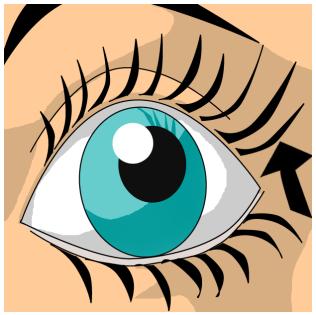
4-6: Formalizing Relations & Functions



Eye Opener

Your friend is playing a board game. He is on the space shown in the diagram at the right. He rolled a 3 to get to that space. Where could he have started? Explain your reasoning.

Essential Understandings

A **relation** is a pairing of numbers in one set (the **domain** - "x" values) with the numbers in another set (the **range** - the "y" values). A relation is often represented as a set of ordered pairs.

A **function** is a special type of relation in which each value in the domain is paired with exactly one value in the range.

You can identify functions using a **mapping diagram** or **vertical line test**. If any vertical line passes through more than one point of the graph, then for some domain value there is more than one range value, so the relation is not a function.

You can use various forms of **function notations** to define a function:

f(x) =	read f of x
y =	
f:x⟶	read f maps x to

$y = 5x$

$f(x) = 5x$

$f: x \to 5x$

$f: 2 \to 10$

$(2, 10)$

$g(x) = 3x$

$g(3) = 3 \cdot 3 = 9$

$(3, 9)$

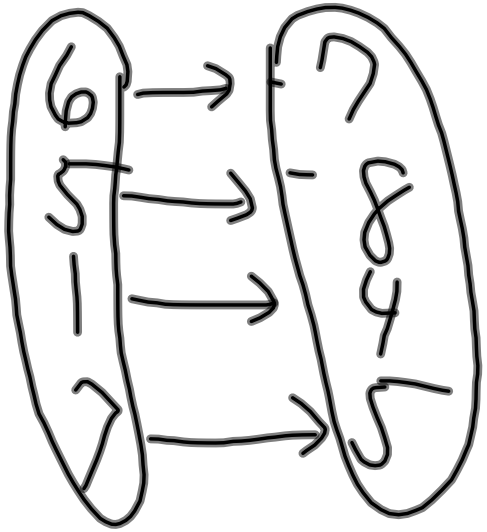
Identify the domain and range of each relation. Use a mapping diagram to determine whether the relation is a function.

Fnt

$\{(6, -7), (5, -8), (1, 4), (7, 5)\}$

$D = \{6, 5, 1, 7\}$

$R = \{-7, -8, 4, 5\}$



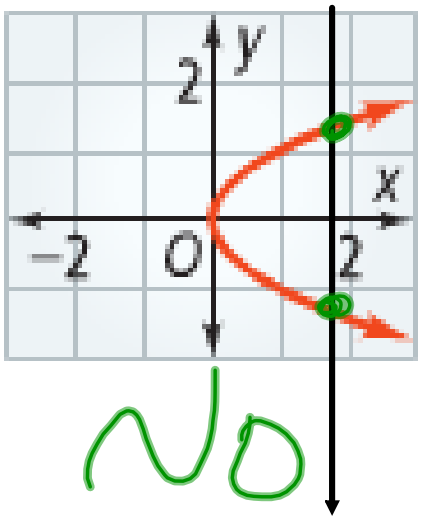
Not Fnt.

$\{(4, 2), (1, 1), (0, 0), (1, -1), (4, -2)\}$

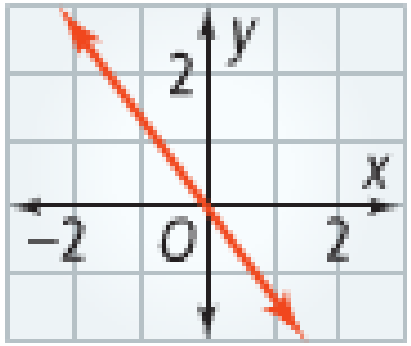
$D = \{4, 1, 0\}$

$R = \{2, 1, 0, -1, -2\}$

Use the vertical line test to determine whether the relation is a function.



NO



YES

Shopping You are buying orange juice for \$4.50 per container and have a gift card worth \$7. The function $f(x) = 4.50x - 7$ represents your total cost $f(x)$ if you buy x containers of orange juice and use the gift card. How much do you pay to buy 4 containers of orange juice?

$y = 4.50x - 7$

$f(x) = 4.50x - 7$

$f(4) = 4.50(4) - 7$

$= 18 - 7$

$= 11$

$g(t) = 4.5t - 7$

$f(4) = 11$

Find the range of each function for the given domain.

$g(x) = -4x + 1; \{-5, -1, 0, 2, 10\}$

$f(x) = 8x - 3; \left\{-\frac{1}{2}, \frac{1}{4}, \frac{3}{4}, \frac{1}{8}\right\}$

$-4 \cdot -5 \quad -4 \cdot -1 \quad 2 \cdot -4 \quad 10 \cdot -4$

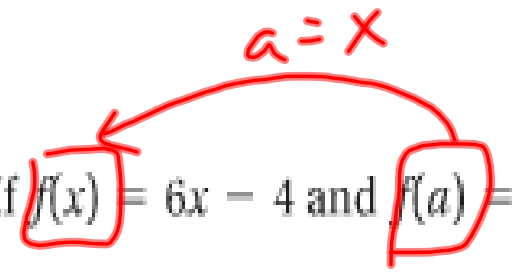
$20+1 \quad 4+1 \quad 0+1 \quad -8+1 \quad -40+1$

$21 \quad 5 \quad 1 \quad -7 \quad -39$

$8 \cdot -\frac{1}{2} \quad 8 \cdot \frac{1}{4} \quad 8 \cdot \frac{3}{4} \quad 8 \cdot \frac{1}{8}$

