Math 1450 - Calculus 1

Wed, Oct. 15

Announcements:

* Exam 2 is tonight, 5pm-6pm, this room
  covers up to 3.4, no 3.5
  * Bring a calculator for decimals - scientific or graphing *

Office Hours
Mondays, 12-1
Wednesdays, 2-3
+ Help Desk!

Tuesday discussion + Wednesday lecture:

* Review

24) $f(x) = -\frac{x^3}{3} + x^2 + 3x - 7$

(a) compute $f'(x)$, $f''(x)$, $f'''(x)$, $f^{(4)}(x)$

$f'(x) = -x^2 + 2x + 3 = -(x^2 - 2x - 3)$
$= -(x-3)(x+1)$

$f''(x) = -2x + 2$

$f'''(x) = -2$

$f^{(4)}(x) = 0$

b) where is $f(x)$ inc / dec $\Rightarrow$ where is f' pos/neg

inc: $(-1, 3)$

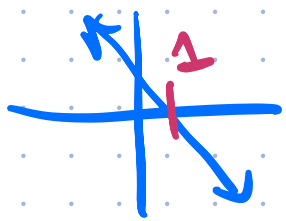
dec: $(-\infty, -1)$ and $(3, \infty)$

c) where is f CC↑ / CC↓ $\Rightarrow$ where is f'' pos/neg

$(-\infty, 1)$ $(1, \infty)$

$-2x + 2 = 0 \Rightarrow -2x = -2$
$= x = 1$

$-2x + 2$



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$$= -(x-3)(x+1)$$
$$f''(x) = -2x + 2$$
$$f'''(x) = -2$$
$$f^{(4)}(x) = 0$$

(d) What is the eq. of the T.L. at $x = 2$?

$$y = m\cdot(x-a) + b$$
$$= 3\cdot(x-2) + \frac{1}{3}$$
$$= 3x - 6 + \frac{1}{3} = 3x - \frac{17}{3}$$

slope: $f'(2) = -2^2 + 2\cdot2 + 3$
$= -4 + 4 + 3$
$= 3.$

point: $(2, f(2))$
$= -\frac{8}{3} + 4 + 6 - 7 = -\frac{8}{3} + 3$
$= \frac{1}{3}$

