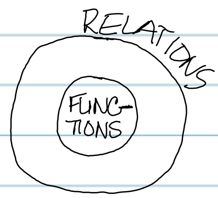
SECTION $\boxed{3.1}$

FUNCTIONS



$\boxed{EX}$: "USE A PEANUT M&M"

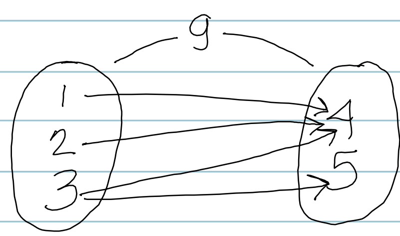
* NO REPEATING X-VALUES
→ FOR EVERY INPUT
↳ ONE OUTPUT ONLY

$\boxed{EX}$:

$A = \{(1,2), (3,4), (5,6)\}$

FUNCTION: YES OR NO
DOMAIN: $\{1,3,5\}$
RANGE: $\{2,4,6\}$ → CAN HAVE REPEATED VALUES

$\boxed{EX}$:



(1,4)
(2,4)
(3,4)
(3,5)

NOT A FUNCTION
D: $\{1,2,3\}$
R: $\{4,5\}$

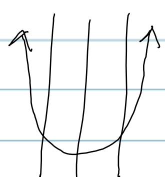
$\boxed{EX}$:

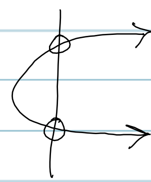
YEAR	WORLD SERIES DATA
2011 →	STL
1985 →	KC
1997 →	MARLINS
2010 →	GIANT

* SMALLEST TO LARGEST

D: $\{1985, 1997, 2010, 2011\}$
R: {STL, KC, MARLINS, GIANTS}

GRAPH(S):
VLT → VERTICAL LINE TEST

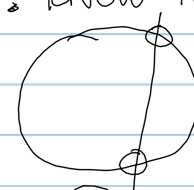




FCN: YES NO

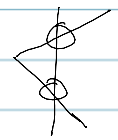
$x^2 + y^2 = 4$

IMPT: KNOW THE SHAPE (BASICS)



FCN: NO

$x = |y+3|$



no

FUNCTION NOTATION

$f(x) \rightarrow = y\text{-VALUE}$ f of x

$f(3)$
$f(x) = x^2 - 1$
$= (3)^2 - 8$
$= 9 - 1$
$f(3) = 8$

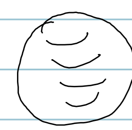
$(3, 8)$

$\boxed{EX}$: $y = x + 3$

Find y when $x = 12$

$f(x) = x + 3$
$f(12) = 12 + 3 = 15$

$\boxed{EX}$:
$f(x, y, z) = x^3 + y^3 + z^3$
$f(2, 3, 4)$



$\boxed{EX}$: $y = x + 2$ Find y when $x = 3$
$y = x - 3$
$y = x^2 + 4$
$y = 7x - 2$

$f(x) = x + 2$
$g(x) = x - 3$
$h(x) = x^2 + 4$
$k(x) = 7x - 2$

$h(3) = (3)^2 + 4 = 13$

$\boxed{EX}$:
$f(x) = x^2 - 3x + 4$
$f(1) = (1)^2 - 3(1) + 4$
$= 1 - 3 + 4$
$= 2$

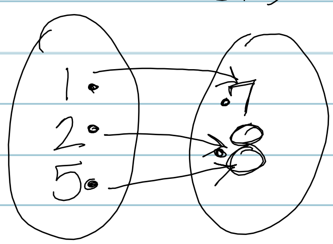
$f(z) = (z)^2 - 3(z) + 4$
$f(☺) = ☺^2 - 3☺ + 4$
$f(x+3) = (x+3)^2 - 3(x+3) + 4$
$= x^2 + 6x + \cancel{9} - 3x - \cancel{9} + 4$
$= x^2 + 3x + 4$

$\boxed{\text{PRACTICE}}$!

