Note on Notation

Recall for ordered pair

(x, y)

x = 1st coordinate which stores input value(s) for this point

y = 2nd coordinate which stores output value(s) for this point

Graphical Technique

We can also use the vertical line test to check if a given relation is a function. To do so, we draw a vertical line at every point in the domain of our relation. If any of these vertical lines touch ~~more~~ more than one output, the relation is not a function.

Class #:

...ctions (p. 511 – 522)

...ures 15 & 16 p. 511)

...2)

...)

...6)

...ons (p. 517)

...ction (p. 517)

Function: *noun* (Section 7.1 p. 512)

- Nerdy definition: A **function** ... element in the domain of the ... or element in the range of the ...
- Street definition:

Vertical line test

We can draw vertical lines at each input ~~point~~ in the domain to test the graph for multiple outputs

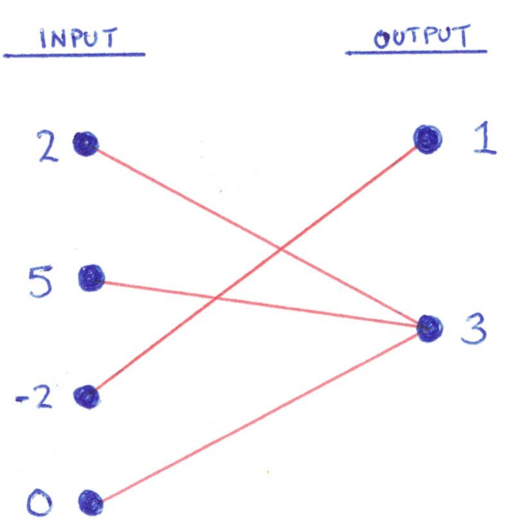
- if each vertical line touches the graph only once, its a function
- if not, the graph does not represent a function

For problems 1 and 2 below, consider the given relationship...

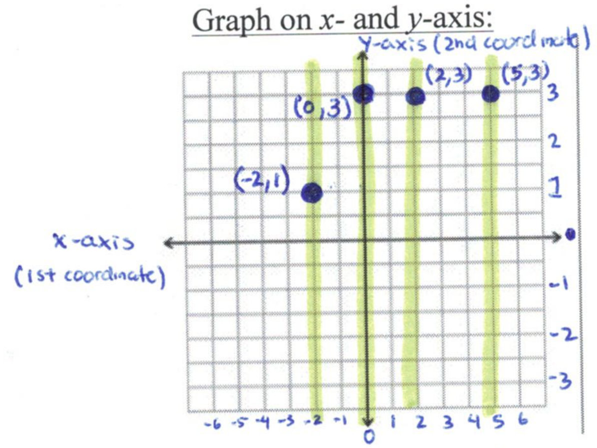
a. Draw an input-output diagram.
b. Draw the points on an x- and y-axis.
c. Determine whether each of the following is a functi...

1. $\{(2,3), (5,3), (-2,1), (0,3)\}$

Draw input-output diagram



Graph on x- and y-axis:



Input-output diagrams are used to visualize relations.

We can check if a relation is a function by counting the number of lines coming out of each input element.

- if only one line comes out of each input our relation is a function
- if not the relation is NOT a function

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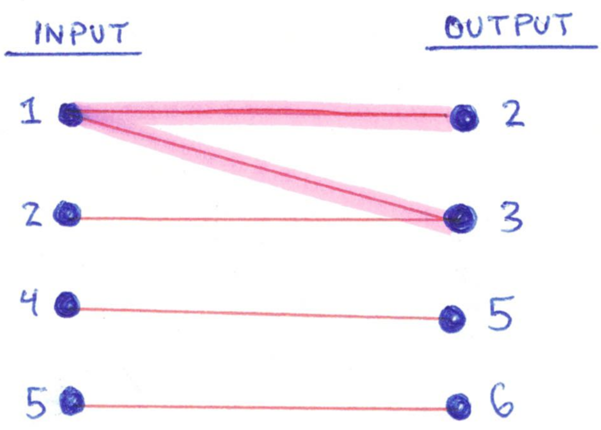
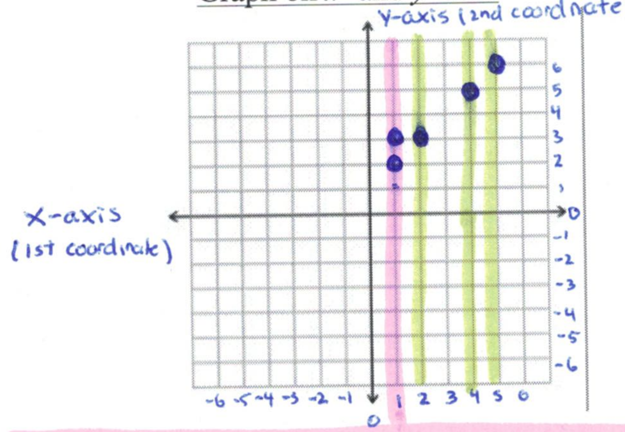
2. $\{(1,2), (2,3), (1,3), (4,5), (5,6)\}$