$$\underbrace{e^{7x}}_{f} \cdot \underbrace{\left(x^9 + 7^x \right)}_{g}$$

$f(x) = e^{7x}$

$g(x) = x^9 + 7^x$

$f'(g(x)) \cdot g'(x)$

$$f'(x) = e^{7x} \cdot \frac{d}{dx}(7x)$$

$$= e^{7x} \cdot 7 = 7e^{7x}$$

$f' \cdot g + f \cdot g'$

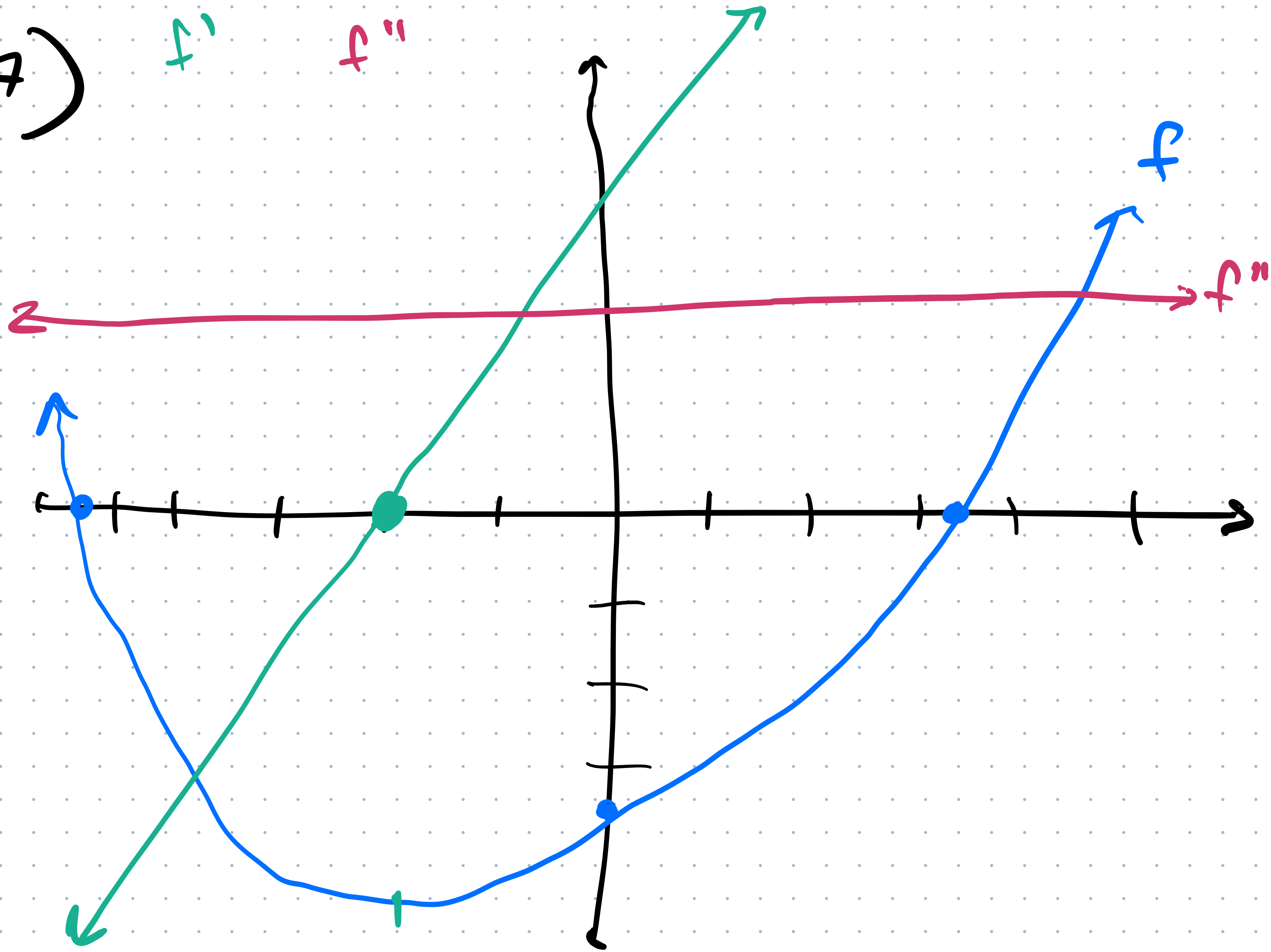
$$g'(x) = 9x^8 + \ln(7) \cdot 7^x$$

$$(7e^{7x})(x^9 + 7^x) + e^{7x}(9x^8 + \ln(7) \cdot 7^x)$$

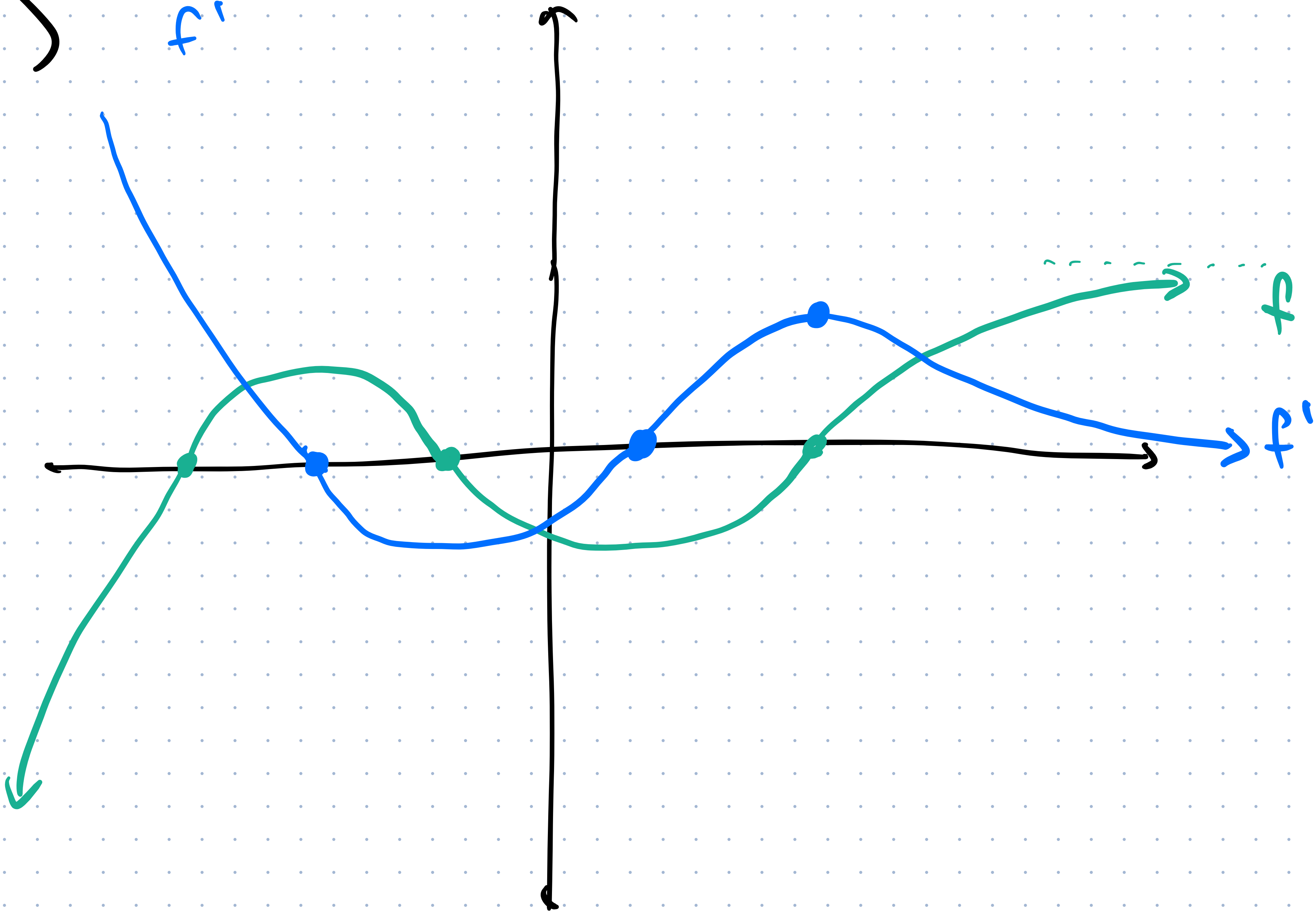
$$\frac{d}{dx}(2^{7x})$$

$$= 2^{7x} \cdot \ln(2) \cdot 7$$

27)



26)



Find the derivative of:

$$\sqrt{2^x \cdot (x^3+7x)} = \left(2^x \cdot (x^3+7x)\right)^{1/2}$$

$$\frac{1}{2}\left(2^x \cdot (x^3+7x)\right)^{-1/2} \cdot \frac{d}{dx}\left[\underbrace{2^x}_{f} \cdot \underbrace{(x^3+7x)}_{g}\right]$$

$f' = \ln(2) \cdot 2^x$

$g' = 3x^2+7$

$$\boxed{= \frac{1}{2}\left(2^x \cdot (x^3+7x)\right)^{-1/2} \cdot \left(\ln(2) \cdot 2^x \cdot (x^3+7x) + 2^x \cdot (3x^2+7)\right)}$$

2a): $p(x) = \dfrac{1}{1+x}$

a) Use the limit def to find $p'(2)$.

