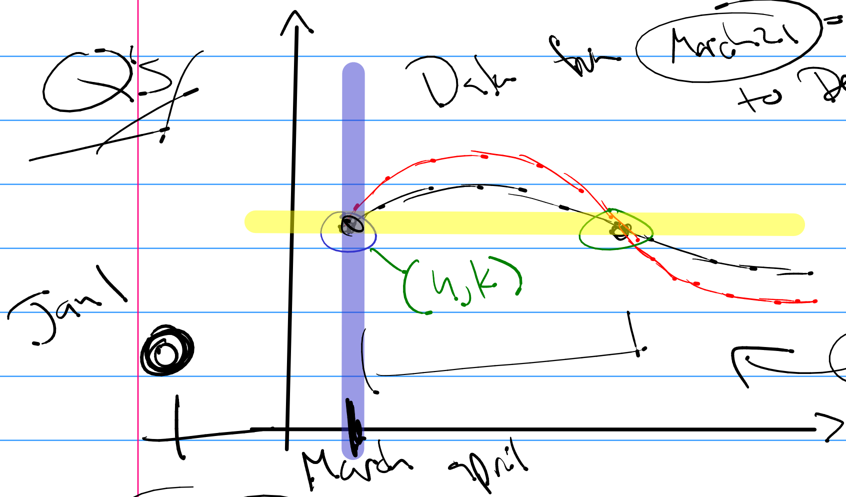
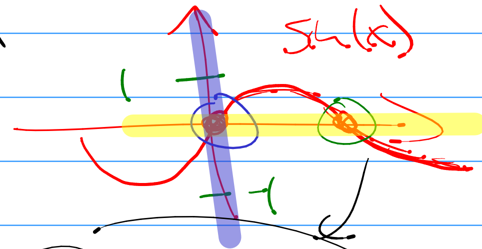
Math 242

Q5

Data for March 21 $=80$ to Dec 21





$\sin(x-h)+K$

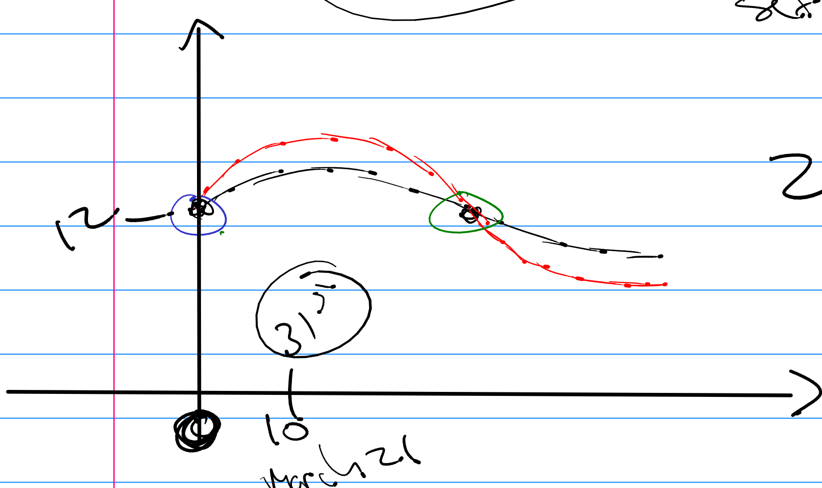
#25 $\quad -1 \le \sin(x) \le 1 \qquad$ amp. $=1$

$10 \le f(x) \le 14 \qquad$ amp $=2$

Pg 40 $\quad L(t) = 2.8\sin\left(\frac{2\pi}{365}(t-80)\right)+12$

#9 $\quad L(t) = 2\sin\left(\frac{2\pi}{365}(t-\boxed{80})\right)+12$

Check $\quad$ March 31 $\quad$ rise 5:51 AM, set 6:18 PM

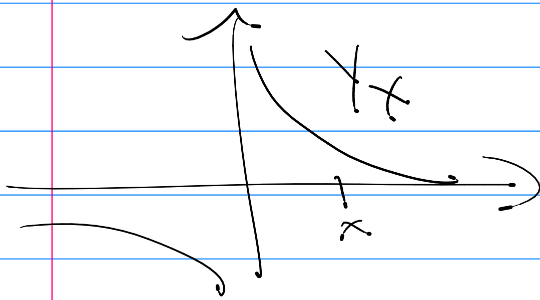


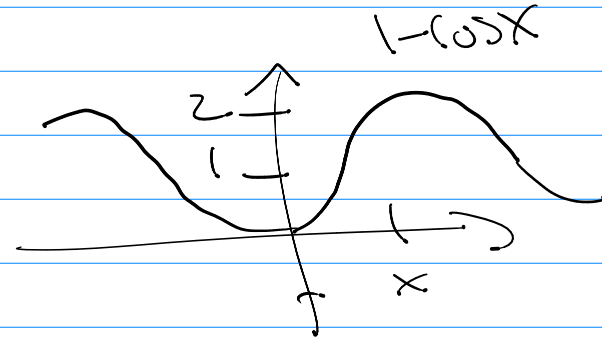
$2\sin\left(\frac{2\pi}{365}t\right)+12$

