Good afternoon: sit anywhere for now, we will randomize after the warmup

Warmup (do this in your notes + date it)

Simplify (no calculators!!!)
Give answer in radical form.

$$\left(-\frac{8^{\frac{1}{3}}-2\sqrt[3]{64}}{\ln e^{2}+\sqrt[4]{(-9+5)^{2}}}\right)^{-\frac{2}{3}}$$

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$$\left(-\frac{\sqrt[3]{8}-2\cdot\sqrt[3]{64}}{\ln e^{2}+\sqrt[4]{(-4)^{2}}}\right)^{-2/3}$$

$$\left(-\frac{2-2\cdot 4}{2+\sqrt[4]{16}}\right)^{-2/3}$$

$$\left(-\frac{-6}{2+2}\right)^{-2/3}$$

$$\left(\frac{6}{4}\right)^{-2/3} \longrightarrow \left(\frac{3}{2}\right)^{-2/3} \longrightarrow \left(\left(\frac{3}{2}\right)^{-1}\right)^{2/3} \rightarrow \left(\frac{2}{3}\right)^{2/3} \rightarrow \left(\left(\frac{2}{3}\right)^{2}\right)^{1/3}$$

$$\left(\frac{4}{9}\right)^{1/3} \leftarrow$$

$$\sqrt[3]{\frac{4}{9}}$$

Key takeaways

$$a^{b/c} = \sqrt[c]{a^b}$$

$$x^{-n} = \frac{1}{x^n}$$

$$\log_b a = x \iff b^x = a$$

"a logarithm is an exponent"

$$\ln x \rightarrow \log_e x$$

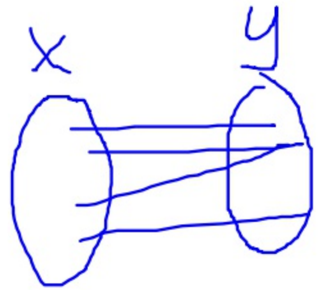
(attach to your notes)

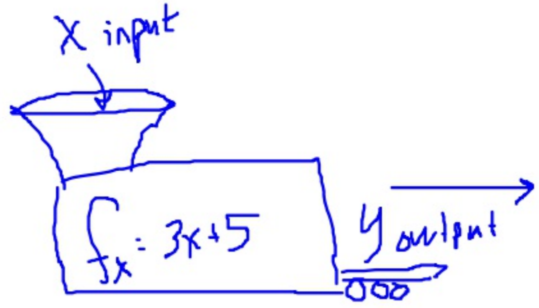
Suppose Mr. Frumble is traveling in his pickle car which, due to poor maintenance, has no functioning speedometer. He does, however, have a spiffy wristwatch and an odometer. He is on his way to the shoppe at 2pm and wishes to estimate what his speedometer would say. How does he do this?

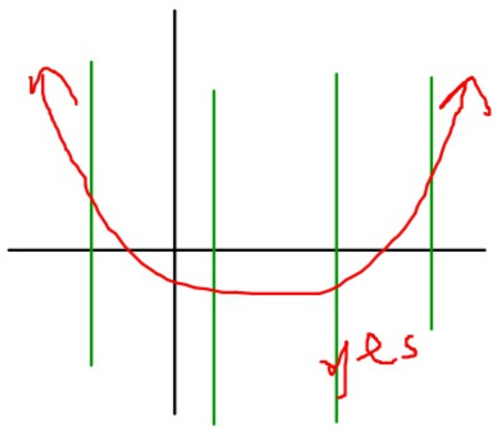
Basic formula from 7th grade
Verbal description
Function notation
Approximations
Calculus

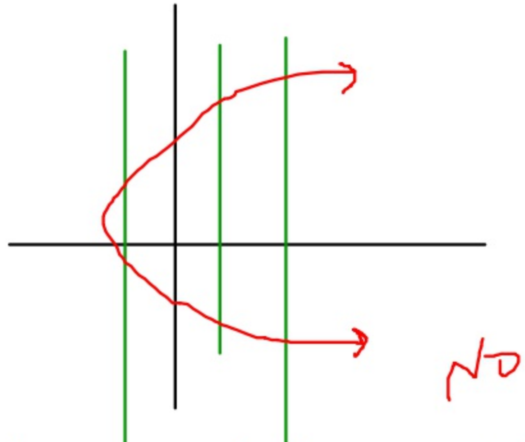
What is a function?

x	y
0	5
1	8
2	11
3	14
⋮	









a function is a mathematical operation that takes certain inputs (domain) and maps them to certain outputs (range)

How do functions behave?