Draw input-output diagram



Graph on *x*- and *y*-axis:

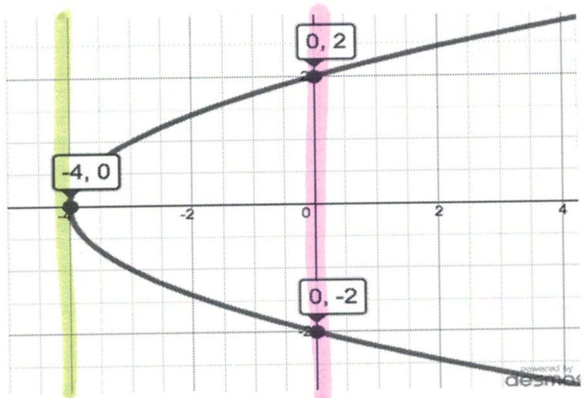


Notice the vertical line $x=1$ intersects TWO points from our relation (NOT a function)

SECTION 7.1: Determining if a Relation Represents a Function (p. 512)

For problems 3, 4, 5, and 6, observe the given graph. Using this graph, determine whether the relationship displayed represents a function or not. Justify your answer.

3.



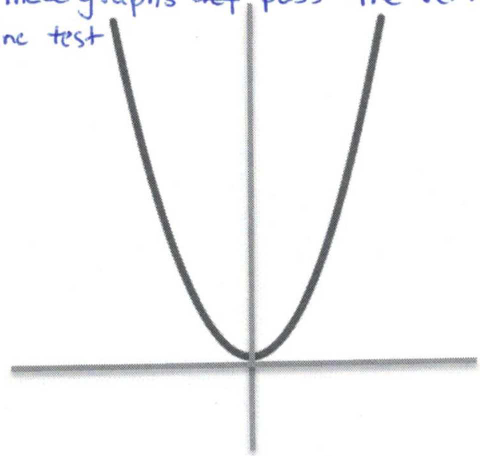
The relation $x = y^2 - 4$ is NOT a function. We see that the graph of this relaton fails the vertical line test. In particular, the vertical line

$x = 0$

touches the graph at two points $(0,2)$ and $(0,-2)$ confirming that this relation is NOT a function.

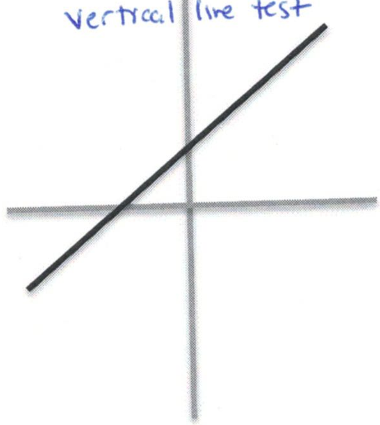
4. Parabola

Parabola's "are functions" because these graphs ~~not~~ pass the vertical line test

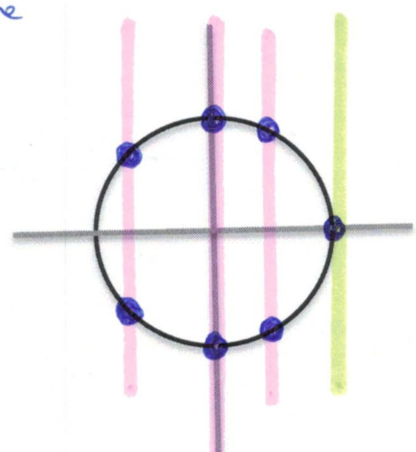


5. Line

Lines are functions. The graphs of lines pass the vertical line test



6. Circle



A circle "is not a function. The graph of a circle fails the vertical line test.

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Algebraic Technique
When evaluating functions at a given input our first step is to replace variable with input value using parenthesis, then simplify

SECTION 7.1: Finding Function Values (p. 515)
For problems 7 and 8 below, evaluate the given function at the given points.

