Closing Thurs: 3.1-2
Closing Fri: 3.3
Closing next Fri: 3.4(1), 3.4(2)

Exam 1 is Tuesday, Oct 24th in quiz section. 2.1-2.3,2.5-2.8, 3.1-3.3.

- One 8.5 by 11 inch sheet of ***handwritten*** notes (front and back)
- A Ti-30x IIs calculator (no other calc)
- Pen or pencil (no red or green)
- No make-up exams.

All homework is fair game. Know the concepts well. Practice on old exams.

$$6.\ \frac{d}{dx}(f(x)g(x)) = f(x)g'(x) + f'(x)g(x)$$

$$7.\ \frac{d}{dx}\left(\frac{f(x)}{g(x)}\right) = \frac{g(x)f'(x) - f(x)g'(x)}{g(x)^2}$$

Entry Task: Find the derivatives of

1) $y = (x^4 + 3)^2 + x^5 e^x$

2) $y = \dfrac{2x^2 + 1}{x^3 e^x}$

“Proof” of product rule

$$\lim_{h\to 0}\frac{f(x+h)g(x+h)-f(x)g(x)}{h}$$

$$=\lim_{h\to 0}\frac{f(x+h)g(x+h)-f(x+h)g(x)+f(x+h)g(x)-f(x)g(x)}{h}$$

$$=\lim_{h\to 0}f(x+h)\,\frac{g(x+h)-g(x)}{h}+g(x)\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$$

3.3 Derivatives of Trig Functions

First a review: you will need to know all the following well in Math 124/5/6.

1. Triangle definitions

$\sin(x) = \dfrac{\text{opp}}{\text{hyp}}$	$\cos(x) = \dfrac{\text{adj}}{\text{hyp}}$
$\tan(x) = \dfrac{\text{opp}}{\text{adj}}$	$\cot(x) = \dfrac{\text{adj}}{\text{opp}}$
$\sec(x) = \dfrac{\text{hyp}}{\text{adj}}$	$\csc(x) = \dfrac{\text{hyp}}{\text{opp}}$

Thus,

$\sec(x) = \dfrac{1}{\cos(x)}$	$\csc(x) = \dfrac{1}{\sin(x)}$
$\tan(x) = \dfrac{\sin(x)}{\cos(x)}$	$\cot(\text{x}) = \dfrac{\cos(x)}{\sin(x)}$

2. **Know what their graphs look like**.
3. **Know their inverses** and how to use them (and how to get more solutions)

4. Know the standard values (unit circle) and circular motion

Examples (do NOT use a calculator)

$$\cos\left(\frac{\pi}{6}\right) =$$

$$\sec\left(-\frac{\pi}{4}\right) =$$

$$\tan\left(\frac{2\pi}{3}\right) =$$

$$\sin^{-1}\left(\frac{1}{2}\right) =$$

$$\tan^{-1}(1) =$$

5. Know the main identities.

$$\sin^2(x) + \cos^2(x) = 1$$

$$2\sin(x)\cos(x) = \sin(2x)$$

For lecture today, we also need:

$$\sin(a+b) = \sin(a)\cos(b) + \cos(\mathrm{a})\sin(b)$$

$$\cos(a+b) = \cos(\mathrm{a})\cos(b) - \sin(a)\sin(b)$$

Consider $f(x) = \sin(x)$.

Then

$$f'(x) = \lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$$

$$= \lim_{h\to 0}\frac{\sin(x+h)-\sin(x)}{h}$$

$\frac{d}{dx}(\sin(x)) = \cos(x)$	$\frac{d}{dx}(\cos(x)) = -\sin(x)$
$\frac{d}{dx}(\tan(x)) = \sec^2(x)$	$\frac{d}{dx}(\cot(x)) = -\csc^2(x)$
$\frac{d}{dx}(\sec(x)) = \sec(\mathrm{x})\tan(\mathrm{x})$	$\frac{d}{dx}(\csc(x)) = -\csc(\mathrm{x})\cot(\mathrm{x})$