{dx}$ is equal to

A. $\frac{y\sin x - \cos y}{\cos x - x\sin y}$

B. $\frac{\cos y - y\sin x}{x\sin y + \cos x}$

C. $\frac{y\sin x + \cos y}{\cos x - x\sin y}$

D. $\frac{y\sin x + \cos y}{\cos x + x\sin y}$

Answer: A

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24. Let f : (-1,1) $\rightarrow$ R be a differentiabale function with f(0) = -1 and f'(0) = 1. Let

g(x) = $[f(2f(x)+2)]^2$, then g'(0)=

A. 4

B. -4

C. 0

D. -2

Answer: B

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25. If $y = \frac{a^{\cos^{-1}x}}{1 + a^{\cos^{-1}x}}$ and $z = a^{\cos^{-1}x}$, then $\frac{dy}{dz}$ is equal to

A. $-\frac{1}{1 + a^{\cos^{-1}x}}$

B. $\frac{1}{1 + a^{\cos^{-1}x}}$

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

D. None of these

Answer: C

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

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

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

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

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

Answer: B

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

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

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

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

D. None of these

Answer: C

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28. If $y = \sec\left(\tan^{-1} x\right)$ 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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29. If $y = \sin^{-1} x \sin^{-1} \sqrt{1 + x^2}, \ -1 \leq x \leq 1,$ then $\frac{dy}{dx}$ is

A. 0

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

C. 1

D. 4

Answer: A

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30. If $x = \frac{2t}{1+t^2}$ and $y = \frac{1-t^2}{1+t^2}$, then $\frac{dy}{dx}$ is equal to

A. $\frac{2t}{t^2+1}$

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

C. $\frac{2t}{1-t^2}$

D. None

Answer: B

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31. If $x = a\cos t\sqrt{\cos 2t}$ and $y = a\sin t\sqrt{\cos 2t}$ (where, $a > 0$), then $\left|\frac{1+\frac{dy^2}{dx}^{\frac{3}{2}}}{\frac{d^2y}{dx^2}}\right|$ at $\frac{\pi}{6}$ is given by

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

B. $a\sqrt{2}$

C. $\frac{\sqrt{2}}{3a}$

D. $\frac{\sqrt{2a}}{3}$

Answer: D

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32. If $x = a(\theta + \sin\theta)$ and $y = a(1 - \cos\theta)$, find dy/dx.

A. $\tan\frac{\theta}{2}$

B. $\cot\frac{\theta}{2}$

C. $\tan\theta$

D. $\cot\theta$

Answer: A

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33. If $x = e^{-t^2}, y = \tan^{-1}(2t+1)$, then $\frac{dy}{dx} =$

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

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

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

D. None of these

Answer: B

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34. If $\sqrt{\left(x^2+y^2\right)}=ae^{\tan^{-1}(y/x)}, a>0,$ then y''(0) equals

A. $\frac{a}{2}e^{\pi/2}$

B. $ae^{\pi/2}$

C. $\frac{-2}{a}e^{-\pi/2}$

D. $\frac{a}{2}e^{-\pi/2}$

Answer: C

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35. The expression of $\frac{dy}{dx}$ of the function $y=a^{x^{a^{x\ldots\infty}}}$, 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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36. Derivative of $(\sin x)^x + \sin^{-1}\sqrt{x}$ with respect to x is

A. $(x\cot x + \log\sin x) + \frac{1}{2\sqrt{x-x^2}}$

B. $(x\cot x + \log\sin x) + \frac{1}{\sqrt{x-x^2}}$

C. $(\sin x)(x\cot x + \log) + \frac{1}{\sqrt{x-x^2}}$

D. $(\sin x)^x(x\cot x + \log\sin x) + \dfrac{1}{2\sqrt{x-x^2}}$

Answer: D

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37. If $x^m \cdot y^n = (x+y)^{m+n}$, then: $\dfrac{dy}{dx}$ is independent of

A. $\dfrac{x+y}{xy}$

B. xy

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

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

Answer: D

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38. Let $y = \sqrt{x + \sqrt{x + \sqrt{x + \ldots \infty}}}$, then $\frac{dy}{dx}$ is equal to

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

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

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

D. All

Answer: D

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

A. -1

B. 1

C. $\log 2$

D. $-\log 2$

Answer: A

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40. 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 $\frac{1}{8}$ (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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41. 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. zero

B. -1

C. independent of θ

D. None of these

Answer: B

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42. Let f(x) $= \begin{vmatrix} x^3 & \sin x & \cos x \\ 6 & -1 & 0 \\ p & p^2 & p^3 \end{vmatrix}$ where p is a constant. Then $\frac{d^3}{dx^3}\{f(x)\}$ at x=0 is