7. Let $f(x) = \frac{x^2-25}{5-x}$.

a. Find $f(2)$

input $x = 2$

$$f(2) = \frac{(2)^2 - 25}{5 - (2)}$$

$$= \frac{4 - 25}{5 - 2}$$

$$= \frac{-21}{3} = \boxed{-7}$$

b. Find $f(5)$

input $x = 5$

$$f(5) = \frac{(5)^2 - 25}{5 - (5)}$$

$$= \frac{5^2 - 25}{5 - 5}$$

$$= \frac{25 - 25}{0}$$

$$= \frac{0}{0}$$

undefined
(Not possible. we cannot divide by zero)
see reverse

Note on Notation

Function notation is given by

$$y = f(x) \quad \text{"f of x"}$$

- input is inside parenthesis
- output is the expression that results when evaluating f at given input
- parenthesis do not represent multiplicatn

WARNING: Division by 0

Note that division is connected to multiplication

- $x = \frac{10}{2} \Rightarrow 2 \cdot x = 10$

if we multiply the quotient by the denominator of our fraction, we should get the numerator

Given this relation, consider

- $x = \frac{10}{0} \Rightarrow 0 \cdot x = 10$

When dividing any nonzero number by zero, we are trying to find a quotient that will multiply to zero to produce our nonzero numerator. This is not possible.

We can similarly consider

- $x = \frac{0}{0} \Rightarrow 0 \cdot x = 0$

There is no single, well defined x that satisfies this equation. and thus we say $\frac{0}{0}$ does not exist

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8. Let $h(t) = -t - t^2$. Find

a. Find $h(2)$

input $t=2$

$$h(2) = -(2) - (2)^2$$
$$= -2 - (2^2)$$
$$= -2 - 4$$
$$= \boxed{-6}$$

b. Find $h(-3)$

input $t=-3$

$$h(-3) = -(-3) - (-3)^2$$
$$= +3 - (-3 \cdot -3)$$
$$= 3 - 9$$
$$= \boxed{-6}$$

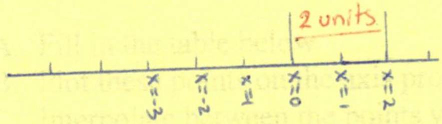
WARNING

$(-3)^2 \neq -3^2$

Algebraic Technique

We can define the absolute value function graphically using the real number line as the distance away from zero.

$|2|$: gives the "distance" between $x=2$ and $x=0$



(p. 522 – 531)

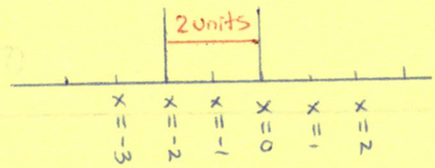
on (p. 522)

properties (p. 5

ion Evaluation

otted to create th

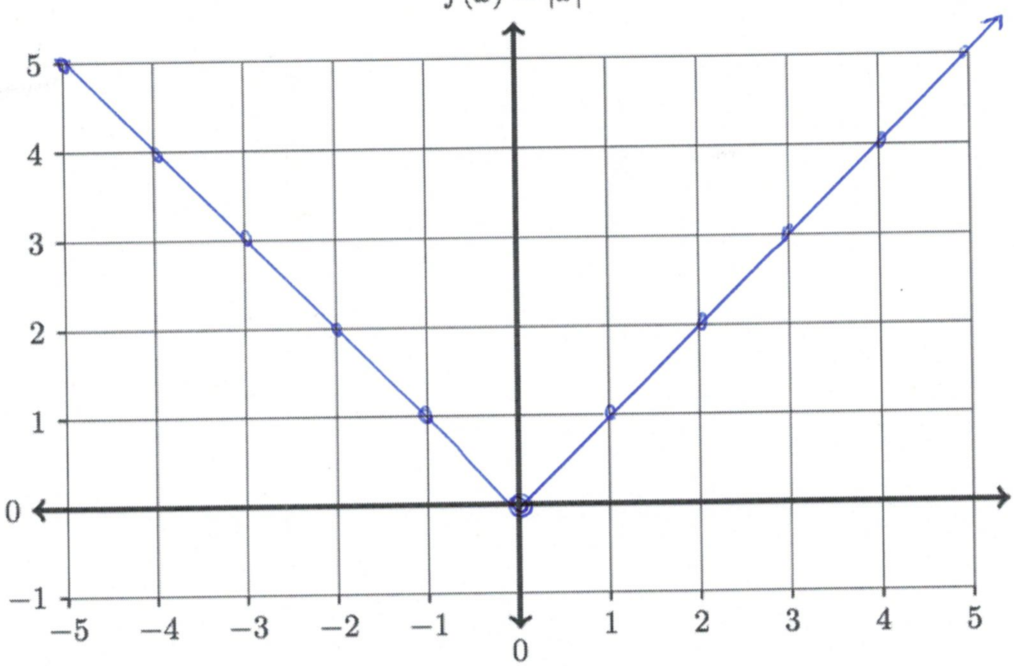
$|-2|$: gives the "distance" between $x=-2$ and $x=0$



