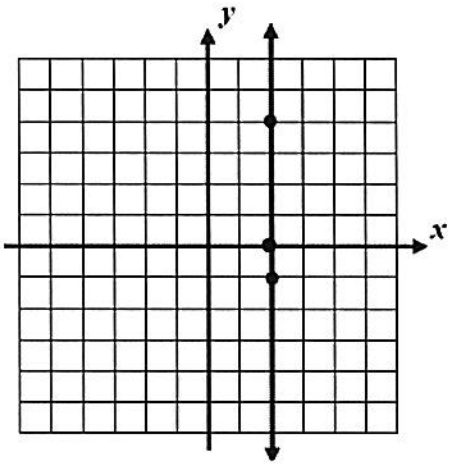
Essential Question: How can we identify the equations of vertical lines?

Do Now: Pictured below is the graph of a **vertical line**.



a) Name three points on the line.

(2, 4) (2, 0) (2, -1)

b) What do these three points have in common?

The inputs (x-values) are the same.

Graphing Vertical Lines

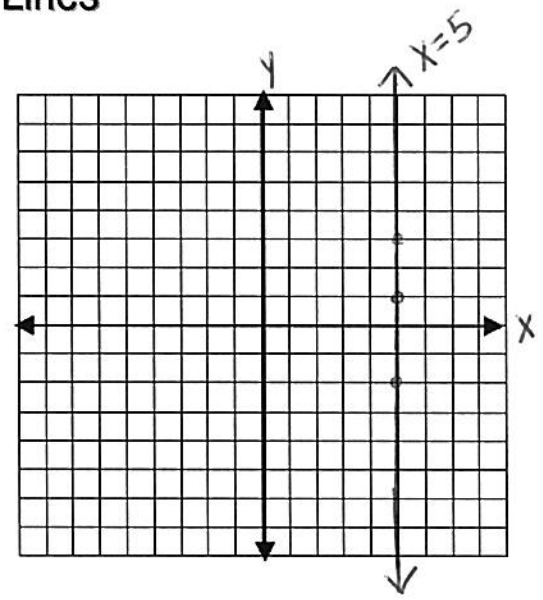
Example 1:

Consider: $x + 0y = 5$

Equation: $x = 5$

The equation of a vertical line is $x = a$, where a is any real number.

The x-value for the points that make up this equation is always a regardless of the y- value.



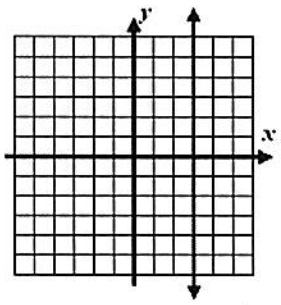
Graph $x = 5$

x	y
5	-2
5	1
5	3

Domain: [5] **Range:** $(-\infty, \infty)$

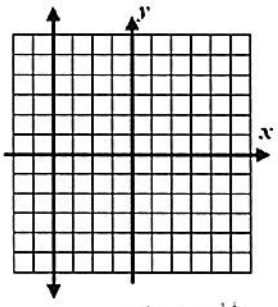
For each of the following, write the equation of the line shown or described.

(a)



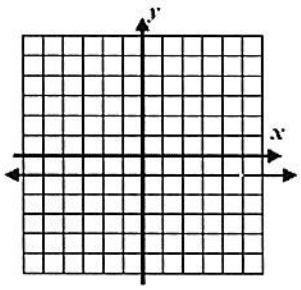
EQUATION: $x = 3$

(b)



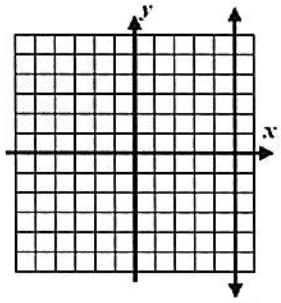
EQUATION: $x = -4$

(c)



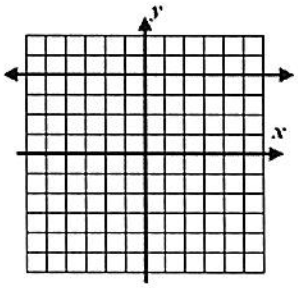
EQUATION: $y = -1$

(d)



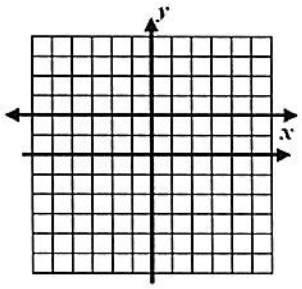
EQUATION: $x = 5$

(e)



EQUATION: $y = 4$

(f)



EQUATION: $y = 2$

(g) The equation of a vertical line passing through the point $(-4, 5)$.

x y

x = a number

$x = -4$

(h) The equation of a horizontal line passing through the point $(3, 2)$.

x y

y = a number

$y = 2$

Think about this...are horizontal and vertical lines functions? Explain.

