

# Functions

Precalculus is about functions.

We study Examples,  
Tools,  
 & Tricks.

Define: a function is a "machine" where  
one input gives one output

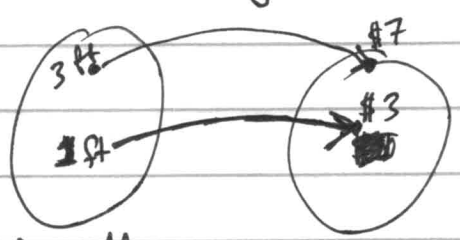
5-10

~~Example of a function: cost of engine~~

Eg: Some hardware sell wire  
 by the length.

one length should have one cost.

As an arrow diagram



cost = ~~2~~  $\frac{\$2}{\text{foot}}$  + ~~1~~ base fee

Cost = ~~2~~ length + ~~1~~ 1

cost of 3 ft = ~~2~~ (3) + 1 = 6 + 1 = 7

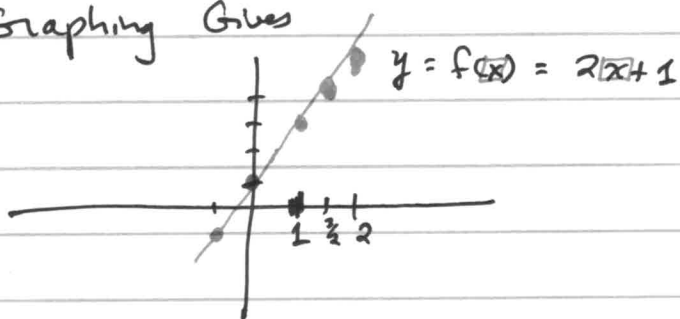
~~Usually~~ Usually, we have an algebraic definition.

eg:  $f(x) = 2x + 1$

This lets us plug in #'s

$x$	$f(x)$
-1	$2(-1) + 1 = -2 + 1 = -1$
0	$2(0) + 1 = 1$
1	$2(1) + 1 = 2 + 1 = 3$
$\frac{3}{2}$	$2(\frac{3}{2}) + 1 = 3 + 1 = 4$

Graphing Gives



We don't always plug in #'s,  
we also plug in expressions

Eg:  $f(x-1) = 2(x-1) + 1 = 2x - 2 + 1 = 2x - 1$

~~Eg~~ Eg: let  $f(x) = x^2 + 1$

simplify  $f(x-1) = (x-1)^2 + 1$   
 $= (x-1)(x-1) + 1$   
 $= x^2 - x - x + 1 + 1$

therefore  $f(x-1) = x^2 - 2x - 2$

This is important in calculus.

The slope of the line between  
 $(x, f(x))$   
and  $(x+h, f(x+h))$

$$\text{is } \frac{f(x+h) - f(x)}{(x+h) - x} = \frac{f(x+h) - f(x)}{h}$$

Eg: let  $f(x) = 2x + 1$

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$$\text{Then } \frac{f(x+h) - f(x)}{h} = \frac{\overset{\text{plug in } x+h}{2(x+h)+1} - \overset{\text{plug in } x}{2x+1}}{h}$$

$$= \frac{(2x + 2h + 1) - (2x + 1)}{h}$$

$$= \frac{2h}{h} = 2$$

↑  
this makes sense!  
 $y = f(x)$  is a line!