Section 3.5

Exercise 1. Suppose y is a function of x. Find (a) $\frac{d}{dx}(y^2)$ (b) $\frac{d}{dx}y^3$.

Exercise 2. Find dy/dx if $x + y = 1$.

Exercise 3. Find $\frac{dy}{dx}$ if $y^4 + 3y - 4x^3 = 5x + 1$.

We can find dy/dx using the method of **implicit differentiation**, in which we differentiate each term of the equation with respect to x.

Exercise 4. Assuming that the equation $y^4 + 3y - 4x^3 = 5x + 1$ determines, implicitly, a differentiable function f such that $y = f(x)$, find its derivative. (Swok Sec 3.7 Ex 2)

Exercise 5. If $y = f(x)$, where f is determined implicitly by the equation $x^2 + y^2 = 1$, find y'. (Swok Sec 3.7 Ex 4)

Exercise 6. Find y' if $4xy^3 - x^2y + x^3 - 5x + 6 = 0$. (Swok Sec 3.7 Ex 5)

Exercise 7. Find y' if $y = x^2 \sin y$. (Swok Sec 3.7 Ex 6)

Class Exercise 1. Find dy/dx. (Waits Sec 3.7 #9-20)
(a) $x^2y + xy^2 = 6$ (b) $x^3 + y^3 = 18xy$ (c) $y^2 = \frac{x-1}{x+1}$ (d) $x^2 = \frac{x-y}{x+y}$
(e) $y = \sqrt{1 - \sqrt{x}}$ (f) $y = (2x^{-1/2} + 1)^{-1/3}$ (g) $y = 3(\csc x)^{3/2}$ (h) $y = [\sin(x + 5)]^{5/4}$
(i) $x = \tan y$ (j) $x = \sin y$ (k) $x + \tan(xy) = 0$ (l) $x + \sin(xy) = xy$

Exercise 8. Find d^2y/dx^2 if $2x^3 - 3y^2 = 8$. (Hass Sec 3.7 Ex 4)

Class Exercise 2. Use implicit differentiation to find dy/dx and d^2y/dx^2. (Waits Sec 3.7 #23-26)
(a) $x^2 + y^2 = 1$ (b) $x^{2/3} + y^{2/3} = 1$ (c) $y^2 = x^2 + 2x$ (d) $y^2 + 2y = 2x + 1$

Exercise 9. Suppose $y = \sin^{-1}(x)$. Find $\frac{dy}{dx}$. (Swok Page 434)

Exercise 10. Suppose $y = \tan^{-1}(x)$. Find $\frac{dy}{dx}$. (Swok Page 434)

Exercise 11. Suppose $y = \sec^{-1}(x)$. Find $\frac{dy}{dx}$. (Swok Page 435)

Class Exercise 3. Suppose $y = \cos^{-1}(x)$. Find $\frac{dy}{dx}$.

Class Exercise 4. Suppose $y = \cot^{-1}(x)$. Find $\frac{dy}{dx}$.

Class Exercise 5. Suppose $y = \csc^{-1}(x)$. Find $\frac{dy}{dx}$.

From the previous exercises and class exercises, we have the following formulas:
1. $\frac{d}{dx}(\sin^{-1}x) = \frac{1}{\sqrt{1-x^2}}$
2. $\frac{d}{dx}(\cos^{-1}x) = -\frac{1}{\sqrt{1-x^2}}$
3. $\frac{d}{dx}(\tan^{-1}x) = \frac{1}{1+x^2}$
4. $\frac{d}{dx}(\cot^{-1}x) = -\frac{1}{1+x^2}$
5. $\frac{d}{dx}(\sec^{-1}x) = \frac{1}{x\sqrt{x^2-1}}$
6. $\frac{d}{dx}(\csc^{-1}x) = -\frac{1}{x\sqrt{x^2-1}}$

Exercise 12. Find $\frac{d}{dx}(\sin^{-1}x^2)$. (Hass Sec 3.9 Ex 2)

Exercise 13. Find $\frac{d}{dx}(\sec^{-1}(5x^4))$. (Hass Sec 3.9 Ex 3)

Class Exercise 6. Find the derivative of the function. (#50-60 even)
(a) $y = \tan^{-1}(x^2)$ (b) $g(x) = \sqrt{x^2 - 1}\,\sec^{-1}x$ (c) $y = \tan^{-1}(x - \sqrt{1 + x^2})$
(d) $F(\theta) = \arcsin\sqrt{\sin\theta}$ (e) $y = \cos^{-1}(\sin^{-1}t)$ (f) $y = \arctan\sqrt{\frac{1-x}{1+x}}$.

Homework: 3, 7, 15, 21, 25, 31-51 (every 4th)