A. P

B. $P + P^2$

C. $P + P^3$

D. independent of P

Answer: D

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43. If $y = Ae^{-kt}\cos(pt + c)$, then prove that $\frac{d^2y}{dt^2} + 2k\frac{dy}{dx} + n^2y = 0$, where $n^2 = p^2 + k^2$

A. $p^2 - k^2$

B. p^2

C. k^2

D. $p^2 + k^2$

Answer: D

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

A. $2/c$

B. $-2/c^2$

C. $2/c^2$

D. None

Answer: C

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1. If x is in degrees, then: $\frac{d}{dx}(\cos x) =$

A. $-\sin x$

B. $-\frac{180}{\pi}\sin x$

C. $-\frac{\pi}{180}\sin x$

D. $\sin x$

Answer: C

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2. $\frac{d}{dx}[\log(\sec x - \tan x)]$ is equal to

A. $-\sec x$

B. $\sec x + \tan x$

C. $\sec x$

D. $\sec x - \tan x$

Answer: A

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3. If $x = \cos^3\theta$ and $y = \sin^3\theta$, then $1 + \frac{d^2y}{dx^2}$ is equal to

A. $\tan^2\theta$

B. $\cot^2\theta$

C. $\sec^2\theta$

D. $\cos ec^2\theta$

Answer: C

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4. If $x = \mathrm{at}^2, y = 2at$, then $\frac{d^2y}{dx^2}$ is equal to

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

B. $-\frac{1}{2at^3}$

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

D. $-\frac{a}{2t^3}$

Answer: B

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5. If $\Delta_1 = \begin{vmatrix} x & a & b \\ b & x & a \\ a & b & x \end{vmatrix}$ and $\Delta_2 = \begin{vmatrix} x & b \\ a & x \end{vmatrix}$ are the given determinants then

A. $\Delta_1 = 3(\Delta_2)^2$

B. $\frac{d}{dx}(\Delta_1) = 3\Delta_2$

C. $\frac{d}{dx}(\Delta_1) = 3(\Delta_2)^2$

D. $\Delta_1 = 3(\Delta_2)^{3/2}$

Answer: B

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6. $\frac{d}{dx}(x^x)$ is equal to

A. $x^x \log(e/x)$

B. $x^x \log ex$

C. $\log ex$

D. $x^x \log x$

Answer: B

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7. If $y^2 = P(x)$ is a polynomial of degree 3, then $2\left(\frac{d}{dx}\right)\left(y^2 \frac{d^2y}{dx^2}\right)$ is equal to $P^x + P'(x)$ (b) $P^x \dot{P}^x$ $P(x)\dot{P}^x$ (d) a constant

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

B. $P''(x)P'''(x)$

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

D. constant

Answer: C

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

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

A. 2^n

B. 0

C. 2^{n-1}

D. 1

Answer: B

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9. If $f(x) = \log_x$ (In x) then $f'(x)$ at x=e is

A. $1/e$

B. e

C. $-1/e$

D. 0

Answer: A

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10. 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. $0 < x < 1$

B. $0 \leq x < 1$

C. $x > 0$

D. $xgr0$

Answer: C

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11. $y = \sin^{-1}\left(\frac{5x + 12\sqrt{1 - x^2}}{13}\right)$

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

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

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

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

Answer: A

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

A. -1

B. 1

C. 2

D. 4

Answer: B

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14. If $\cos^{-1}\frac{1-x^2}{1+x^2}$, then $\frac{dy}{dx}$ is equal to

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

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

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

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

Answer: B

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15. If $y = \tan^{-1}\left[\frac{\sqrt{1+x^2}-\sqrt{1-x^2}}{\sqrt{1+x^2}+\sqrt{1-x^2}},\right]$ find $\frac{dy}{dx}$

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

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

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

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

Answer: D

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16. If x=sint and y=cos pt, then

A. $\left(1-x^2\right)y_2+xy_1+p^2y=0$

B. $\left(1-x^2\right)y_2+xy_1-p^2y=0$

C. $\left(1+x^2\right)y_2-xy_1+p^2y=0$

D. $(1-x)^2y_2-xy_1+p^2y=0$

Answer: D

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17. If $r=\left[2\varphi+\cos^2(2\varphi+\pi/4)\right]^{1/2}$, then what is the value of the derivative of $dr/d\varphi$ at $\varphi=\pi/4$?

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

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

C. $\frac{2^{1/2}}{\pi+1}$

D. $2\frac{2^{1/2}}{\pi+1}$

Answer: D

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