

## Outline

1. Functions (tables and graphs)
2. Function notation.
3. Domain.
4. Formulas for important functions.

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Quiz on Thursday in recitation.

# 1. Definition of Function

- A function is a rule relating one variable (input) to another variable (output) so that each input has one and only one output.

- Example: Table of values

x	1	2	7	9
y	0	-3	2	2

- $x = \text{input}$        $y$  is a function of  $x$   
 $y = \text{output}$       because each value of  $x$  has only one value of  $y$ .

- $y = \text{input}$       The input value  $y=2$   
 $x = \text{output}$       has two different  
output values (7, 9).

## Example: President & Drug Use

$x = \text{input} = \text{political party of President.}$

$y = \text{output} = \text{\% of high school seniors who have tried drugs.}$

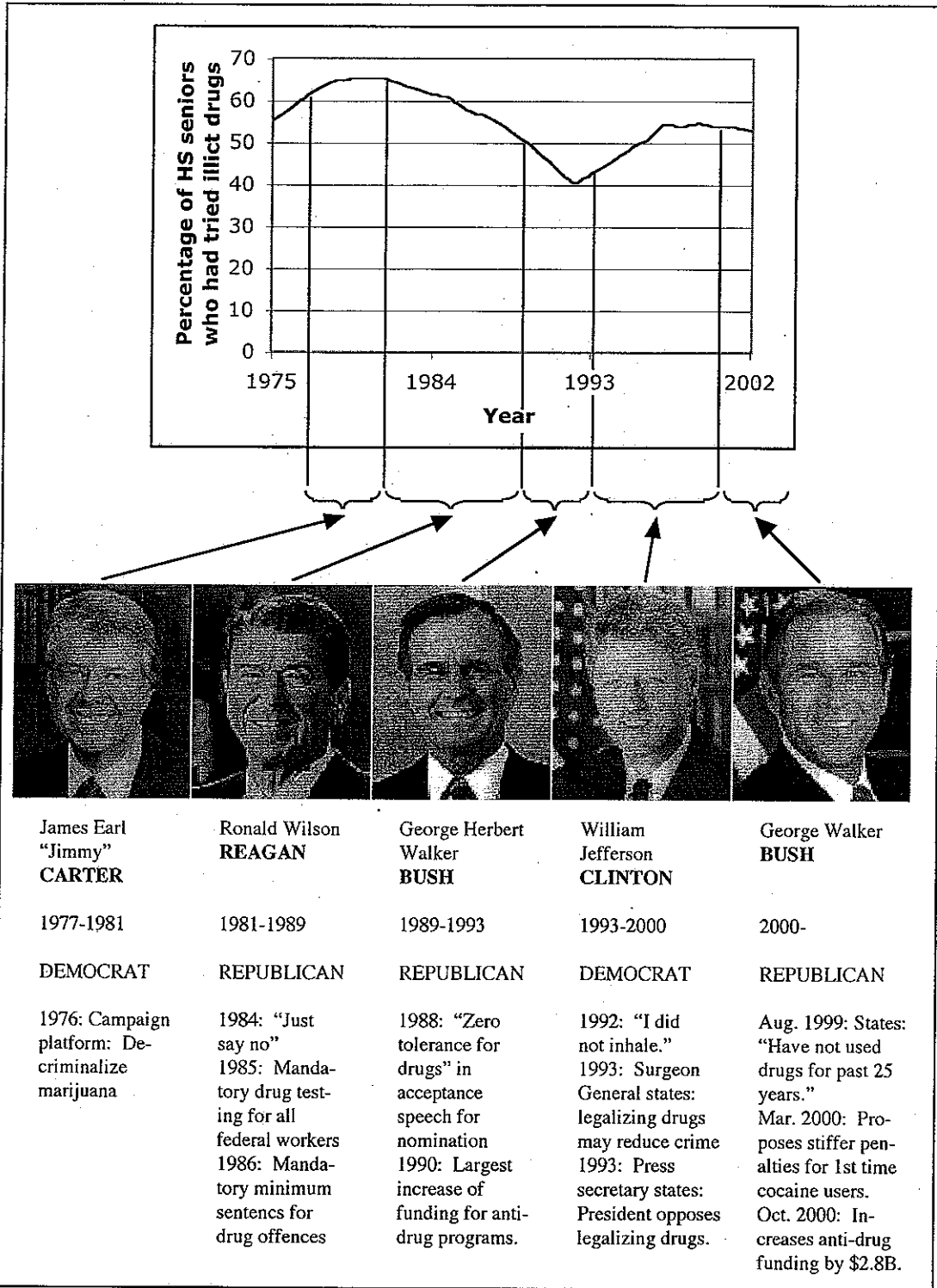
- Not a function because Presidents with same party (e.g. Reagan & G.W. Bush) had very different levels of drug use.