2.2:

$$p'(2) = \lim_{h \to 0} \frac{p(2+h) - p(2)}{h}$$

2.3

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

$$= \lim_{h \to 0} \frac{\left(\frac{1}{1+(2+h)} - \frac{1}{1+2}\right)}{h} = \lim_{h \to 0} \frac{\frac{3}{3}\left(\frac{1}{3+h} - \frac{1}{3}\right)\cdot\frac{3+h}{3+h}}{h}$$

$$= \lim_{h \to 0} \frac{\left(\frac{3}{3(3+h)} - \frac{3+h}{3(3+h)}\right)}{h} = \lim_{h \to 0} \frac{\left(\frac{3-(3+h)}{3\cdot(3+h)}\right)}{h}$$

$$\lim_{h\to 0} \frac{\left(\frac{3-(3+h)}{3\cdot(3+h)}\right)}{h} = \lim_{h\to 0} \frac{\left(\frac{-h}{3\cdot(3+h)}\right)}{h}$$

$$= \lim_{h\to 0} \frac{1}{\cancel{h}} \cdot \left(\frac{-\cancel{h}}{3\cdot(3+h)}\right) = \frac{-1}{3\cdot(3+0)} = -\frac{1}{9}$$

$$p'(2) = -\frac{1}{9}$$

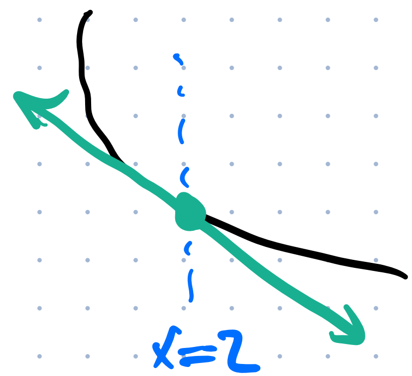
$$p(x) = \frac{1}{1+x}$$

(b): eq. of TL at $x=2$

slope $= -\frac{1}{9}$

point: $(2, p(2)) = (2, \frac{1}{3})$

$$\boxed{y = -\frac{1}{9}(x-2) + \frac{1}{3}}$$



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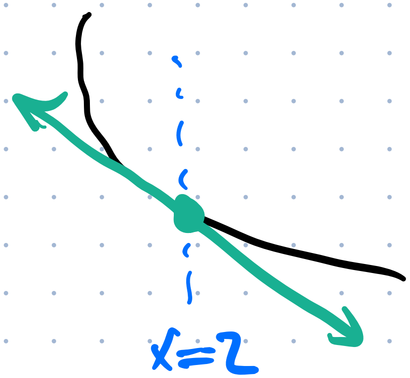


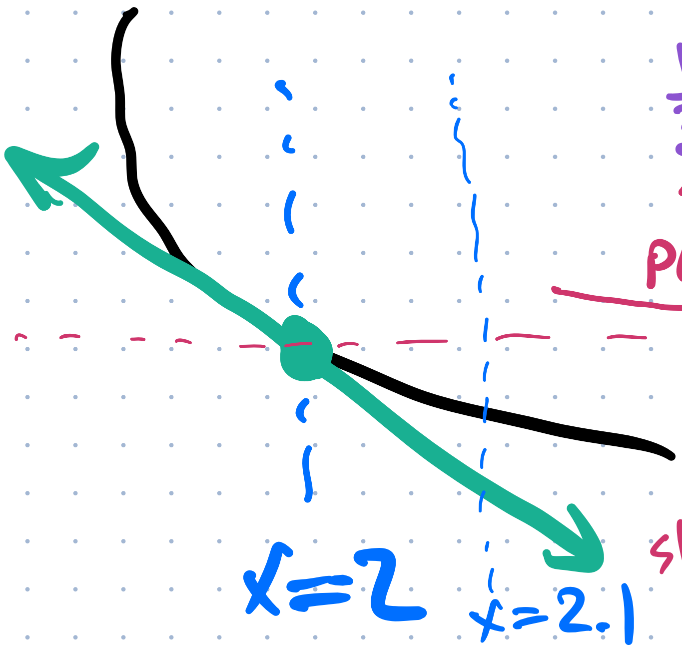
(c) Use $p(2)$ and $p'(2)$ to estimate $p(2.1)$

$$\frac{1}{3} + (0.1)\left(-\frac{1}{9}\right)$$

$p(2)$ how far we move $p'(2)$

$f'(2.1) = -\frac{1}{9}$

$p(2) = \frac{1}{3}$



slope $\left(-\frac{1}{9}\right)$