Math 1450 - Calculus 1

Wed, Nov. 12

Announcements:

* Exam 3 tonight!, 5pm-6pm
  cover 3.5, 3.6, 3.7, 3.9, 3.10
  4.1, 4.2, 4.3, 4.6
* Make sure you have a calculator!
* Course withdrawal deadline: Friday
* Discussion tomorrow: bring a laptop or tablet

Today:

→ Review

Office Hours

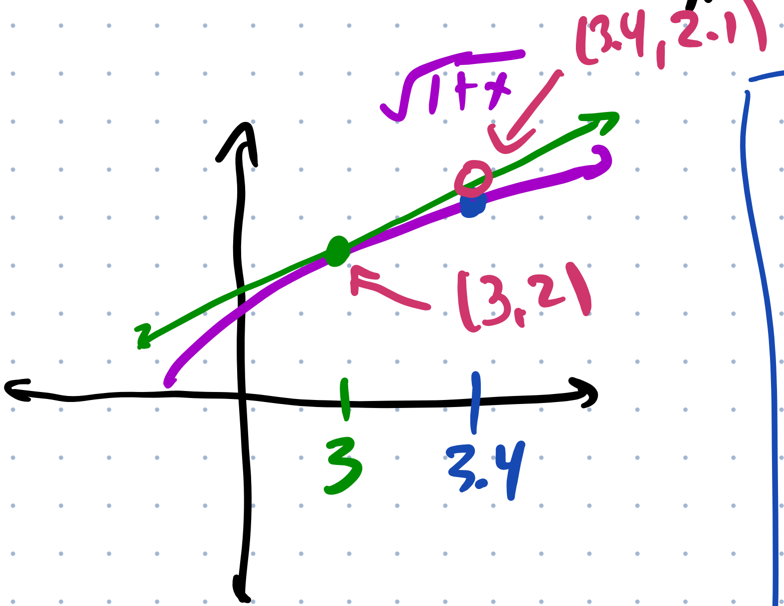
Mondays, 12-1

Wednesdays, 2-3

+ Help Desk! 12-1

34] Use the linear approx. of $f(x) = \sqrt{1+x}$ $= (1+x)^{1/2}$

at $x=3$ to approximate $f(3.4)$



TL of $f(x)$ at $x=3$

$$f'(x) = \frac{1}{2}(1+x)^{-1/2}\cdot(1)$$

$\frac{1}{2}\cdot 4^{-1/2}$

$$= \frac{1}{2}\cdot\frac{1}{\sqrt{1+x}}$$

$$f'(3) = \frac{1}{2}\cdot\frac{1}{\sqrt{1+3}} = \frac{1}{2}\cdot\frac{1}{\sqrt{4}} = \boxed{\frac{1}{4}}$$

point: $(3, f(3)) = (3, \sqrt{4}) = \boxed{(3,2)}$

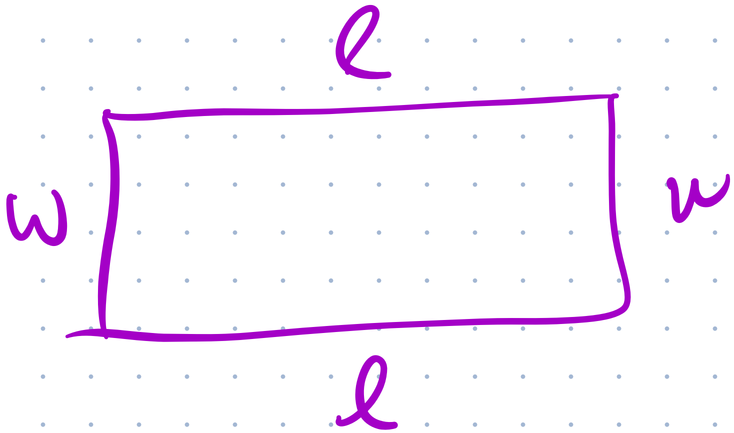
TL:

$$y-2 = \frac{1}{4}(x-3)$$

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

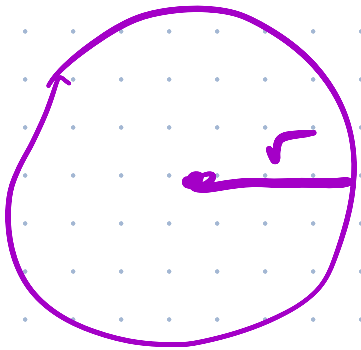
plug in $x=3.4$:

$$\frac{1}{4}(0.4)+2 = 0.1+2 = \boxed{2.1}$$



$A = w \cdot l$

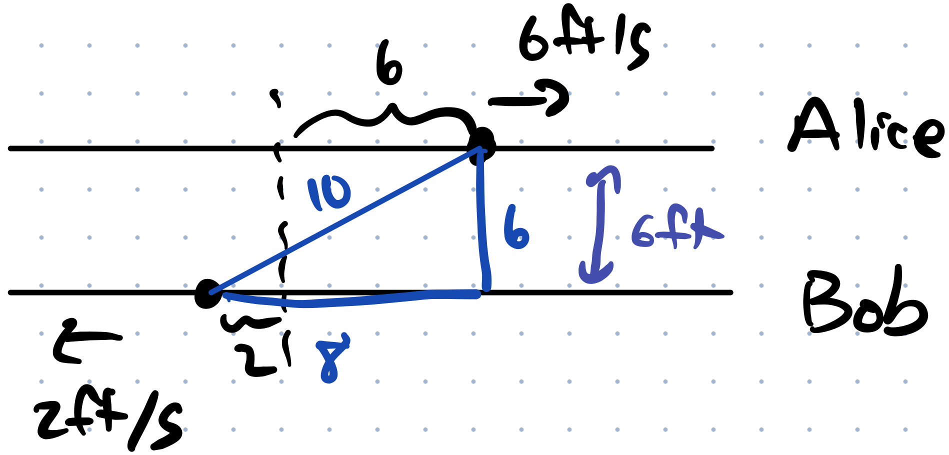
$P = 2w + 2l$



$A = \pi r^2$

$P = 2\pi r$

35]

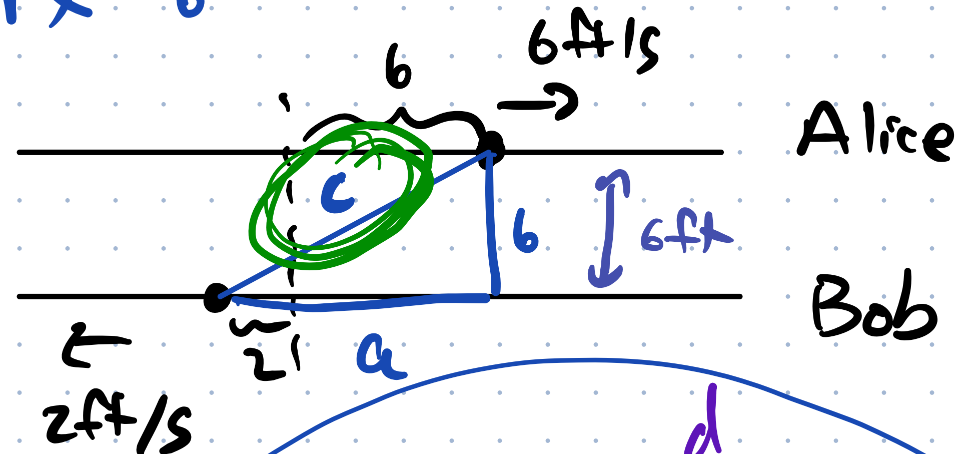


$t = 1$

$8 \cdot 8 = 10 \cdot \frac{dc}{dt}$

$64 = 10 \cdot \frac{dc}{dt}$

$c = \sqrt{x^2 + 6^2}$



$t = 1$ $\quad \boxed{\frac{dc}{dt} = 64 \text{ ft/sec}}$

$\frac{d}{dt}(a^2 + 36) = \frac{d}{dt}(c^2)$

$\cancel{2} \cdot a \cdot \frac{da}{dt} = \cancel{2} \cdot c \cdot \boxed{\frac{dc}{dt}}$

Know: $a = 8$

$c = 10$

$\frac{da}{dt} = 8 \text{ ft/sec}$

25)