Some are predictable, well behaved

Some are not

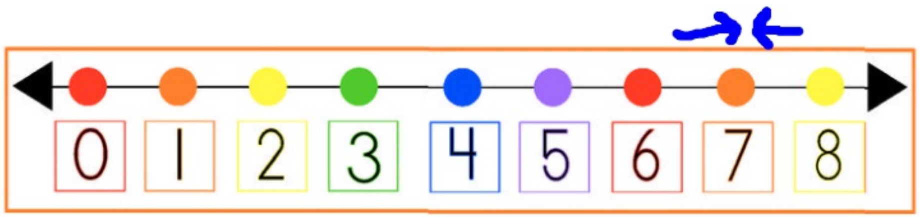
What does it mean to get 'close' to a number?

close from both sides

Close to 7?

6.99.....6.99999...6.9999999...but not 7

7.01.....7.000001.....but not 7



What is a limit? $\lim_{x \to c} f(x) = b$

The limit as x approaches c (some number, as an x-value) of a function f(x) is some number, b (a y-value, output).

A limit is: - an operator, something done to math

other operators: +,-,x,÷, ln,√

- an output, or "y-value

my first limit

$$\lim_{x \to 3} (x + 4) = 3 + 4 = 7$$

Direct Substitution

(plug it in, see what happens)

Let's try another!

$$\lim_{x\to 3}\frac{x^2-9}{x-3} = \frac{0}{0} = ???$$

indeterminate

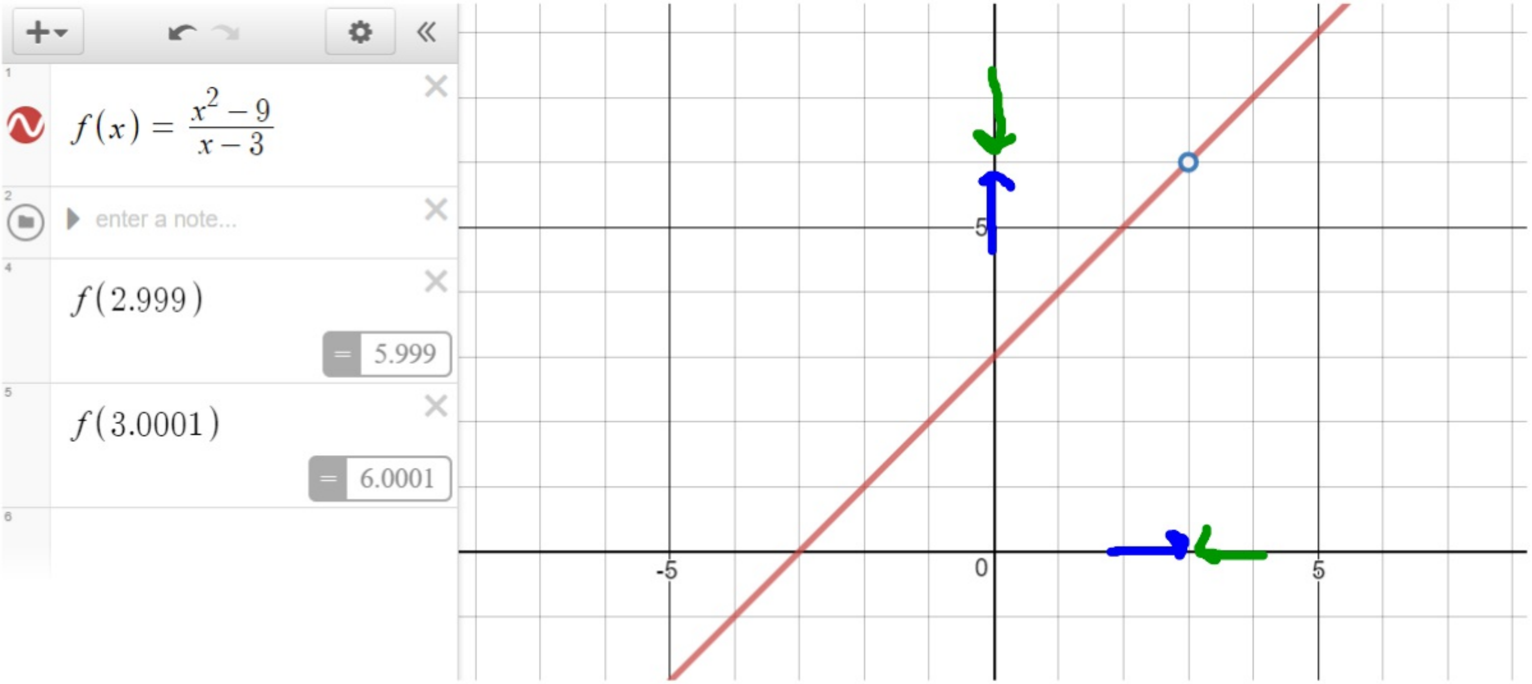
You used a limit...