$\Rightarrow |-2| = 2$

x	$f(x) = \lvert x \rvert$
−5	5
−4	4
−3	3
−2	2
−1	1
0	0
1	1
2	2
3	3
4	4
5	5

$f(x) = |x|$



10. What is the x–intercept of this graph?

The x-intercept is at point (0,0) with $x=0$.

11. Why does the graph of the absolute value function never go below the line $y = 0$

The absolute value must be nonnegative.

Calculator Technique

To use a TI calculator to graph an absolute value function, push the MATH button, scroll to NUM list and choose "abs("

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Calculator Technique

We can look at the graph

OR we can use the "TABLE"

button combined with the

"TBL SET" button on our ~~ca~~

calculator to find points

on our graph

Graphical Technique to solve algebraic equations

To find the solution to algebraic equations using a graphical t

Step 1: Identify and graph the function on the left-hand

Step 2: Identify the function on the right-hand side of tl function on the same axis you used in step 1.

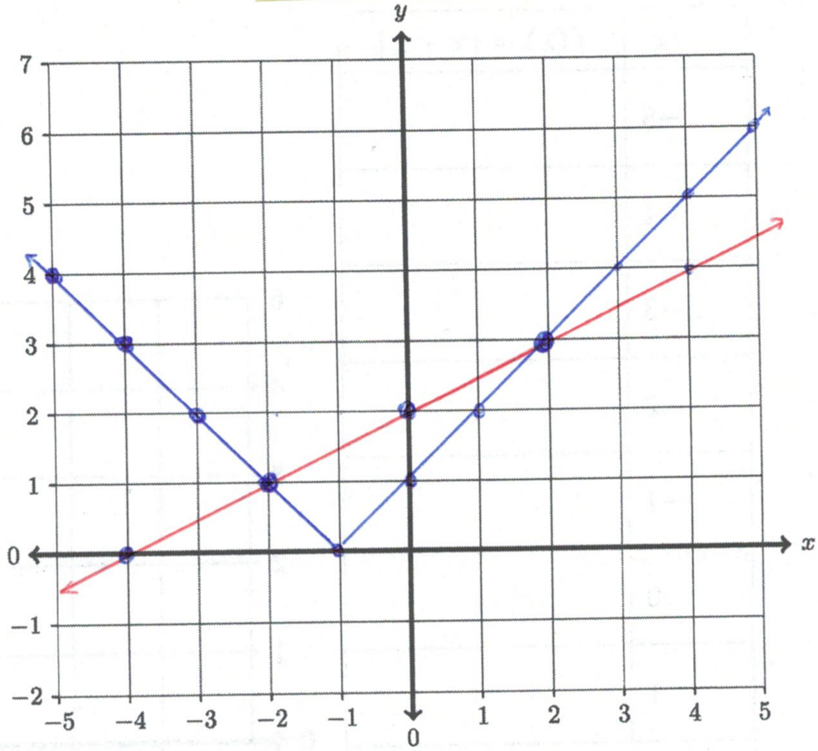
Step 3: Find the point(s) of intersection between the gr

Step 4: Identify the 1st coordinate (the "x" value) of the

Step 5: The 1st coordinate(s) represent the solution(s) t

2. Use a graphical technique to solve the equation $|x+1| = 2 + \frac{1}{2}$

x	$y_1 = \lvert x+1 \rvert$	$y_2 = 2 + \frac{1}{2}x$
−5	4	-1/2
−4	3	0
−3	2	1/2
−2	1	1
−1	0	3/2
0	1	2
1	2	5/2
2	3	3
3	4	7/2
4	5	4
5	6	9/2



3. Using your table and graph above, identify the solution(s) for equation: $|x+1| = 2 + \frac{1}{2}x$

Recall: the solution to our equation occurs where the graphs intersects

Left point of intersection: $(-2, 1) \Rightarrow \boxed{x = -2}$

Right point of intersection: $(2, 3) \Rightarrow \boxed{x = 2}$

4. Explain, in your own words, how to use the graphical technique to solve algebraic equations.

Rewrite the graphical technique from above in your own language.