

2.8 | The Derivative as a Function

$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x + h) - f(x)}{h}$$

If $f(x) = x^3 - x$, find a formula for $f'(x)$.

If $f(x) = \sqrt{x}$, find the derivative of f . State the domain of f' .

Find f' if $f(x) = \frac{1 - x}{2 + x}$.

3.1 | Derivatives of Polynomials and Exponential Functions

The Power Rule (General Version) If n is any real number, then

$$\frac{d}{dx}(x^n) = nx^{n-1}$$

If $f(x) = x^6$, then $f'(x) = 6x^5$.

If $y = x^{1000}$, then $y' = 1000x^{999}$.

If $y = t^4$, then $\frac{dy}{dt} = 4t^3$.

Derivative of a Constant Function

$$\frac{d}{dx}(c) = 0$$

The Sum and Difference Rules If f and g are both differentiable, then

$$\frac{d}{dx}[f(x) + g(x)] = \frac{d}{dx}f(x) + \frac{d}{dx}g(x)$$

$$\frac{d}{dx}[f(x) - g(x)] = \frac{d}{dx}f(x) - \frac{d}{dx}g(x)$$

$$\frac{d}{dx} (x^8 + 12x^5 - 4x^4 + 10x^3 - 6x + 5)$$

Derivative of the Natural Exponential Function

$$\frac{d}{dx} (e^x) = e^x$$

Derivative of the Exponential Function

$$y = b^{f(x)} \Rightarrow y' = b^{f(x)} \ln(b) f'(x)$$

3–34 Differentiate the function.

3. $g(x) = 4x + 7$

5. $f(x) = x^{75} - x + 3$

10. $r(z) = z^{-5} - z^{1/2}$

18. $W(t) = \sqrt{t} - 2e^t$

20. $F(t) = (2t - 3)^2$

41–42 Find equations of the tangent line and normal line to the curve at the given point.

42. $y = x^{3/2}, \quad (1, 1)$