MATH 1420: WORKSHEET FOR SECTION 3.4

MORE RULES FOR DERIVATIVES: TRIG AND EXPONENTIALS

Trig functions.

$$\frac{\mathrm{d}}{\mathrm{d}x} \sin x = \cos x$$

$$\frac{\mathrm{d}}{\mathrm{d}x} \cos x = -\sin x$$

$$\frac{\mathrm{d}}{\mathrm{d}x} \tan x = \sec^2 x$$

$$\frac{\mathrm{d}}{\mathrm{d}x} \cot x = -\csc^2 x$$

$$\frac{\mathrm{d}}{\mathrm{d}x} \sec x = \tan x \sec x$$

$$\frac{\mathrm{d}}{\mathrm{d}x} \csc x = -\cot x \csc x$$

Exponential functions.

$$\frac{\mathrm{d}}{\mathrm{d}x} e^x = e^x$$

$$\frac{\mathrm{d}}{\mathrm{d}x} b^x = \ln(b) \cdot b^x, \qquad \text{where } b \neq 1 \text{ is positive}$$

Here's some problems to practice differentiating with these rules.

(1) Differentiate $a(x) = 2\sin x - \cos x$. Then find $a''(x)$.
(2) Differentiate $b(x) = e^x \sin x$ using the product rule.
(3) If $c(x) = \cot x$, find $c'(x)$ and $c''(x)$.
(4) Use the rules for differentiating sin and cos and the quotient rule to work out the rules for differentiating the other four trig functions.
(5) Differentiate $d(x) = (\sin x + \cos x)(\sin x + \cos x)$.
(6) If $f(x) = 20 \cdot 4^x$, determine $f'(0)$.
(7) Find the second derivative of $\sin x$ and $\cos x$. Then find the third derivatives, then the fourth derivatives. What is the pattern if you keep differentiating?
(8) Find the first, second, third, and so on derivatives of e^x. Then do the same for b^x for b an arbitrary base. What is the general pattern?