Graphically

Use your calculator

$$Y1 = \frac{x^2 - 9}{x - 3}$$

Use the TRACE feature to approach 3 from both sides.



Algebraic Approach

$$\lim_{x \to 3} \frac{x^2 - 9}{x - 3}$$

$$\lim_{x \to 3} \frac{(x-3)(x+3)}{x-3}$$

$$\lim_{x \to 3} x+3 = 6$$

Limits Toolkit

Direct substitution (plug it in, plug it in)

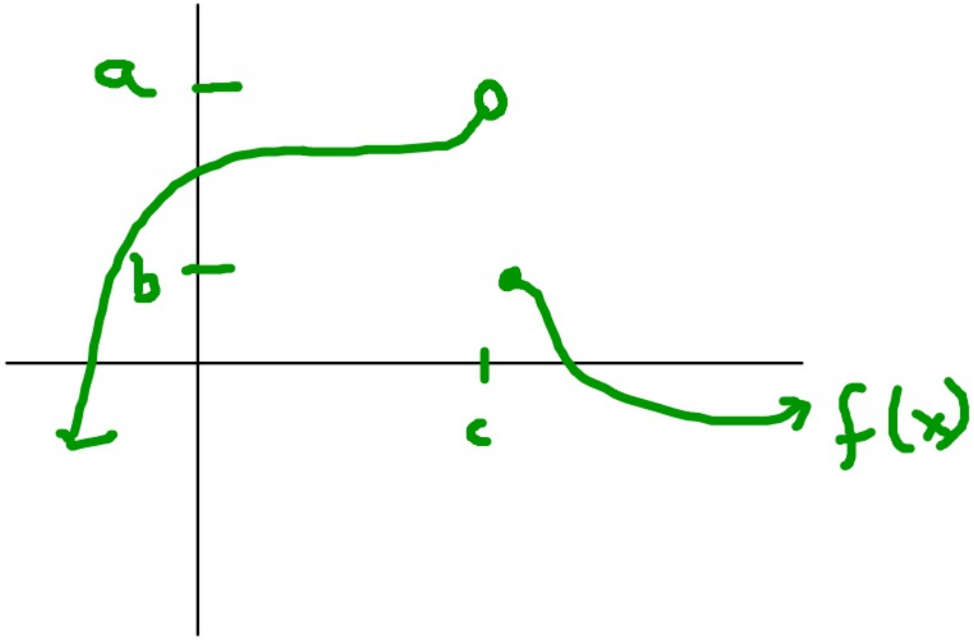
Factor, then cancel (give it a massage)

Look at graph, try nearby numbers

Keep in mind!!! there is no value AT 3. f(3) is undefined.

Will limits always work?

No!