Horizontal lines are functions. Every x-value has just one y-value. The graph passes the vertical line test.

vertical lines are not functions. The x-value has multiple different y-values. The graph fails the vertical line test.

The TAKE AWAY

The graphs of linear equations are pictures of diagonal, vertical and horizontal lines.

- A linear equation with both ***x*** and ***y*** terms will graph as a diagonal line.
- A linear equation with only an ***x*** term will graph as a vertical line.
- A linear equation with only a ***y*** term will graph as a horizontal line.

One more thought...

The x and y-axes are horizontal and vertical lines. Can they be represented by equations?

What is the equation of the line that represents the *x*-axis? $y = 0$

What is the equation of the line that represents the *y*-axis? $x = 0$

Let's review what we have learned up until this point.

Determine if each relation is a function. Justify your response by *explaining* your reasoning.

1. (-3, 1), (0, 0), (3, 1), (6, 4), (9, 0)

Function

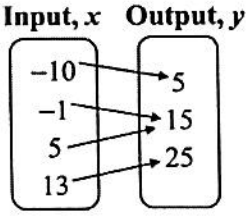
Every input has only one output.

2.

Domain	Range
4	1.5
-2	3
-2	3.5
0	4.5

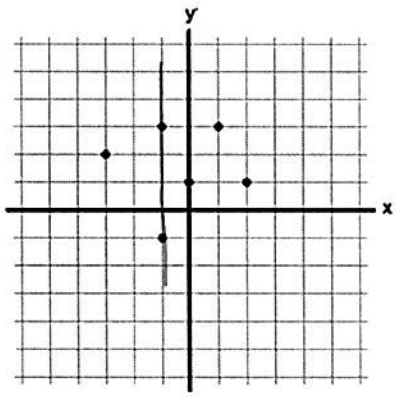
Not a function.
The input of -2 has two different outputs.

3.



Function
Each input has only one output.

4.



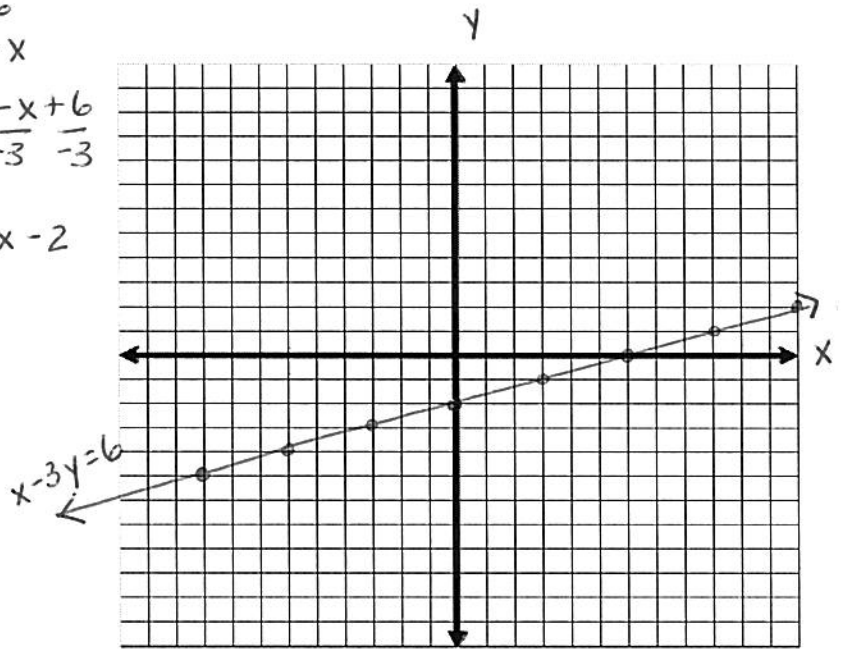
Not a function
Fails the vertical line test.
Input of -1 has two different outputs.

5. Graph the following linear function by creating a table of values. *Check all graphs with your calculator.*

$x - 3y = 6$

$x - 3y = 6$
$-x \quad -x$
$-3y = -x + 6$
$\frac{-3y}{-3} = \frac{-x}{-3} + \frac{6}{-3}$
$y = \frac{1}{3}x - 2$

x	y
-9	-5
-6	-4
-3	-3
0	-2
3	-1
6	0
9	1
12	2



Consider the function $x - 3y = 6$ graphed above. Is the point **(696, 230)** part of the line? Justify your response.

$x - 3y = 6$
$696 - 3(230) = 6$
$696 - 690 = 6$
$6 = 6$ ✓

yes, the point is part of the line because it makes the equation true.

substitute the value in for the variable

if the equation is true, the point lies on the graph.

6. Graph the lines defined by the equations $x = 4$ and $y = -5$ on the same set of axes. Name the ordered pair where the two lines intersect.

(4, -5)