

### Section 3.3

Here are some limits we will use to find derivatives of trigonometric functions:

$$\lim_{\theta \rightarrow 0} (\sin \theta)/\theta = 1$$

$$\lim_{\theta \rightarrow 0} (\cos \theta - 1)/\theta = 0$$

**Exercise 1.** Find  $\frac{d}{dx} (\sin x)$  using the definition of the derivative.

**Class Exercise 1.** Find  $\frac{d}{dx} (\cos x)$  using the definition of the derivative.

**Exercise 2.** Find  $\frac{d}{dx} (\tan x)$  using the Quotient Rule.

**Class Exercise 2.** Find  $\frac{d}{dx} (\cot x)$  using the Quotient Rule.

**Exercise 3.** Find  $\frac{d}{dx} (\sec x)$  using the Quotient Rule.

**Class Exercise 3.** Find  $\frac{d}{dx} (\csc x)$  using the Quotient Rule.

In summary, here are the derivatives of the six trigonometric functions:

1.  $\frac{d}{dx} (\sin x) = \cos x$
2.  $\frac{d}{dx} (\cos x) = -\sin x$
3.  $\frac{d}{dx} (\tan x) = \sec^2 x$
4.  $\frac{d}{dx} (\cot x) = -\csc^2 x$
5.  $\frac{d}{dx} (\sec x) = \sec x \tan x$
6.  $\frac{d}{dx} (\csc x) = -\csc x \cot x$

**Exercise 4.** Find  $y'$  if  $y = e^x \sin x$ . (Hass Sec 3.5 Ex 1(b))

**Exercise 5.** Find  $y'$  if  $y = (\sin x)/(1 + \cos x)$ . (Swok Sec 3.4 Ex 1)

**Exercise 6.** Find  $g'(x)$  if  $g(x) = \sec x \tan x$ . (Swok Sec 3.4 Ex 2)

**Exercise 7.** Find  $dy/d\theta$  if  $y = \sec \theta \cot \theta$ . (Swok Sec 3.4 Ex 3)

**Class Exercise 4.** Find  $dy/dx$ . (Waits Sec 3.5 #1-10)

(a)  $y = 1 + x - \cos x$    (b)  $y = 2 \sin x - \tan x$    (c)  $y = \frac{1}{x} + 5 \sin x$

(d)  $y = x \sec x$    (e)  $y = 4 - x^2 \sin x$    (f)  $y = 3x + x \tan x$

(g)  $y = 4/(\cos x)$    (h)  $y = x/(1 + \cos x)$

(i)  $y = (\cot x)/(1 + \cot x)$    (j)  $y = (\cos x)/(1 + \sin x)$

**Exercise 8.** Show that  $\lim_{x \rightarrow 0} (\sin 2x)/5x = \frac{2}{5}$ . (Hass Sec 2.4 Ex 5)

**Exercise 9.** Find  $\lim_{t \rightarrow 0} (\tan t \sec 2t)/3t$ . (Hass Sec 2.4 Ex 6)

**Class Exercise 5.** Find the limit. (#40-48 even)   (a)  $\lim_{x \rightarrow 0} (\sin 4x)/(\sin 6x)$

(b)  $\lim_{\theta \rightarrow 0} (\cos \theta - 1)/(\sin \theta)$    (c)  $\lim_{x \rightarrow 0} (\sin 3x \sin 5x)/x^2$

(d)  $\lim_{x \rightarrow 0} (\sin(x^2))/x$    (e)  $\lim_{x \rightarrow 1} \sin(x-1)/(x^2 + x - 2)$

Homework: 1, 7, 15, 19, 23, 27, 31, 35, 39