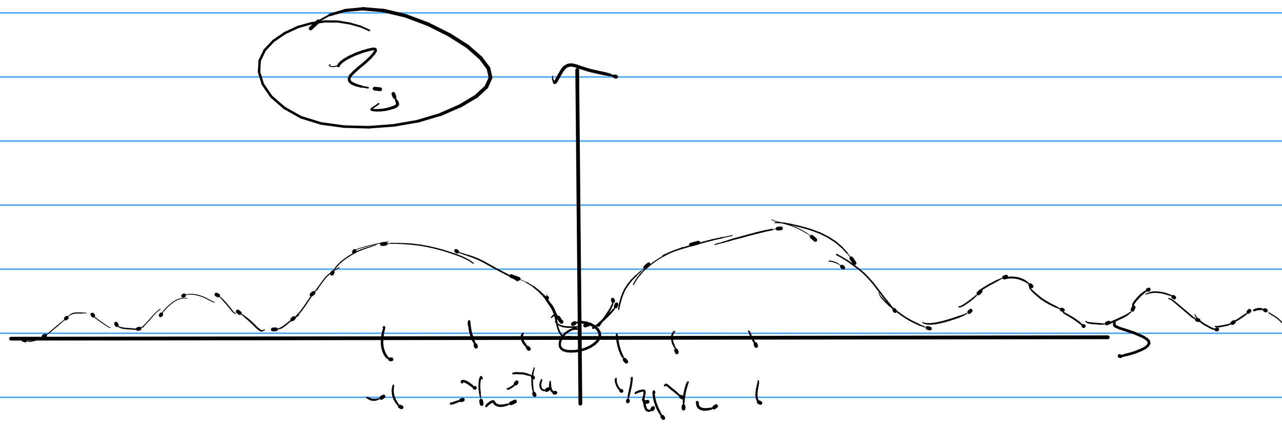
$L(10)$

$\frac{1-\cos x}{x}$ $\frac{0}{0}$

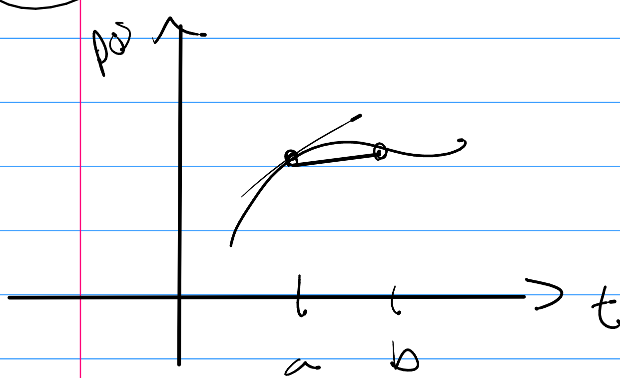
$f(x) = \frac{1}{x}(1-\cos x)$ Near x







1.4 Tangents / Velocities (change)



as b gets close to a then secant gets close to a tangent

slope of tangent

gets close to

$$\frac{f(b)-f(a)}{b-a} = \text{slope of secant}$$

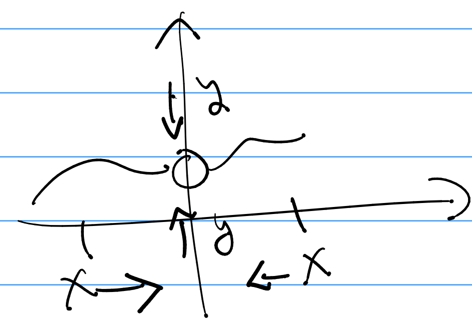
as b gets close to a

rough idea Graph

ex $\frac{1-\cos x}{x}$

as x gets close to 0?

x	$y = \frac{1-\cos x}{x}$
-1	
$-.1$	
$-.001$	
$-.0001$	
	? going to?
0.0001	
0.001	
0.01	
0.1	
1	

