

1. Given a function $f(x)$ with derivative $f'(x)$, the second derivative $f''(x)$ is the derivative of the derivative $\frac{d}{dx}f'(x)$, the third derivative $f'''(x)$ is the derivative of the second derivative $\frac{d}{dx}f''(x)$, and so on.

For each of the following functions, calculate its derivative and second derivative.

$$f(x) = 5x^3 + x + e^2$$

$$g(x) = \sqrt{x}e^x$$

$$h(x) = \frac{e^x}{x^2+1}$$

2. Recall the derivative measures the instantaneous rate of change. If $h(t)$ measures the height of a rocket (in meters) at time t (in seconds). Determine what the following represent physically:

$$h'(t)$$

$$h''(t)$$

$$h'''(t)$$

3. Given $f(1) = 3$ and $f'(1) = -2$ determine $\frac{d}{dx} \frac{f(x)}{x^2}$ at $x = 1$.