$-4-3 \quad 2-3 \quad 6-3 \quad 1-3$

$-7 \quad -1 \quad 3 \quad -2$



Reasoning If $f(x) = 6x - 4$ and $f(a) = 26$, what is the value of a? Explain.

$$26 = 6x - 4$$

$$\frac{30}{6} = \frac{6x}{6}$$

$$5 = x$$

$$f(5) = 6(5) - 4$$

$$= 30 - 4$$

$$= 26$$

If $f(x) = 3x - 5$ and $g(x) = x^3 - 4$ find:

$f(3) =$ $3(3) - 5$ $9 - 5$ 4

$g(0) =$ $0^3 - 4$ $0 - 4 = -4$

$f(2) + g(-2) =$ $1 + -12 = 11$

$3(f(-1)) =$ -8 -24

$2^3 - 4 = 8 - 4$ $f(4)$ $3(4) - 5$ $12 - 5 = 7$

$f(g(2)) =$

$g(f(2)) =$ $3 \cdot 2 - 5$ $6 - 5$ $g(1)$

$1^3 - 4$ $1 - 4$ -3

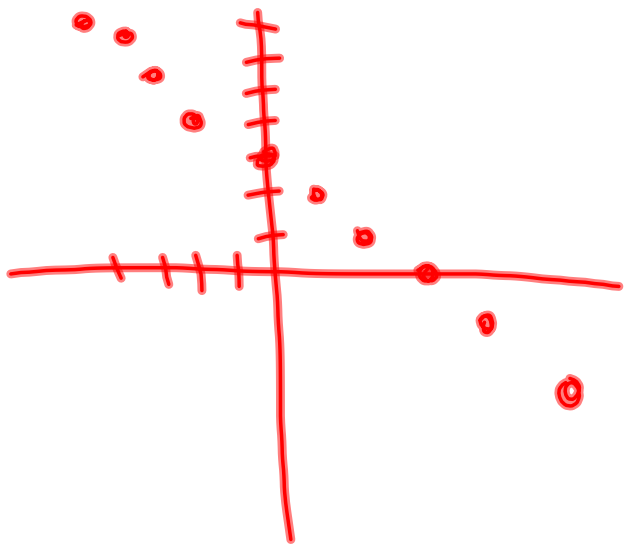
31. $(-4, 7), (-3, 6), (-2, 5), (-1, 4), (0, 3), (1, 2), (2, 1), (3, 0), (4, -1)$

	-4	7
	-3	6
+1	-2	5
+1	-1	4
+1	0	3
+1	1	2
	2	1
	3	0
	4	-1

-1 -1 -1 -1 -1 -1 -1

linear

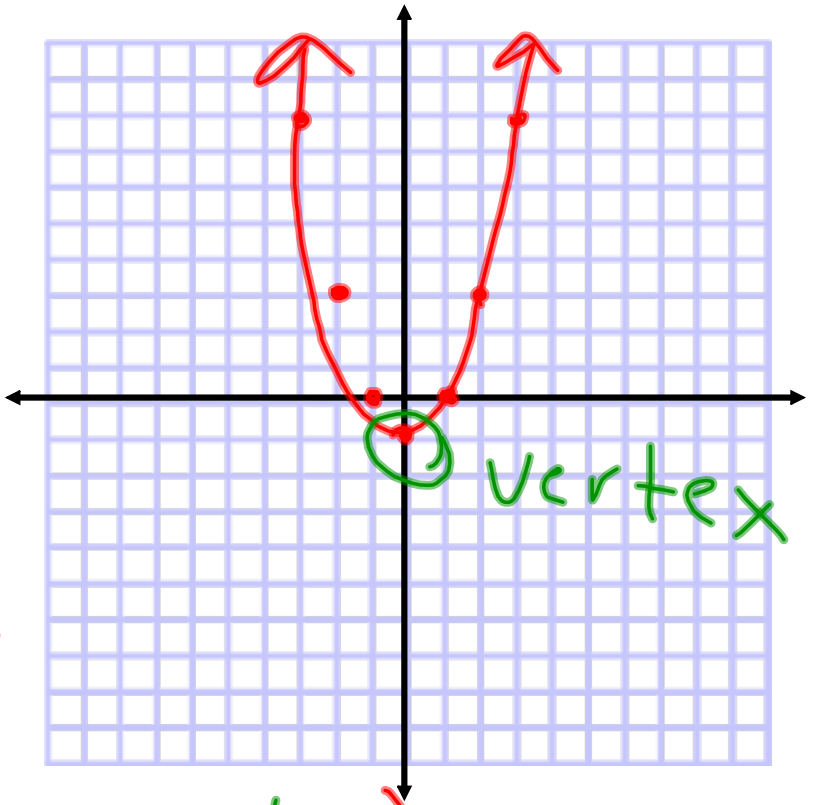
$y = -1x + 3$



32. $(-4, 15), (-3, 8), (-2, 3), (-1, 0), (0, -1), (1, 0), (2, 3), (3, 8), (4, 15)$

	−4	15	−7
+1	−3	8	−5
+1	−2	3	−3
+1	−1	0	−1
	0	−1	+1
	1	0	+3
	2	3	+5
	3	8	+7
	4	15	

non-linear



$y = \frac{1}{1}x^2 + 0 - 1$

Each set of ordered pairs represents a function. Write a rule that represents the function.

7. (2, 10), (4, 20), (5, 25), (7, 35), (9, 45)

8. (2, 5), (4, 9), (5, 11), (7, 15), (10, 21)

9. (0, 0), (1, 1), (2, 8), (3, 27), (4, 64)

10. (2, 5), (3, 10), (4, 17), (5, 26), (6, 37)