

## Section 4.1

### Section Objectives:

- Know the following derivative rules. Be comfortable using them in a variety of problems.

function	derivative
$f(x) = c$	$f'(x) = 0$
$f(x) = x^n$	$f'(x) = nx^{n-1}$
$f(x) = e^x$	$f'(x) = e^x$
$g(x) = c \cdot f(x)$	$g'(x) = c \cdot f'(x)$
$f(x) = \ln(x)$	$f'(x) = \frac{1}{x}$
$h(x) = f(x) \pm g(x)$	$h'(x) = f'(x) \pm g'(x)$

- Solve problems involving derivatives, like finding where there is a horizontal or vertical tangent.
- Know how to find and interpret derivatives in application problems.
- Know the definitions and interpretations of marginal cost, marginal revenue and marginal profit.

### Practice Problems

1. Evaluate the following derivatives using the rules we learned in this section. (Practice, practice practice!!)

(a)  $\frac{d}{dx}(3x^2 + 2)$

(b)  $\frac{d}{dx}(\sqrt{x} + 5x^3 + e^x)$

(c)  $\frac{d}{dx}(e^x - 3\ln(x))$

(d)  $\frac{d}{dx}((x - 1)^3)$

(e)  $\frac{d}{dx}\left(\frac{2x^3 + x + x^2e^x}{x^2}\right)$

(f)  $\frac{d}{dx}\left(\sqrt[4]{x^3} + \ln(x^2)\right)$

2. Let  $f(x) = x^4 + x^3$ . Find all point where there are horizontal tangents.
3. Let  $f(x) = \frac{1}{3}x^3 + \frac{3}{2}x^2 - 9x + 5$ . Find  $x > 0$  where the slope of the tangent line is equal to 1. Then find the equation of the tangent line at that point.
4. David has decided to start a business that sells goldfish. He finds his revenue model to be  $R(x) = \sqrt{x}(x + 7)$  where  $x$  is in hundreds of goldfish sold.
- (a) Find  $R'(x)$ .
- (b) Find and interpret  $R(4)$ . Be sure to include units.
- (c) Find and interpret  $R'(4)$ . Be sure to include units.

**More Practice from Textbook 1.1:** You should do as many problems from each set (1-64 (note all the different notation for derivatives, 65-66, 67-68, 69 -72, 73-88, 89-97), as needed until you are comfortable with these techniques. 73-88 are good practice for application problems.