$$\lim_{z \to x} \frac{f(z) - f(x)}{z - x} \qquad \left(\frac{f}{g}\right)' = \frac{f'g - fg'}{g^2}$$

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

§3.6 # 25

$$y = x^2 \sin^4 x + x \cos^{-2} x$$

$$y' = 2x \sin^4 x + x^2 (4 \sin^3 x) \cos x + \cos^{-2} x + x (-2 \cos^{-3} x)(-\sin x)$$

(39) $$g = \sin\left(\frac{t}{\sqrt{t+1}}\right) = \sin\left(\frac{t}{(t+1)^{1/2}}\right)$$

$$\Rightarrow g' = \cos\left(\frac{t}{\sqrt{t+1}}\right) \cdot \frac{1 (t+1)^{1/2} - t\left(\frac{1}{2}(t+1)^{-\frac{1}{2}}(1)\right)}{\left((t+1)^{1/2}\right)^2}$$

clean up the messy part.

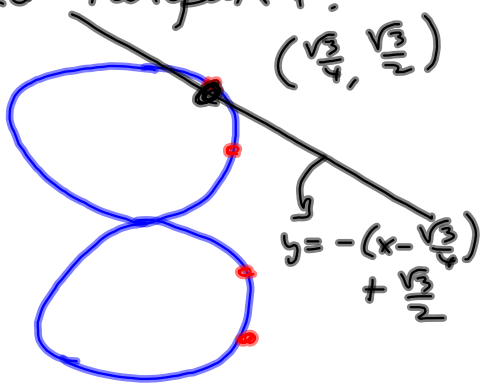
$$\frac{\sqrt{t+1} - \frac{t}{2\sqrt{t+1}}}{t+1} = \frac{\frac{2t+2-t}{2\sqrt{t+1}}}{t+1} = \frac{t+2}{(2\sqrt{t+1})(t+1)}$$

$$\frac{t+2}{2(t+1)^{3/2}} = \frac{t+2}{2\sqrt{(t+1)^3}} = \frac{t+2}{2(\sqrt{t+1})^3}$$

$y^4 = y^2 - x^2$ (0,0) is on it.

Pg 154 #41

Find tangents.



Never solved for y

$\left(\frac{\sqrt{3}}{4}, \frac{\sqrt{3}}{2}\right)$

$\left(\frac{\sqrt{3}}{4}, \frac{1}{2}\right)$

$\left(\frac{\sqrt{3}}{4}, -\frac{1}{2}\right)$

$\left(\frac{\sqrt{3}}{4}, -\frac{\sqrt{3}}{2}\right)$

$4y^3y' = 2yy' - 2x$

$4y^3y' - 2yy' = -2x$

$y'(4y^3 - 2y) = -2x$

$y' = \frac{-2x}{4y^3 - 2y}$

$y'\Big|_{(x,y)=\left(\frac{\sqrt{3}}{4}, \frac{\sqrt{3}}{2}\right)} = \frac{-2\left(\frac{\sqrt{3}}{4}\right)}{4\left(\frac{\sqrt{3}}{2}\right)^3 - 2\left(\frac{\sqrt{3}}{2}\right)} = \frac{-\frac{\sqrt{3}}{2}}{4\left(\frac{3\sqrt{3}}{8}\right) - \sqrt{3}}$

$= \frac{-\frac{\sqrt{3}}{2}}{\frac{3\sqrt{3}}{2} - \frac{2\sqrt{3}}{2}} = \frac{\left(-\frac{\sqrt{3}}{2}\right)}{\frac{\sqrt{3}}{2}} = -1 = y' \Big|_{x=\frac{\sqrt{3}}{4},\ y=\frac{\sqrt{3}}{2}}$

Tangent line @ $\left(\frac{\sqrt{3}}{4}, \frac{\sqrt{3}}{2}\right)$:

$y = -1\left(x - \frac{\sqrt{3}}{4}\right) + \frac{\sqrt{3}}{2}$

$y = m(x - x_1) + y_1$

$y = m(x - x_1) + y_1$

$\sin(xy) + y^2 - 3x = 0$ y is implicitly a $f(x)$.