$g(z) = \dfrac{z}{1+z^2}$ $[0, \infty)$ global extrema
inflection pts

$$g'(z) = \frac{(1+z^2)\cdot(1) - (z)(2z)}{(1+z^2)^2}$$

$$= \frac{1+z^2-2z^2}{(1+z^2)^2} = \frac{1-z^2}{(1+z^2)^2} = \frac{(1+z)(1-z)}{(1+z^2)^2}$$

critical points [$g'=0$] or [g' is undefined and g is defined]

$z=1$, $\cancel{z=-1}$

local max at $z=1$

$$g''(1) = \frac{2\cdot 1\cdot(1^2-3)}{(1^2+1)^3} = \frac{\text{pos}\cdot\text{pos}\cdot\text{neg}}{\text{pos}} = \boxed{\text{neg}}$$

25) $g(z)=\dfrac{z}{1+z^2}$ $[0,\infty)$ global extrema

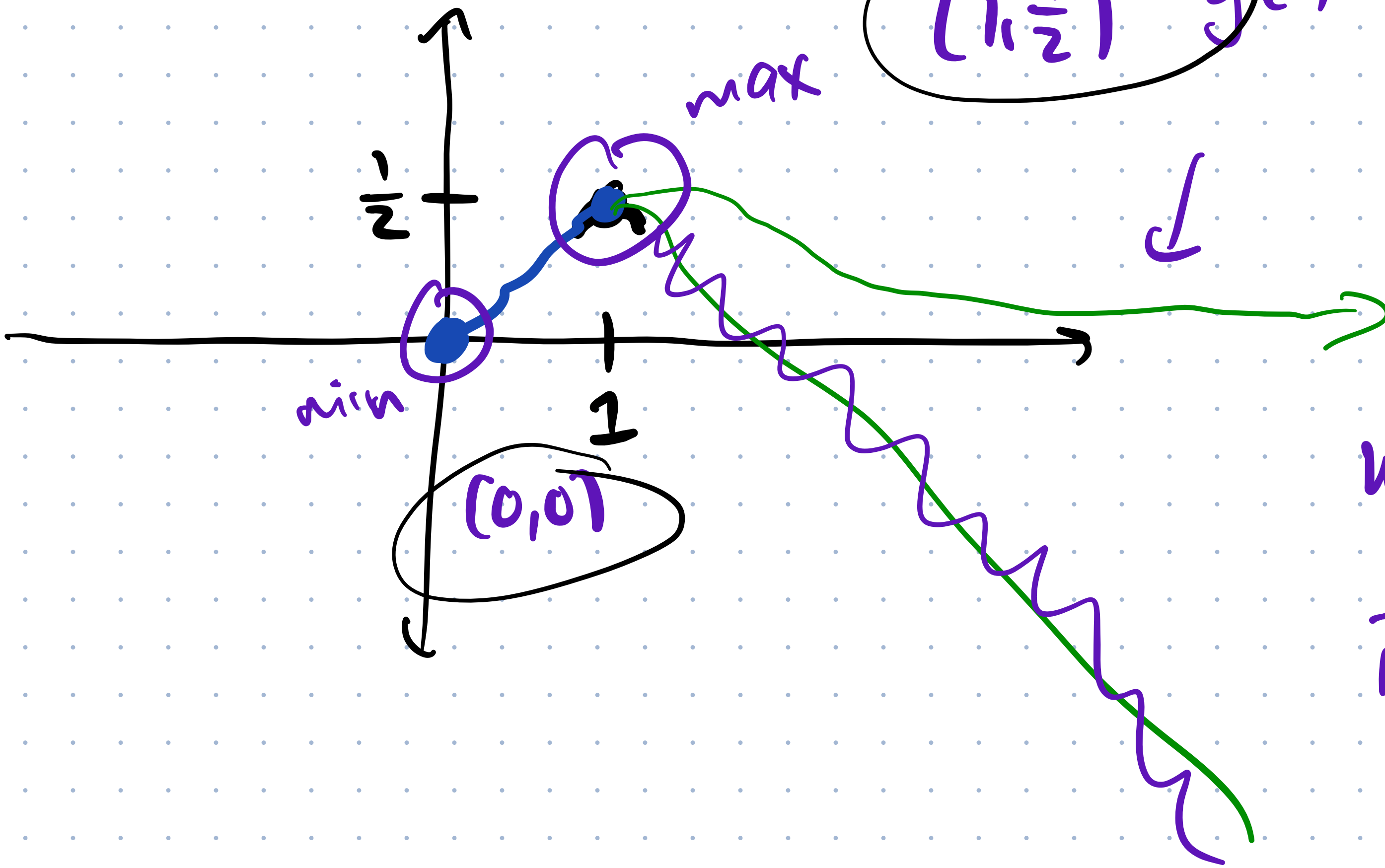
inflection pts

$$\frac{(1+z)(1-z)}{(1+z^2)^2}$$

at $z=1$: local max

$(1,\frac{1}{2})$ $g(1)$

$g(0)=0$



What does $\dfrac{z}{1+z^2}$ do as $z\to\infty$

It goes to 0

25]

$$g(z) = \frac{z}{1+z^2} \qquad [0, \infty)$$

global extrema

inflection pts

$$g''(z) = \frac{2\cdot z\cdot(z^2-3)}{(z^2+1)^3} = 0$$

$$g''(2) = \frac{2\cdot 2\cdot 1}{125}$$

$$\Rightarrow z = 0, \qquad z^2 - 3 = 0$$

