

Find the derivative for each function.

1. $y = (3x^2 + 6)(2x - 1)$

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

3. $y = x^2 \cos x$

4. $y = \cos^2(3\sqrt{x})$

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

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

6. Find the equations of the tangent and normal lines to the curve
 $y = 4 + \cot x - 2 \csc x$ at $x = \frac{\pi}{2}$.

7. Find $\frac{d^2y}{dx^2}$ for $y = \tan 3x$

8. **Working with Numerical Values** Suppose that a function f and its first derivative have the following values at $x = 0$ and $x = 1$.

x	$f(x)$	$f'(x)$
0	9	-2
1	-3	1/5

Find the first derivative of the following combinations at the given value of x .

(a) $\sqrt{x}f(x)$, $x = 1$

(b) $\sqrt{f(x)}$, $x = 0$

(c) $f(\sqrt{x})$, $x = 1$

9. $y = \sec t$ $x = \frac{1}{2}\pi - t$

Find $\frac{dy}{dt}$, $\frac{dx}{dt}$, and $\frac{dy}{dx}$ at $t = \pi/4$

Find $\frac{d^2y}{dx^2}$ also at $t = \pi/4$

Answers:

1. $y' = 18x^2 - 6x + 12$

2. $y' = \frac{7}{(x+3)^2}$

3. $y' = -x^2 \sin x + 2x \cos x$

4. $y' = \frac{-3 \cos(3\sqrt{x}) \sin(3\sqrt{x})}{\sqrt{x}}$

5. $y' = 3 \cos(\tan 3x) \sec^2 3x$, $y'' = 18 \cos(\tan 3x) \sec^2 3x \tan 3x - 9 \sin(\tan 3x) \sec^4 3x$

6. Tangent: $y - 2 = -1(x - \frac{\pi}{2})$ Normal: $y - 2 = 1(x - \frac{\pi}{2})$

7. $\frac{dy}{dx} = 3 \sec^2 3x$, $\frac{d^2y}{dx^2} = 18 \sec^2 3x \tan 3x$

8. a) -13/10 b) -1/3 c) 1/10

9. $\frac{dy}{dt} = \sec t \tan t$, $\frac{dx}{dt} = -1$, $\frac{dy}{dx} \Big|_{t=\frac{\pi}{4}} = \sqrt{2}$, $\frac{d^2y}{dx^2} \Big|_{t=\frac{\pi}{4}} = 3\sqrt{2}$ (did you divide by $\frac{dx}{dt}$?)