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Differentiation

- If $f(x) = \sin(\cos x)$, then $f'(x)$ is
 (A) $\cos(\cos x)$ (B) $\sin(-\sin x)$
 (C) $-\sin(\cos x)$ (D) $-\sin x \cos(\cos x)$
- The derivative of $\sin^{-1}\left(\frac{2x}{1+x^2}\right)$ wrt $\tan^{-1}\left(\frac{2x}{1-x^2}\right)$ is
 (A) -2 (B) -1
 (C) 1 (D) 2
- If $y = \operatorname{cosec}^{-1}\frac{\sqrt{x+1}}{\sqrt{x-1}} + \cos^{-1}\frac{\sqrt{x-1}}{\sqrt{x+1}}$, then $\frac{dy}{dx}$ is equal to
 (A) $\frac{2}{(\sqrt{x}-1)^2}$ (B) $\frac{2}{(\sqrt{x}+1)^2}$
 (C) $\frac{1}{x-1}$ (D) 0
- If $y = \sqrt{\sin x + \sqrt{\sin x + \sqrt{\sin x + \dots}}}$, then $\frac{dy}{dx}$ is equal to
 (A) $\frac{\sin x}{2y-1}$ (B) $\frac{\cos x}{2y-1}$
 (C) $\frac{y^2}{\cos x - x}$ (D) $\frac{2y-1}{\cos x}$
- If $y = \log \sqrt{\tan x}$, then what is the value of $\frac{dy}{dx}$ at $x = \frac{\pi}{4}$?
 (A) 0 (B) -1
 (C) $\frac{1}{2}$ (D) 1
- What is the derivative of $\sin^2 x$ wrt $\cos^2 x$?
 (A) $\tan^2 x$ (B) $\cot^2 x$
 (C) -1 (D) 1
- If $\sqrt{x} + \sqrt{y} = 2$, then what is the value of $\frac{dy}{dx}$ at $y = 1$?
 (A) 5 (B) 4
 (C) 2 (D) -1
- $\frac{d}{dx}\left(\tan^{-1}\frac{\sqrt{1+x^2}-1}{x}\right)$ is equal to
 (A) $\frac{1}{1+x^2}$
 (B) $\frac{x^2}{2\sqrt{1+x^2}(\sqrt{1+x^2}-1)}$
 (C) $\frac{2}{1+x^2}$
 (D) $\frac{1}{2(1+x^2)}$
- If $f(x) = \sin^2 x^2$, then what is the value of $f'(x)$?
 (A) $4x \sin(x^2) \cos(x^2)$
 (B) $2 \sin(x^2) \cos(x^2)$
 (C) $4 \sin(x^2) \sin^2 x$
 (D) $2x \cos^2(x)^2$
- If $x = \cos 2t$ and $y = \sin^2 t$, then what is the value of $\frac{d^2y}{dx^2}$?
 (A) 0 (B) $\sin(2t)$
 (C) $-\cos(2t)$ (D) $-\frac{1}{2}$
- If $y = \sin^{-1}\left(\frac{4x}{1+4x^2}\right)$, then what is the value of $\frac{dy}{dx}$?
 (A) $\frac{1}{1+4x^2}$ (B) $-\frac{1}{1+4x^2}$
 (C) $\frac{4}{1+4x^2}$ (D) $\frac{4x}{1+4x^2}$