$$z^2 = 3$$

$$z = \pm\sqrt{3}$$

$\cancel{z=0}$

$z = \sqrt{3}$

f''

$-$ $+$

1 $\sqrt{3}$ 2

infl pt

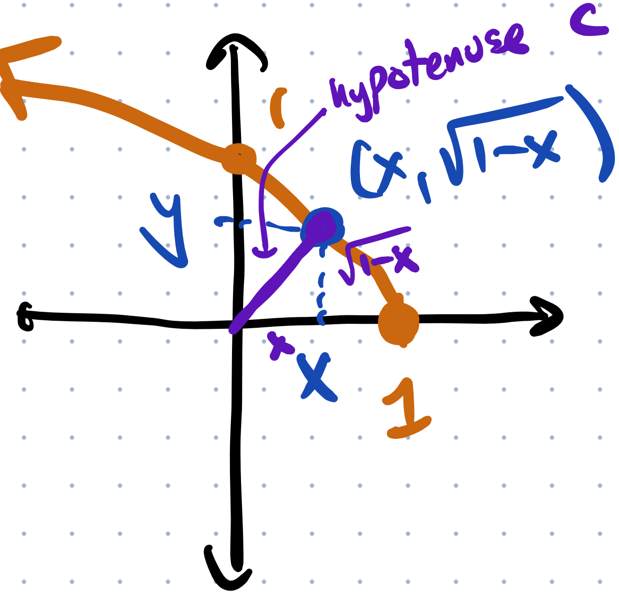
$$g(\sqrt{3}) = \frac{\sqrt{3}}{1+(\sqrt{3})^2} = \frac{\sqrt{3}}{4}$$

$$g''(1) = \frac{2\cdot 1\cdot(1-3)}{\text{pos}}$$

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

40) $y=\sqrt{1-x}$ closest to the origin

$(-\infty, 1]$



Distance from $(0,0)$ to $(x, \sqrt{1-x})$

distance: $c^2 = x^2 + (\sqrt{1-x})^2$

$c^2 = x^2 + 1 - x$

$c = \sqrt{x^2 - x + 1}$

global minimum

32] $p(\theta)=\sin^2(\theta)+\cos(\theta)$ $\quad [0,2\pi]$

(a) $p'(\theta) = 2\cdot\sin(\theta)\cdot\cos(\theta) - \sin(\theta)$

$= \sin(\theta)\cdot(2\cos(\theta)-1) = 0$

$\sin(\theta)=0 \rightarrow \theta=0,\ \theta=\pi,\ \theta=2\pi$

$2\cdot\cos(\theta)-1=0$

$\Rightarrow \cos(\theta)=\frac{1}{2} \quad \theta=\pi/3,\ \theta=\frac{5\pi}{3}$

$p''(\theta) = 2\cdot(\cos^2(\theta)-\sin^2(\theta)) - \cos(\theta)$