Why the product rule is true:

$$\frac{d}{dx}\left(f(x)\,g(x)\right)$$

$$= \lim_{h\to 0} \frac{f(x+h)\,g(x+h) - f(x)\,g(x)}{h}$$

$$= \lim_{h\to 0} \frac{f(x+h)\,g(x+h) - f(x)\,g(x+h) + f(x)\,g(x+h) - f(x)\,g(x)}{h}$$

$$= \lim_{h\to 0} \left(\frac{f(x+h)\,g(x+h) - f(x)\,g(x+h)}{h} + \frac{f(x)\,g(x+h) - f(x)\,g(x)}{h} \right)$$

$$= \lim_{h\to 0} \left(\left[\frac{f(x+h) - f(x)}{h}\right] g(x+h) \;+\; f(x) \left[\frac{g(x+h) - g(x)}{h}\right] \right)$$

$$= f'(x)g(x) + f(x)g'(x)$$

1. For each function, find its derivative.

   (a) $h(x) = (x^{3/2} - 4x)\left(\sqrt{x} + \dfrac{2}{x^3}\right)$

   (b) $h(x) = \dfrac{3 + 2x^{-3}}{8x^3 - 4x}$

   (c) $h(x) = \dfrac{(x^2 - 2x)\left(x^{10} - \dfrac{1}{x}\right)}{x^2}$

2. Using the function from 1(b), find the equation of the line tangent to $y = h(x)$ at $x = 1$.