Try again:

$x = \text{input} = \text{political party of President.}$

$y = \text{output} = \text{rate of change of drug use during administration.}$

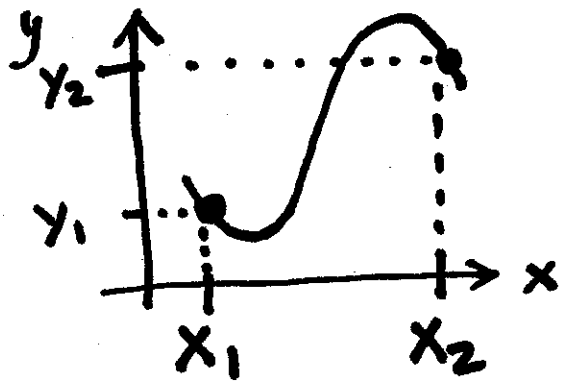
**Handout 1: Politics and Teenage Drug Use**



- Which factors seem to influence teenage drug use?

## Sidebar: Rate of Change

$x = \text{input}$        $y = \text{output}$



Rate of change  
between  $x_1$  and  
 $x_2$  is:

$$\text{Rate of change} = m = \frac{\text{Change in } y}{\text{Change in } x} = \frac{y_2 - y_1}{x_2 - x_1}$$

- Increasing:

Graph rises from  
left to right.

Rate of change  $> 0$ .

- Decreasing:

Graph drops from  
left to right.

Rate of change  $< 0$ .

Back to example:

President	Party	Average rate of change
Carter	D	$+5/4$
Reagan	R	-2
Bush I	R	-1.75
Clinton	D	$+5/4$

Input                  Output

- Not a function yet because the input 'R' has two outputs (-2 and -1.75).

Last attempt for a function:

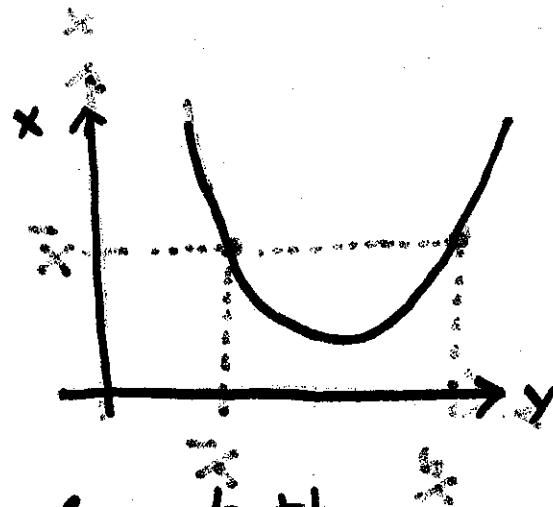
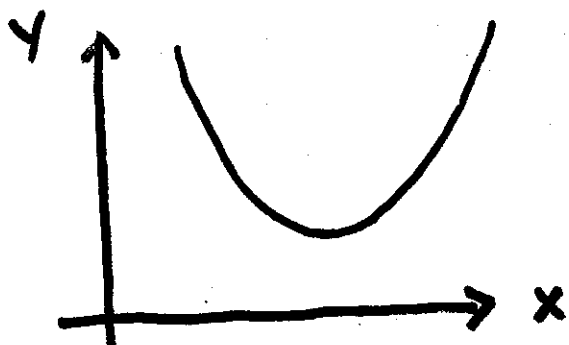
$x = \text{input} = \text{political party of President.}$

$y = \text{output} = \text{sign (+ or -)}$  of the average rate of change.

President	Carter	Reagan	Bush I	Clinton
$x$	D	R	R	D
$y$	+	-	-	+

• Finally:  $y$  is a function of  $x$ .

### Example: Graph



$x = \text{input}$       $y = \text{output}$  for both.

- Graph on the left is a function.
- Graph on the right, some  $x$ -values correspond to more than one  $y$ -value.
- Test: Vertical line test.

Horizontal axis = input

Vertical axis = output

- If each vertical line passes through only one point of the graph, then you have a function.

## Domains

- Domain of a function is the set of all legitimate inputs that can be plugged into the function.

e.g.  $y = \sqrt{4 - x^2}$  ← has to be  $\geq 0$ .

$$4 - x^2 \geq 0$$

$$4 \geq x^2$$

$$-2 \leq x \leq 2$$

add  $x^2$   
both sides.

square  
root both  
sides

Domain of  $y = \sqrt{4 - x^2}$  is all real numbers from  $-2$  to  $+2$ , including both of these.