Exercise 48

Find the first and second derivatives of the function. Check to see that your answers are reasonable by comparing the graphs of f, f', and f''.

$$f(x) = e^x - x^3$$

Solution

Calculate the first derivative.

$$\begin{aligned} f'(x) &= \frac{d}{dx}(e^x - x^3) \\ &= \frac{d}{dx}(e^x) - \frac{d}{dx}(x^3) \\ &= e^x - 3x^2 \end{aligned}$$

Calculate the second derivative.

$$\begin{aligned} f''(x) &= \frac{d}{dx}(e^x - 3x^2) \\ &= \frac{d}{dx}(e^x) - \frac{d}{dx}(3x^2) \\ &= \frac{d}{dx}(e^x) - 3\frac{d}{dx}(x^2) \\ &= (e^x) - 3(2x) \\ &= e^x - 6x \end{aligned}$$

Below is a graph of $f(x)$ versus x, $f'(x)$ versus x, and $f''(x)$ versus x.