

## Section 3.2

**Derivative Product Rule:** If  $u$  and  $v$  are differentiable function at  $x$ , then so is their product  $uv$ , and

$$\frac{d}{dx}(uv) = u \frac{dv}{dx} + v \frac{du}{dx}.$$

**Exercise 1.** Find the derivative of the following functions. (Hass Sec 3.3 Ex 6)

(a)  $y = \frac{1}{x}(x^2 + e^x)$     (b)  $y = e^{2x}$     (c)  $y = (x^2 + 1)(x^3 + 3)$

**Class Exercise 1.** Find the derivative of the following functions. (#4,10,12)

(a)  $g(x) = \sqrt{x} \cdot e^x$     (b)  $J(v) = (v^3 - 2v)(v^{-4} + v^{-2})$     (c)  $f(z) = (1 - e^z)(z + e^z)$

**Derivative Quotient Rule:** If  $u$  and  $v$  are differentiable at  $x$  and if  $v(x) \neq 0$ , then the quotient  $u/v$  is differentiable at  $x$ , and

$$\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2}.$$

**Exercise 2.** Find the derivative of the following functions. (Hass Sec 3.3 Ex 8(a), 9)

(a)  $y = \frac{t^2-1}{t^3+1}$     (b)  $y = \frac{(x-1)(x^2-2x)}{x^4}$

**Class Exercise 2.** Find the derivative of the following functions. (#8,14,16,22,24)

(a)  $G(x) = \frac{x^2-2}{2x+1}$     (b)  $y = \frac{x+1}{x^3+x-2}$     (c)  $y = \frac{t}{(t-1)^2}$   
(d)  $g(t) = \frac{t-\sqrt{t}}{t^{1/3}}$     (e)  $f(x) = \frac{1-xe^x}{x+e^x}$

**Definition:** If  $f'$  has a derivative, it is denoted by  $f''$  and is called the **second derivative** of  $f$ . Thus

$$f''(x) = D_x[f'(x)] = D_x[D_x f(x)] = D_x^2 f(x).$$

**Exercise 3.** Find  $f'''$  for  $f(x) = x^4 - 3x^3 + 6x^2$ .

**Class Exercise 3.** Find  $f''''$  for  $f(x) = x^5 - 4x^3 - 9$ .

Homework: 1, 3, 5, 11, 19, 23, 25, 29, 31, 35, 37