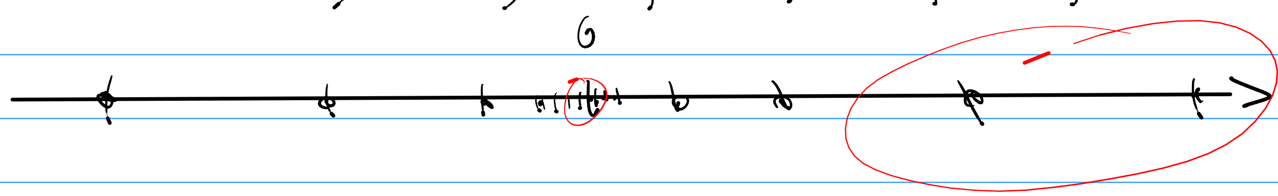


Note: technology

3.145 e 20

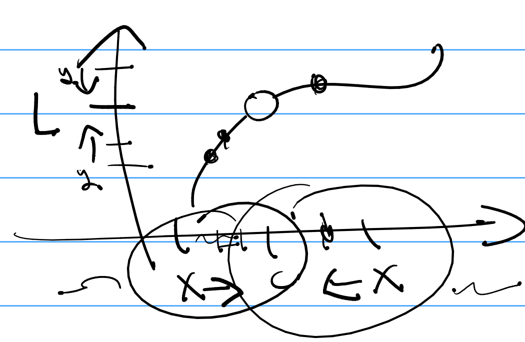
3.145×10^{20}

314,500,000,000,000,000,000



Gets close? → **Limit**

① Intuitive

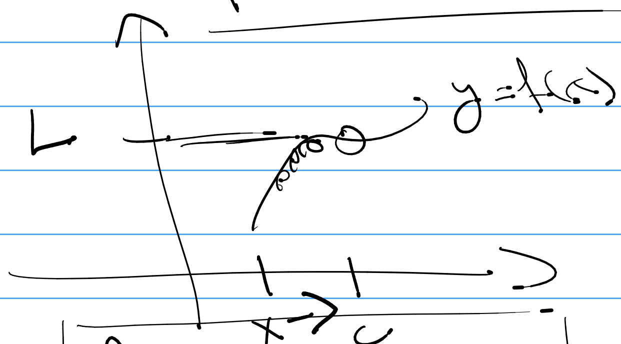


left side $x \to c^-$

right side $x \to c^+$

both $x \to c$

Def ① $\boxed{\lim_{x \to c^-} f(x) = L}$ means $f(x)$ approaches the number L whenever x approach c from the left



② $\boxed{\lim_{x \to c^+} f(x) = L}$

③ $\lim_{x \to c} f(x) = L$ means $\lim_{x \to c^-} f(x) = L$

$\lim_{x \to c^+} f(x) = L$

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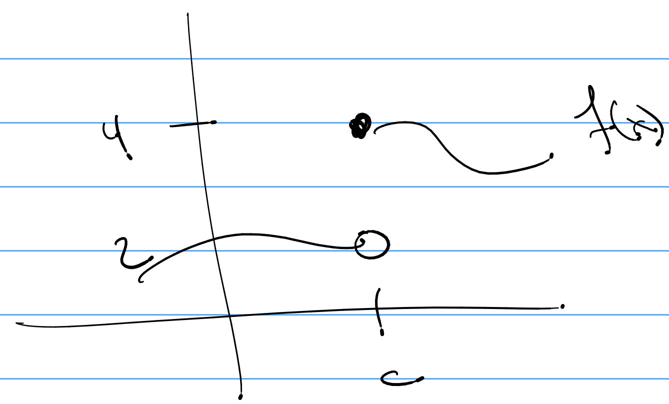
graphical idea:

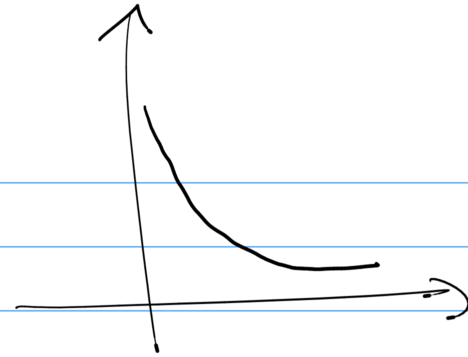


$\lim_{x \to c^-} f(x) = 2$

$\lim_{x \to c^+} f(x) = 4$

$\lim_{x \to c} f(x)$ does not exist

ex $\displaystyle\lim_{x\to 0^+} \frac{1}{x} = \infty$



x	y
1	1
.1	10
.01	100
.001	1000

as $x \to 0^+$

y is not approaching a number

y is getting large without bound.

