2.1 - Rates of Change and Limits

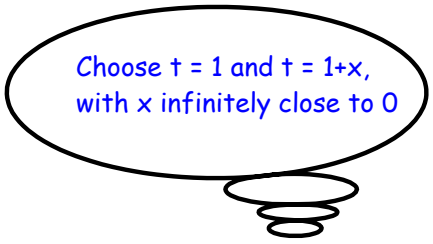
Avg. speed = $\frac{\text{Distance traveled}}{\text{time elapsed}}$

Ex 1) A ball is thrown. Its height is modeled by $h(t) = 40t - 16t^2$

Find the avgerage speed between $t = 0$ and $t = 1$

Instantaneous Speed = Speed at a given point (derivative)

Ex 2) Find the instantaneous speed at t = 1 of $h(t)=40t-16t^2$



Limits

$\lim_{x \to c} f(x) = L$ read "the limit of $f(x)$ as x approaches c is L"

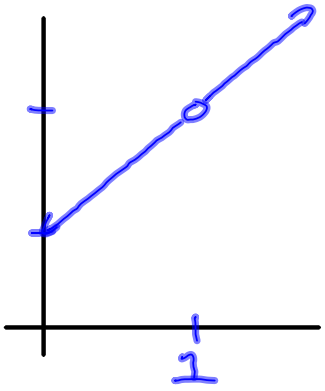
The values of $f(x)$ approach or equal the value of L as the values of x approach (but are not necessarily equal to) c.

What does y get close to as x gets close to some number c?

3 methods to evaluate limits

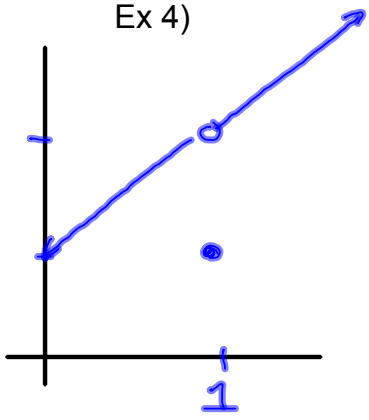
1. Graphically
2. Numerically (using the table)
3. Algebraically (no calculators)

Ex 3)



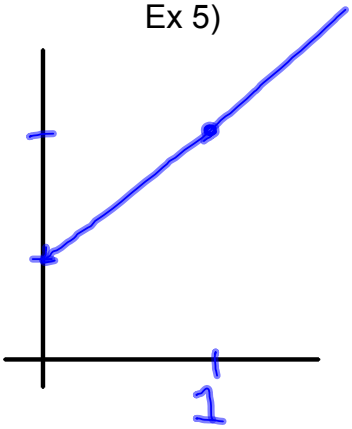
$\lim_{x \to 1} f(x) =$

Ex 4)



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

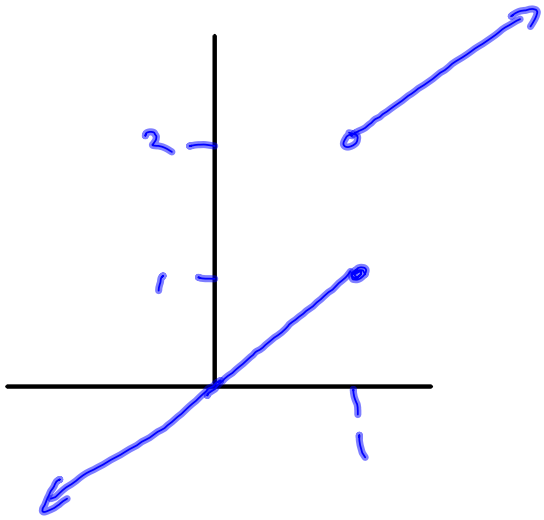
Ex 5)



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

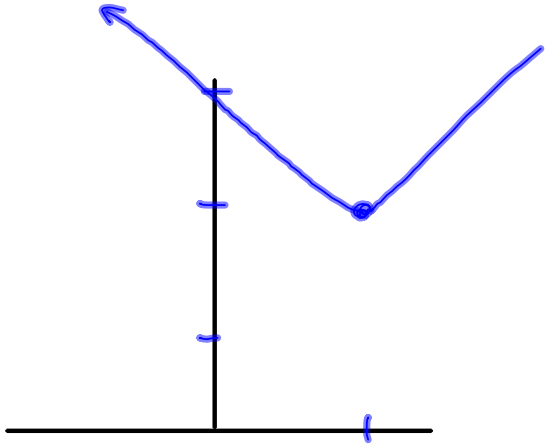
The existence of a limit as $x \to c$ never depends on whether $f(x)$ is defined at c.

Ex 6)



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

Ex 7)



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

You can also find the limit by **Substitution**

If f(x) is a polynomial function, then

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

If f(x) is a rational function, then

$$\lim_{x \to c} \frac{f(x)}{g(x)} = \frac{f(c)}{g(c)}$$

Ex 8) $\lim_{x \to 4} 5x^2 - 2x + 3 =$

Ex 9) $\lim_{x \to -1} \dfrac{x - 2}{x^2 + 4x - 3}$