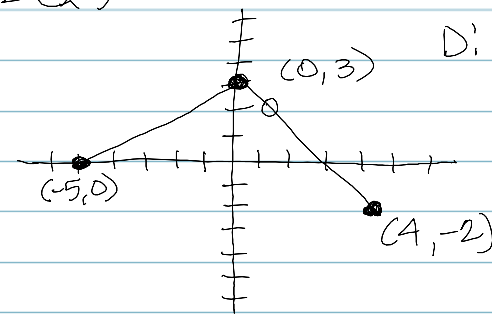
$f(x) = x^2 - x + 2$
$g(x) = x - 1$
$h(x) = 12$

x	R(x)
1	4
2	5
3	6

K(x)



Z(x)



D: [-5,4]

$f(0) = (0)^2 - (0) + 2$
$= 2$

$g(7) = (7) - 1$
$= 6$

$\underbrace{h(5)}_{\text{constant fcn}} = 12$ $\quad h(18) = 12$

$\underbrace{\text{constant fcn}}_{y=12}$

R(2) = 5 (LOOK AT TABLE)
R(3) = 6
R(4) = DOES NOT EXIST (DNE)

R(8) = DNE $\quad$ * MUST BE IN DOMAIN IN ORDER TO USE

K(2) = 8
K(12) = DNE
K(8) = DNE

Z(0) = 3 (ordered pair → $(\overset{x}{0}, \overset{y}{3})$)
Z(8) = DNE
Z(1) = 1.5 (have to look for it on graph)

$(f+g)(x) = f(x) + g(x)$
$= (x^2 \cancel{- x} + 2) + (\cancel{x} - 1)$
$= x^2 + 1$

$(f-g)(x) = f(x) - g(x)$
$(fg)(x) = f(x) \cdot g(x)$
$\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)} \quad g(x) \neq 0$

$2 \cdot f(3) = f(3) \cdot 2$
$= (3)^2 - 3 + 2$
$= 9 - 3 + 2$
$2 \cdot f(3) = 8 \cdot 2$
$= 16$

DIFFERENCE QUOTIENTS

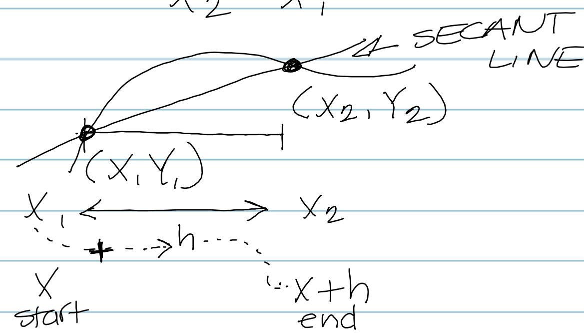
$$\frac{f(x+h)-f(x)}{h}$$

UNDERSTANDING THE HISTORY:

$(x_1, y_1) \quad (x_2, y_2)$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$\frac{f(x_2) - f(x_1)}{x_2 - x_1}$$



$f(x) = x^2 + 3x - 1$

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

$f(x+h) = (x+h)^2 + 3(x+h) - 1$

$$= \frac{\overbrace{(x+h)^2 + 3(x+h) - 1}^{f(x+h)} - (x^2+3x-1) \longrightarrow f(x)}{h}$$

$f(x+h) = (x+h)^2 + 3(x+h) - 1$

$x^2 + 2xh + h^2 + 3x + 3h - 1$

So, $(x, f(x))$

$(x+h, f(x+h))$

$$= \frac{(x^2+2xh+h^2+3x+3h-1) - (x^2+3x-1)}{h}$$ ← 3 should always cancel } hint

$$= \frac{\cancel{x^2} + 2xh + h^2 \cancel{+3x} + 3h \cancel{-1} \cancel{-x^2} \cancel{-3x} \cancel{+1}}{h}$$

$$= \frac{2xh + h^2 + 3h}{h} = \frac{\cancel{h}(2x+h+3)}{\cancel{h}}$$

$$= 2x + h + 3$$

$f(x) = 2x^2 - 3$ find ~~$f(x+h) = (x+h)^2$~~ $\dfrac{f(x+h) - f(x)}{h}$

$$= \frac{f(2x^2 - 3 + h) - 2x^2 - 3}{h}$$ } all over h

$= f(\cancel{2x^2} \cancel{-3} + h - \cancel{2x^2} \cancel{+3}$

$= \frac{h}{h} = 1$

$$f(x+h) = 2(x+h)^2 - 3$$
$$= 2(x^2 + 2xh + h^2) - 3$$
$$= 2x^2 + 4xh + 2h^2 - 3$$

$$f(x+h) - f(x) = \frac{(\cancel{2x^2} + 4xh + 2h^2 \cancel{-3}) - (\cancel{2x^2} \cancel{-3})}{h}$$
$$-\cancel{2x^2} \cancel{+3}$$

$$= \frac{4xh + 2h^2}{h} = \frac{h(4x+2h)}{h}$$
$$= 4x + 2h$$