call $y \to$ infinite $= \infty$

Note: f is $1, 10, 100, 1000, 10\,000, \ldots$

$f \to \infty$ large in the pos. direction

f is $-1, -10, -100, -1000, \ldots$

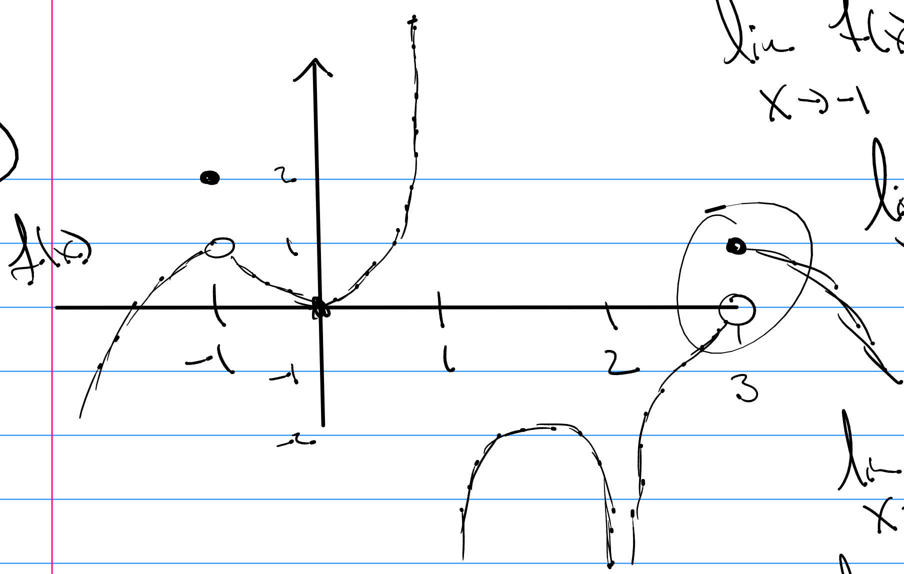
$f \to -\infty$ large in neg. direction

Def $\displaystyle\lim_{x\to a^-} f(x) = \infty$ — means $f(x)$ is arbitrarily large (positive direction) as x goes to a from left

$\displaystyle\lim_{x\to a^+} f(x) = \infty$

$\displaystyle\lim_{x\to a} f(x) = \infty$

Ex



$\lim_{x \to -1} f(x) = 1$, $f(-1) = 2$

$\lim_{x \to 0} f(x) = 0$, $f(0) = 0$

$\lim_{x \to 1^-} f(x) = +\infty$

$\lim_{x \to 1^+} f(x) = -\infty$

$\lim_{x \to 2} f(x) = -\infty$

Ex $\displaystyle \lim_{x \to 2^+} \frac{x^2 - 2x}{x^2 - 4x + 4} = \lim_{x \to 2^+} \frac{x\cancel{(x-2)}}{(x-2)^2} = \lim_{x \to 2^+} \frac{x}{x-2}$

x	y
3	3
2.1	$2.1/.1 = 21$
2.01	$2.01/.01 = 201$
2.001	$2.001/.001 = 2001$

$\displaystyle \lim_{x \to 2^+} \frac{x}{x-2} = +\infty$

Better Way?

Ex $2x + 1 = 0$ $\quad x = -1/2 \leftarrow$

$x^2 - x - 6 = 0$

$(x-3)(x+2) = 0$

$x - 3 = 0 \quad x + 2 = 0$

Idea ① two "easy" limits

② laws that allow us to know our "harder" problems are just variations of the two easy ones.

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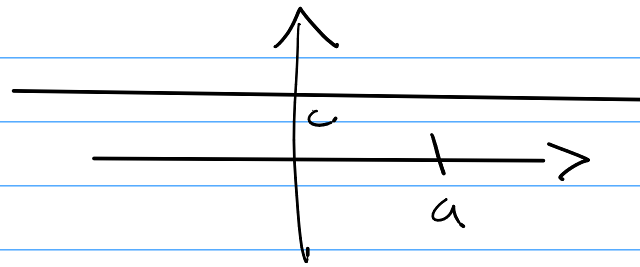
two limits to solve.

① $\lim_{x \to a} c = c$



② $\lim_{x \to a} x = a$