ASSIGNMENT 6

Basic differentiation rules

Reading: §2.3 in Smith-Minton

Basic derivatives to memorize:

$$\frac{d}{dx}[x] = 1, \qquad \frac{d}{dx}\left[x^2\right] = 2x, \qquad \frac{d}{dx}\left[\sqrt{x}\right] = \frac{1}{2\sqrt{x}}, \qquad \frac{d}{dx}\left[\frac{1}{x}\right] = -\frac{1}{x^2},$$

Basic rules

Constant rule: The derivative of any constant function is zero

$$\frac{d}{dx}[c] = 0$$

Addition/subtraction rule: Derivatives respect addition/subtraction

$$\frac{d}{dx}[f(x) \pm g(x)] = \frac{d}{dx}[f(x)] \pm \frac{d}{dx}[g(x)]$$

Scaling rule: Derivatives respect scaling

$$\frac{d}{dx}[cf(x)] = c\frac{d}{dx}[f(x)]$$

Examples (Hint: rearrange first. . .)

$$\frac{d}{dx}\left[3x^2\right] = ? \qquad \frac{d}{dx}\left[5x - 4\sqrt{x}\right] = ? \qquad \frac{d}{dx}\left[\frac{2x+3}{x}\right] = ? \qquad \frac{d}{dx}\left[\frac{x}{x+1}\right] = ?$$

Power rule: $\frac{d}{dx}[x^r] = rx^{r-1}$

Exercise 6.1. Compute the following derivatives. (These are exercises 1 - 12 in §2.3 of the text)

(1) $f(x) = x^3 - 2x + 1$

(2) $f(x) = x^9 - 3x^5 + 4x^2 - 4x$

(3) $f(t) = 3t^2 - 2\sqrt{t}$

(4) $f(s) - 5\sqrt{s} - 4s^2 + 3$

(5) $f(w) = \dfrac{3}{w} - 8w + 1$

(6) $f(y) = \dfrac{2}{y^4} - y^3 + 2$

(7) $h(x) = \dfrac{10}{\sqrt[3]{x}} - 2x + \pi$

(8) $h(x) = 12x - x^2 - \dfrac{3}{\sqrt{x^2}}$

(9) $f(s) = 2s^{3/2} - 3s^{-1/3}$

(10) $f(t) = 3t^{\pi} - 2t^{1.3}$

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

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