

Sections 2.5-2.6: Derivatives of Trig Functions & Chain Rule

Find $f'(x)$.

1. $f(x) = 4\cos x + 2\sin x$
 3. $f(x) = -4x^2 \cos x$
 5. $f(x) = \frac{5 - \cos x}{5 + \sin x}$
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11. $f(x) = \sec x \tan x$
 13. $f(x) = \frac{\cot x}{1 + \csc x}$
 17. $f(x) = \frac{\sin x \sec x}{1 + x \tan x}$

Find $\frac{d^2 y}{dx^2}$.

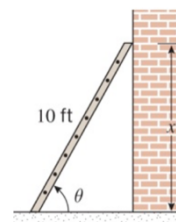
19. $y = x \cos x$
23. $f(x) = \sin x \cos x$

25. Find the equation of the tangent to the graph of $y = \tan x$ at:

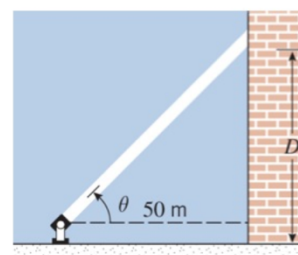
- a. $x = 0$
- b. $x = \frac{\pi}{4}$
- c. $x = -\frac{\pi}{4}$

27. a. Show that $y = x \sin x$ is a solution to $y'' + y = 2 \cos x$
- b. Show that $y = x \sin x$ is a solution of the equation $y^{(4)} + y'' = -2 \cos x$

31. A 10 ft ladder leans against a wall at an angle θ with the horizontal, as shown in the accompanying figure. The top of the ladder is x feet above the ground. If the bottom of the ladder is pushed toward the wall, find the rate at which x changes with respect to θ when $\theta = 60^\circ$. Express the answer in feet/degree.



33. A searchlight is trained on the side of a tall building. As the light rotates, the spot it illuminates moves up and down the side of the building. That is, the distance D between ground level and the illuminated spot on the side of the building is a function of the angle θ formed by the light beam and the horizontal (see accompanying figure). If the searchlight is located 50 m from the building, find the rate at which D is changing with respect to θ when $\theta = 45^\circ$. Express your answer in units of meters/degree.



39. Make a conjecture about the derivative of $\frac{d^{87}}{dx^{87}}[\sin x]$ by calculating the first few derivatives and observing the resulting pattern.

Find $f'(x)$.

11. $f(x) = \frac{4}{(3x^2 - 2x + 1)^3}$

13. $f(x) = \sqrt{4 + \sqrt{3x}}$

15. $f(x) = \sin\left(\frac{1}{x^2}\right)$

17. $f(x) = 4\cos^5 x$

21. $f(x) = 2\sec^2(x^7)$

25. $f(x) = [x + \csc(x^3 + 3)]^{-3}$

Find $\frac{dy}{dx}$.

32. $y = \sin(\tan 3x)$

34. $y = \frac{1 + \csc(x^2)}{1 - \cot(x^2)}$

41. Use a CAS to find $\frac{dy}{dx}$ of $y = [x \sin 2x + \tan^4(x^7)]^5$.

45. Find an equation for the tangent line to the graph of $y = \sec^3\left(\frac{\pi}{2} - x\right)$ at $x = -\frac{\pi}{2}$.

59. a. Use a graphing utility to obtain the graph of the function $f(x) = x\sqrt{4 - x^2}$.
 b. Use the graph in part (a) to make a rough sketch of the graph of f' .
 c. Find $f'(x)$, and then check your work in part (b) by using the graphing utility to graph f' .
 d. Find the equation of the tangent line to the graph of f at $x=1$, and graph f and the tangent line together.

68. Use the accompanying figure of f to evaluate $\frac{d}{dx}[f(2\sin x)]\bigg|_{x=\frac{\pi}{6}}$

