1.6 The Product and Quotient Rule

The Product Rule

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

Example 1 Find the derivative of $(3x^2 + 8x - 5)(5x^2 - 2x - 9)$

Example 2 Find $f'(4)$ given $f(x) = \left(\sqrt{x} - x^2\right)^2$

Example 3 Find the derivative of $y = (2x + 3)(5x - 2)(4x + 1)$

The Quotient Rule

$$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{g(x)\cdot f'(x) - f(x)\cdot g'(x)}{[g(x)]^2}$$

or, “low d high, minus high d low, over low low”.

Example 4 Find $\frac{d}{dx}\left[\frac{3x-5}{2x+1}\right]$

Example 5 Find the equation of the line tangent to the curve $y = \frac{2x^3-3x}{x^2+2x}$ when $x = 1$.

Example 6 Find $\frac{d}{dx}\left[\frac{(2x^2+3x)(4x-9)}{3x+5}\right]$

Example 7 Find the marginal average cost when $x = 20$ if $C(x) = -4.2x^{0.15} + 0.02x^3 + 2000$