As you approach c from the left,
the values of f(x) approach a

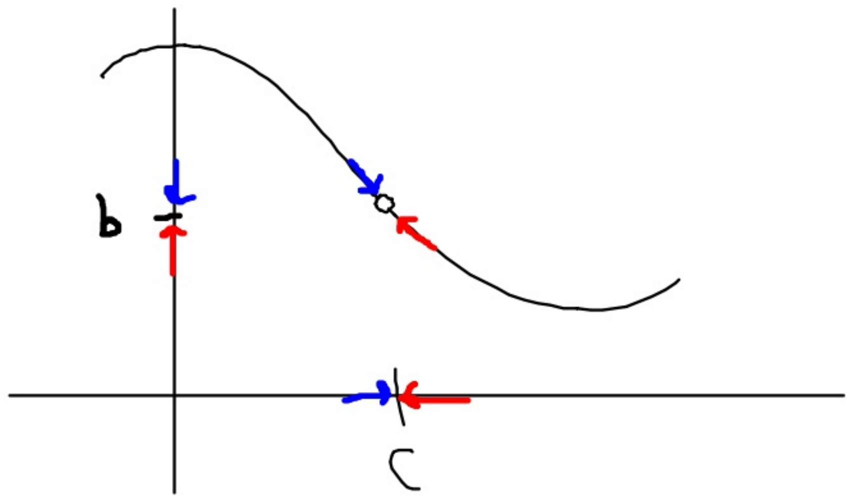
But as you approach c from the right,
the values of f(x) approach b

Thus the limit "does not exist"

Limit Existence Definition

The limit of f(x) as x approaches some number c exists if and only if

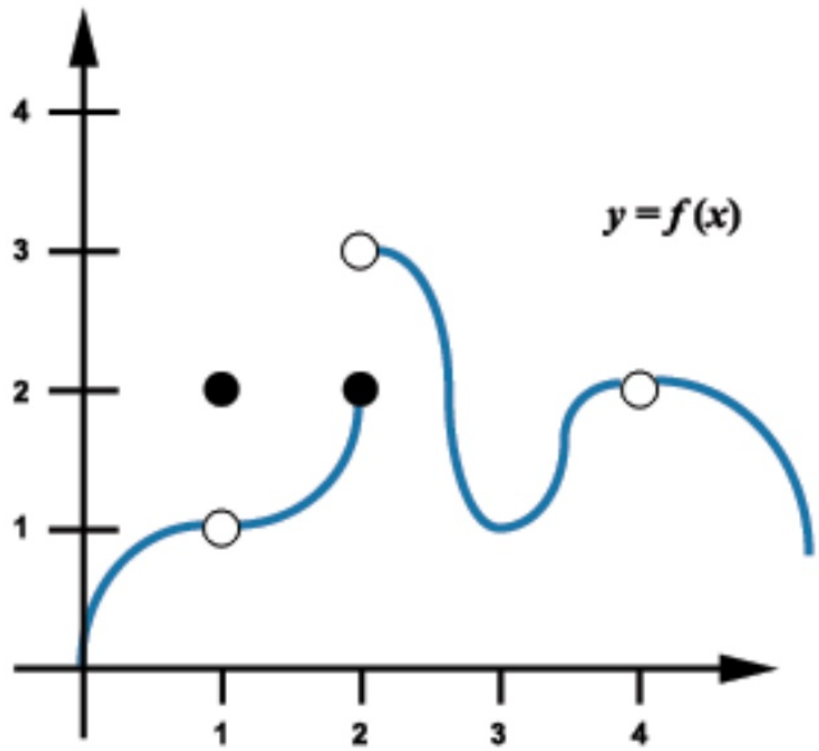
$$\lim_{x \to c^+} f(x) = \lim_{x \to c^-} f(x) = b \qquad \text{for a finite number b.}$$



When does a limit not exist?

When the left and right are not equal

Limits, Graphically:



$$\lim_{x\to 1} f(x)$$

$$\lim_{x\to 2} f(x)$$

$$\lim_{x\to 2^+} f(x)$$

$$\lim_{x\to 3} f(x)$$

$$\lim_{x\to 4} f(x)$$

$$f(1)$$

$$f(2)$$

$$f(4)$$

Homework:
p. 55 #17-24

p. 67 #41-50

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