Example 1

Find $\dfrac{dy}{dx}$ for $y = 8\sqrt[4]{x^3} - \dfrac{7}{\sqrt{x^3}}$.

Example 2

Find $g'(x)$ and $g''(x)$ for $g(x) = x^2 (x+3) e^x$.

Example 3

Find $h'(x)$ for $h(x) = \dfrac{x^2 e^x}{x^2 + 1}$.

Example 4

Suppose that $f(3) = 5$, $g(3) = -2$, $f'(3) = -4$, and $g'(3) = 6$. Let $k(x) = f(x)g(x)$. Find $k'(3)$.

Example 5

A bookstore currently makes an average profit of \$3 per book, but this is declining by about \$0.05 every month. The bookstore sells about 2000 books every month and this is increasing at the rate of about 40 books every month. Use the Product Rule to estimate the rate at which the bookstore's total monthly profit is either increasing or decreasing, in dollars per month. Explain what each of the two terms in the Product Rule represent in this problem.

Example 6

Find the equation of the tangent line to the curve $y = (x+1) e^{-x/2}$ at the point where $x = 0$.

Example 7

Find the point(s) on the curve $y = \dfrac{x+1}{x}$ where the tangent line goes through the point $(1,1)$.

Example 8

Differentiate
(a) $w = \left(u^3 - 2\right)^2 \left(u^2 + 3u + 1\right)^4$

(b) $f(x) = \dfrac{(x+1)^2}{\sqrt{3x-4}}$

(c) $y = \sqrt{1 + \left(\sqrt[3]{1 + e^{3x}}\right)^2}$