Find $\frac{dy}{dx}$

$\cos(xy)\cdot(y + xy') + 2yy' - 3 = 0$

$\frac{d}{dx}[xy] = y + xy'$

$(fg)' = f'g + fg'$

$y\cos(xy) + xy'\cos(xy) + 2yy' - 3 = 0$

$y'(x\cos(xy) + 2y) = 3 - y\cos(xy)$

$$y' = \frac{3 - y\cos(xy)}{x\cos(xy) + 2y}$$

#s 29-38 in 3.7 are ALL like that.

Application of chain rule.

Pumping air into a balloon at a rate of (20) cm^3/s. How fast is the radius of the balloon changing at $t = 15$ s?

$$V = \frac{4}{3}\pi r^3$$

Differentiate w.r.t. time t:

$$\frac{dV}{dt} = \frac{4}{3}\pi \cdot 3r^2 \cdot \frac{dr}{dt} = 4\pi r^2 \frac{dr}{dt}$$

Uh-oh: We can supply THIS much:

$$20 = 4\pi r^2 \frac{dr}{dt}$$

But we need r.

$$V = 20 \frac{cm^3}{s} \cdot 15\ s = 300\ cm^3$$

$$V = 300 = \frac{4}{3}\pi r^3 \longrightarrow$$

$$\sqrt[3]{\frac{900}{4\pi}} = r$$

Now we find $\frac{dr}{dt}$:

$$20 = 4\pi \left(\sqrt[3]{\frac{900}{4\pi}}\right)^2 \frac{dr}{dt}$$

$$\frac{20}{4\pi \left(\sqrt[3]{\frac{900}{4\pi}}\right)^2} = \frac{dr}{dt}$$

whatever that is

3,7 #s 1, 4, 7, 10, 13, 16, 19, 22

Good idea ?

Look at it Try it.
Ask about it
Go back and look, again.

Look at it try to finish in one sitting.

Read ahead

Discuss Pacing:

Friday 9/14
3.1 Tangent Line and Curve, together. We already COVERED Tangent line in Chapter 2.
3.2 View f ' (x) as a function Nothing hugely new. Did some algebra review.

Monday 9/17
#s 33, 34 in 3.1 demonstrated
Graphed x^2 and 2x together.
Two different versions of difference quotient.
Differentiable. What is it? How to check it?
Gave 3.3 Assignment.

Tuesday 9/18 we've been Chapter 3 since the 14th.
3.1 should be collected
More 3.2 and start 3.3 stuff in earnest.

Wed 9/19
Looked @ test question. 3.3 made due on Friday (SEVERAL days after we started 3.3)

Thurs 9/20
Let you off the hook on tests. Begin 3.5. 3.4 Assignment Due Monday. Gave 3.4 and 3.5 Assignment.

3.4 Due Monday. 3.5 Due Tuesday. Did Trig derivatives.

Fri 9/21
Gave 3.6 assignment, after we discussed learning over MANY sittings instead of just massing out homework in ONE sitting. Everyone thought it was great idea.

Answered a couple 3.4 questions. Worked 3.5 examples.

Monday 9/24
Incorporated 3.6's Chain Rule into Trig questions in 3.6. Answered more 3.5 questions. Took time at the end (as there were no more 3.5/3.6 questions) to dive into 3.7 and give you a glimpse of 3.7.

Tuesday 9/25
I'm wondering why everybody seems all freaked-out. Worked a couple concepts in 3.7, and realized nobody but 2 or 3 people were "with me." *sigh*

We're right about where we SHOULD be. We can take a breath for one day, but that's about IT.

You KNOW where we're going in the book. You KNOW you can't learn everything in one sitting. Jot down notes BEFORE you get it. That's how old-school learners do it. We write stuff we don't get all the time. It's not 'til the 3rd or 4th attempt that it sinks in. *And we're OK with that!!!* Key is to make those 1st 2nd and 3rd attempts EARLYenough so that it's not just all in one sitting.

This knowledge is WAY advanced over college algebra or trigonometry. And it goes way FASTER.

The BEST students I've EVER had worked their way through the book before the semester even started!