CCSS Algebra 3 Function Characteristics:

1. Good news! The vending machine in the cafeteria has broken so that you can get a drink without putting in any money. Levi runs down to the vending machine, presses Button 1 and gets a Vitamin Water. He presses Button 1 again and gets another Vitamin Water. He presses Button 2 and gets a Gatorade; when he presses Button 2 again, he gets a Vitamin Water.

a. We say that an operation is a relation when a distinct input leads to an output. What are the inputs and outputs for the vending machine?

b. When an relation (machine or otherwise) is operating consistently, it is called a **function**. Is the vending machine operating as a function for Levi? Explain why or why not.

c. More formally, functions are relations in which a given input always results in the only one output. Explain what this formal definition means for the vending machine. Under what conditions would the vending machine be a function? (This would be a good time to define **function** in your notes).

d. When operating normally, the vending machine should follow the table below:

Button	1	2	3	4	5
Drink	Vitamin Water	Gatorade	Vitamin Water	Gatorade	Orange Juice

Is the vending machine normally a function? Explain why or why not. What is the domain and range for the vending machine?

e. Recall that the **inverse** of a relation reverses the input and outputs. What would the table look like for the inverse of the normally operating vending machine?

f. What is the domain and range of the inverse of the vending machine? How does it compare to the domain and range of the first table? (This would be a good time to put information about the domain and range of inverse functions in your notes).

g. Is the inverse of the vending machine a function? Explain why or why not.

Mathematical Functions: On the previous page, the input was the button you press, and the output was the drink you get from the vending machine. In mathematical functions, the input is the x you plug in, the output is the y. Mathematical functions are like consistent vending machines: each input gives only one output.

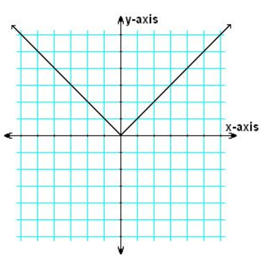
2. a. Complete the table below for the function $g(x) = (x-1)^3 + 2$

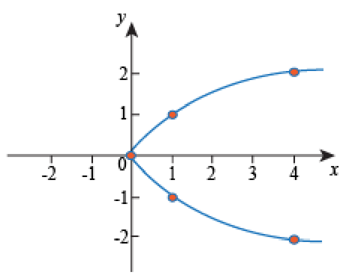
x	-1	0	1	2	3
y					

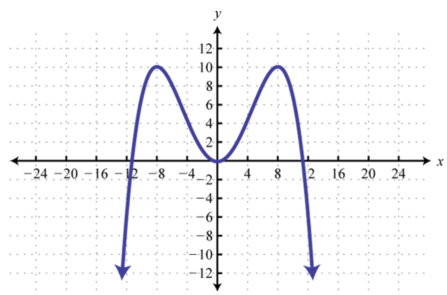
b. Based on the table, is $g(x)$ a function?

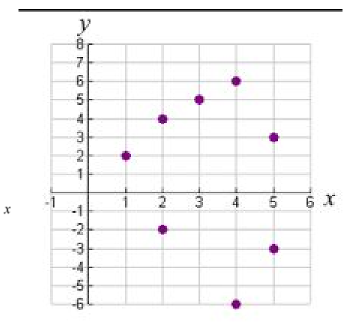
c. Graph $g(x)$. Can you locate any values of x (inputs) that have more than one output (y)?

d. Which of the relations below are functions? Justify your answer. (This would be a good time to put information about how to identify a function using a graph in your notes).









f. Using desmos.com, graph the relation $x^2 + y = 4$.

i. Is this relation a function? Explain why or why not.

ii. By switching the input (x) and output (y), graph the inverse of this relation. Is it a function? Explain why or why not.

iii. Repeat parts i and ii for each relation below:

- $x + y = 7$
- $y = (x-1)^3 + 2$
- $y = 2|x+4|$
- $0.25x^3 - y = 1$
- $4x^2 + y^2 = 25$

f. Under what conditions will both a relation and its inverse be functions? When will one be a function and one not be a function? Are there situations in which both will not be functions? Be specific. Write in your notes about graphs and tables of functions and inverses.