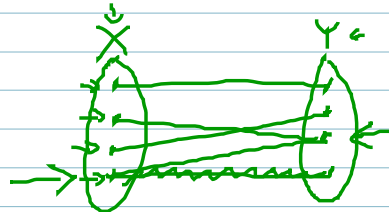


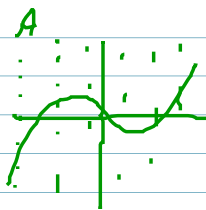
Relations - correspondence between 2 sets

→ X - input, domain, argument
 → Y - output, range, value, image

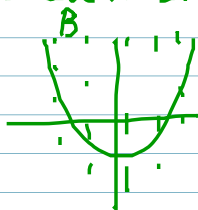
→ $X \rightarrow Y$
 (x,y)



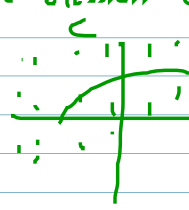
Function - A relation that associates each element of X with EXACTLY one element of Y



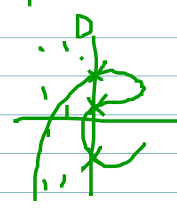
Function



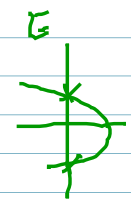
Function



Function



Not Function



Not Function

X	Y
-1	5
0	-7
1	5
3	6
-1	15

$\{(-1, 1), (2, 7), (3, 4), (5, 7), (2, 17)\}$

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

$$f(2) = 4(2)^2 - 3(2) + 7 = 16 - 6 + 7 = 17$$

(2, 17)

$$f(w) = 4w^2 - 3w + 7$$

$$f(0) = 4(0)^2 - 3(0) + 7$$

Implicit

$$3x + 4y = 7$$

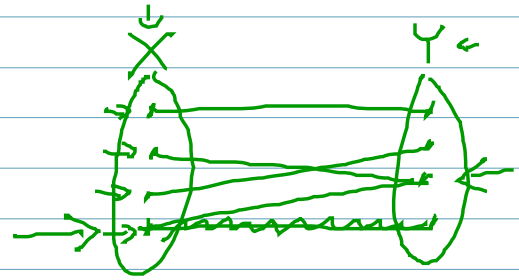
Explicit

$$y = f(x) = -\frac{3}{4}x + \frac{7}{4}$$

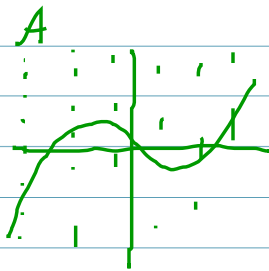
Relations - correspondence between 2 sets

→ x - input, domain, argument
 y - output, range, value, image

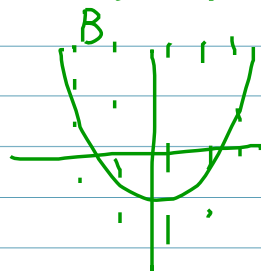
→ $x \rightarrow y$
 (x, y)



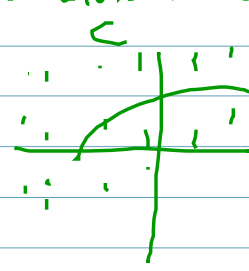
Function - A relation that associates each element of X with EXACTLY one element of Y



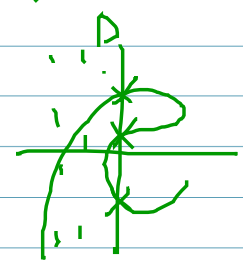
Function



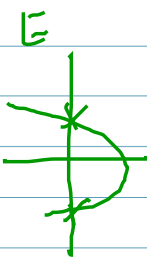
Function



Function



Not Function



Not Function

x	y
-1	5 ←
0	-7
1	5
3	6
-1	15 ←

$\{(-1, 1), (2, 7), (3, 4), (5, 7), (2, 17)\}$

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

$$f(2) = 4(2)^2 - 3(2) + 7$$

$$= 16 - 6 + 7 = 17$$

$(2, 17)$

$$f(w) = 4w^2 - 3w + 7$$

$$f(\odot) = 4(\odot)^2 - 3(\odot) + 7$$

Implicit

$$3x + 4y = 7$$

Explicit

$$y = f(x) = -\frac{3}{4}x + \frac{7}{4}$$

Domain

$$f(x) = \sqrt{7-x}$$

$$7-x \geq 0$$

$$7 \geq x$$

$$[-\infty, 7]$$

$$g(x) = \frac{x-2}{x-4} \leftarrow$$

$$x-4 \neq 0$$

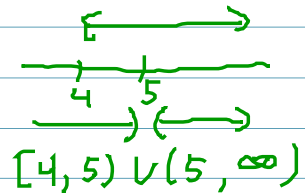
$$x \neq 4$$

$$(-\infty, 4) \cup (4, \infty)$$

$$h(x) = \frac{\sqrt{x-4}}{x-5} \leftarrow$$

$$x-4 \geq 0 \rightarrow x \geq 4$$

$$x-5 \neq 0 \rightarrow x \neq 5$$



Defined

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

$$f(5) = \frac{6}{8} = \frac{3}{4}$$

$$f(2) = \frac{0}{5} = 0$$

$$f(-3) = \frac{-10}{0} = \text{UNDEFINED}$$

$$(f \pm g)(x) = f(x) \pm g(x)$$

$$D = D_f \cap D_g$$

$$(fg)(x) = f(x)g(x)$$

$$D = D_f \cap D_g$$

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

$$D = (D_f \cap D_g) \setminus \{x : g(x) = 0\}$$

$$f(x) = \sqrt{x+1}$$

$$g(x) = x-2$$

$$(f-g)(x) = f(x) - g(x)$$

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

$$= \sqrt{x+1} - x + 2$$

$$x+1 \geq 0$$

$$x \geq -1$$

$$\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)} = \frac{\sqrt{x+1}}{x-2}$$

$$x \geq -1$$

$$x \neq 2$$

$$[-1, 2) \cup (2, \infty)$$

Difference Quotient

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

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

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

$$\underline{4x^2 - 3x + 7} + h = f(x) + h$$

$$\frac{4(x+h)^2 - 3(x+h) + 7 - (4x^2 - 3x + 7)}{h}$$

$$\frac{4(x^2 + 2xh + h^2) - 3x - 3h + 7 - 4x^2 + 3x - 7}{h}$$

$$\begin{array}{ccccccc} \downarrow & & \downarrow & & \downarrow & \downarrow & \downarrow & \downarrow \\ \frac{4x^2 + 8xh + 4h^2 - 3x - 3h + 7 - 4x^2 + 3x - 7}{h} \end{array}$$

$$\rightarrow \frac{8xh + 4h^2 - 3h}{h} = \frac{h(8x + 4h - 3)}{h} = \boxed{8x - 4h + 3}$$