- 12.. If $x = t^2$, $y = t^3$, then what is the value of $\frac{d^2y}{dx}$?
- (A) 1 (B) $\frac{3}{2t}$
 (C) $\frac{3}{4t}$ (D) $\frac{3}{2}$
13. If $y = \frac{x+1}{x-1}$, then what is the value of $\frac{dy}{dx}$?
- (A) $\frac{-2}{x-1}$ (B) $\frac{-2}{(x-1)^2}$
 (C) $\frac{2}{(x-1)^2}$ (D) $\frac{2}{x-1}$
14. The differential of e^{x^3} wrt $\log x$ is
- (A) e^{x^3} (B) $3x^2 2 e^{x^3}$
 (C) $3x^3 e^{x^3}$ (D) $3x^2 e^{x^3} + 3x^2$
15. If $x + y = t - \frac{1}{t}$, $x^2 + y^2 = t^2 + \frac{1}{t^2}$, what is the value of $\frac{dy}{dx}$?
- (A) $\frac{1}{x}$ (B) $-\frac{1}{x}$
 (C) $\frac{1}{x^2}$ (D) $-\frac{1}{x^2}$
16. If $y = \log_a x + \log_x a + \log_x x + \log_a a$, then $\frac{dy}{dx}$ is equal to
- (A) $\frac{1}{x} + x \log a$ (B) $\frac{\log a}{x} + \frac{x}{\log a}$
 (C) $\frac{1}{x \log a} + x \log a$ (D) $\frac{1}{x \log a} - \frac{\log a}{x(\log x)^2}$
17. If $y = e^{\frac{1}{2} \log(1+\tan^2 x)}$, then $\frac{dy}{dx}$ is equal to
- (A) $\frac{1}{2} \sec^2 x$ (B) $\sec^2 x$
 (C) $\sec x \tan x$ (D) $e^{\frac{1}{2} \log(1+\tan^2 x)}$
18. If $y = 2^x \cdot 3^{2x-1}$, then $\frac{dy}{dx}$ is equal to
- (A) $(\log 2)(\log 3)$
 (B) $(\log 18)$
 (C) $(\log 18^2) y^2$
 (D) $(\log 18)y$
19. If $\sqrt{1-x^2} + \sqrt{1-y^2} = a$, then what is the value of $\frac{dy}{dx}$?
- (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
20. If $x = \log t$ and $y = t^2 - 1$, then what is the value of $\frac{d^2y}{dx^2}$ at $t = 1$?
- (A) 2 (B) 3
 (C) -4 (D) 4
21. If $f(x) = \tan x + e^{-2x} - 7x^3$, then what is the value of $f'(0)$?
- (A) -2 (B) -1
 (C) 0 (D) 3
22. If $y = \sqrt{\cos x + \sqrt{\cos x + \sqrt{\cos x \dots \infty}}}$, then $\frac{dy}{dx}$ is equal to
- (A) $\frac{\sin x}{2y+1}$ (B) $\frac{\sin x}{2y-1}$
 (C) $-\frac{\sin x}{2y+1}$ (D) $-\frac{\sin x}{2y-1}$
23. If $x = at^2$ and $y = 2at$, then $\frac{d^2y}{dx^2}$ at $t = 2$ is
- (A) $-\frac{1}{3a}$ (B) $-\frac{1}{16a}$
 (C) $\frac{4a}{3}$ (D) None of these

24. If $x^y = e^{x-y}$, then $\frac{dy}{dx}$ is equal to which one of the following?
- (A) $\frac{(x-y)}{(1+\log x)^2}$ (B) $\frac{y}{(1+\log x)}$
 (C) $\frac{(x+y)}{(1+\log x)}$ (D) $\frac{(\log x)}{(1+\log x)^2}$
25. If $x = \sin t - t \cos t$ and $y = t \sin t + \cos t$, then what is $\frac{dy}{dx}$ at point $t = \frac{\pi}{2}$?
- (A) 0 (B) $\frac{\pi}{2}$
 (C) $-\frac{\pi}{2}$ (D) 1
26. If $f(x) = \sqrt{x + \sqrt{x + \sqrt{x + \sqrt{\dots\infty}}}}$, then what is the value of $f'(x)$?
- (A) $\frac{1}{1-2f(x)}$ (B) $\frac{1}{2f(x)-1}$
 (C) $\frac{1}{1+2f(x)}$ (D) $\frac{1}{2+f(x)}$
27. If $2^x + 2^y = 2^{x+y}$, then the value of $\frac{dy}{dx}$ at $x = y = 1$ is
- (A) 0 (B) -1
 (C) 1 (D) 2
28. The derivative of $\sin^{-1}\left(\frac{2x}{1+x^2}\right)$ wrt $\cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)$, is
- (A) -1 (B) 1
 (C) 2 (D) 4
29. If $x = \frac{1-t^2}{1+t^2}$ and $y = \frac{2t}{1+t^2}$, then $\frac{dy}{dx}$ is equal to
- (A) $-\frac{y}{x}$ (B) $\frac{y}{x}$
 (C) $-\frac{x}{y}$ (D) $\frac{x}{y}$
30. $\frac{d}{dx}\left[\tan^{-1}\left(\frac{a-x}{1+ax}\right)\right]$ is equal to
- (A) $-\frac{1}{1+x^2}$ (B) $\frac{1}{1+a^2} - \frac{1}{1+x^2}$
 (C) $\frac{1}{1+\left(\frac{a-x}{1+ax}\right)^2}$ (D) $\frac{-1}{\sqrt{1-\left(\frac{a-x}{1+ax}\right)^2}}$