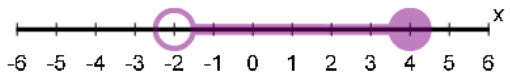
Name_____ Piecewise Functions Introduction

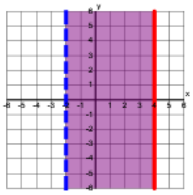
Warm UP Questions 1-4

1. Which of the following is NOT related to $-2 < x \leq 4$?
Circle all that apply

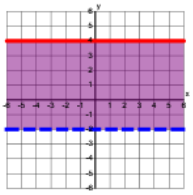
Graph A



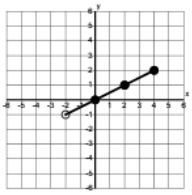
Graph B



Graph C



Graph D



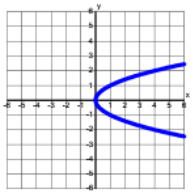
E: Set Notation

$x \in (-2,4]$

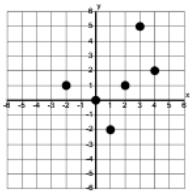
2. Briefly explain your choice(s) for question 1

3. Which of the graphs below depicts a relation that is NOT a function? Circle all that apply

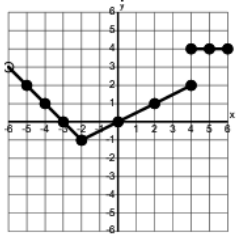
Graph A



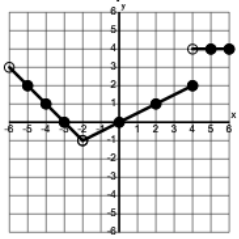
Graph B



Graph C



Graph D



4. Briefly explain your reasoning behind the selection of your answer for question 3

Why is POINT-SLOPE FORM FOR LINES: $y-y_1= m(x-x_1)$ like Vertex Form?

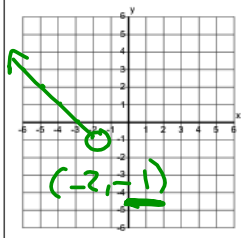
(x_1, y_1) $m = \frac{5}{1}$

$y - y_1 = m(x - x_1)$

$+y_1 \quad +y_1 \Rightarrow y = m(x-x_1)+y_1$

Single-piece piecewise functions are basically functions with a restricted domain. Write lines in Point-Slope/Vertex Form.

5. Graph 1



Graph the function $y = -x - 3$

$\frac{1}{-1} = m = -1 = \frac{-1}{1}$ $b = -3$

Then, erase the part of the function that is not in the domain:

$x < -2$

not including -2

open circle point

What is now the Range in Interval notation for graph 1

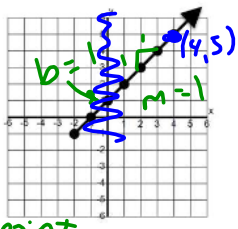
$y \in (-1, \infty)$

open Point

Range using inequality for graph 1

$-1 < y < \infty$

6. Graph 2



Range in Interval notation for graph 2

$y \in [-1, \infty)$

Closed Point

Write the Related function with domain restriction for Graph 2

$y = x + 1$ or $y = 1(x-4)+5$

Range using inequality for graph 2

$-1 \leq y < \infty$

$\therefore$

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Warm UP Questions 1-4

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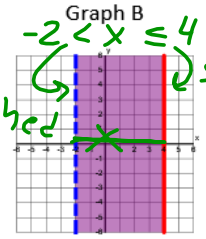
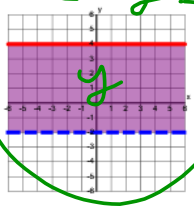
Graph A

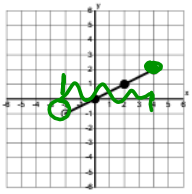
Graph B



Graph C



Graph D



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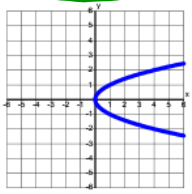
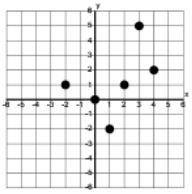
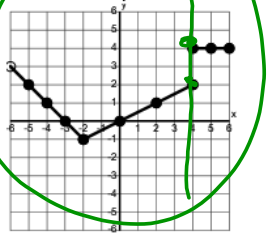


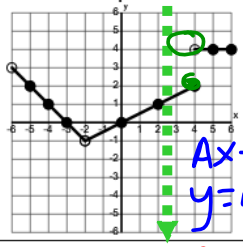
Graph B



Graph C



Graph D



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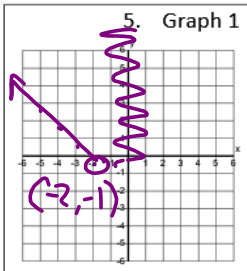


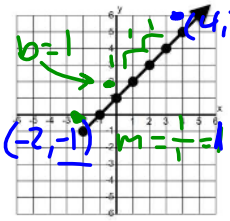
Graph the function $y = +x - 3$

Then, erase the part of the function that is not in the domain: $x < -2$

What is now the Range in Interval notation for graph 1
$y \in$ _____

Range using inequality for graph 1

6. Graph 2



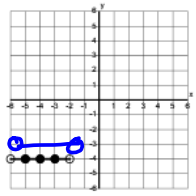
Write the Related function with domain restriction for Graph 2

Range in Interval notation for graph 2
$y \in$ _____

Range using inequality for graph 2

horizontal lines

Graph 3



Graph the function $y = -4$

Then, erase the part of the function that is not in the domain: $-6 < x < -2$

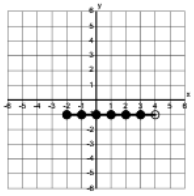
Range in Interval notation for graph 3

$y \in$ {-4}

Range using inequality for graph 3

$y = -4$

Graph 4



Write the Related function with domain restriction for Graph 4

$y = -1$

$-2 \leq x < 4$

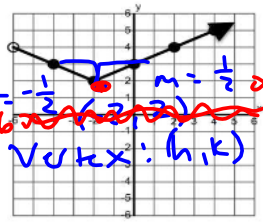
Range in Interval notation for graph 4

$y \in$ {-1}

Range using inequality for graph 4

$y = -1$

Graph 5



Write the Related function with domain restriction for Graph 5 (use vertex form)

$m = -\frac{1}{2}$ $m = \frac{1}{2}$ ∞

$y = a|x-h|+k$

$y = \frac{1}{2}|x+2|+2$

Vertex: (h, k)

$-6 < x < \infty$

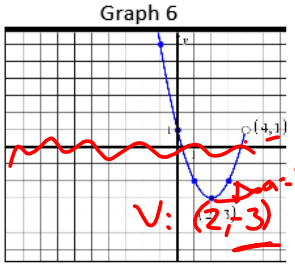
Range in set notation for graph 5

$y \in [2, \infty)$

Range using inequality for graph 5

$2 \leq y < \infty$ or $y \geq 2$

Graph 6



Write the Related function with domain restriction for Graph 6 Quadratic

Use absolute value function in vertex form

$y = a(x-h)^2+k$

$y = 1(x-2)^2-3$

$x < 4$

Range in set notation for graph 6

$y \in [-3, \infty)$

Range using inequality for graph 6

$-3 \leq y < \infty$ or $y \geq -3$

Graph each of the following piecewise functions and determine the related function values. Use the table for any algebraic work necessary.

Piecewise Function 1

$$g(x) = \begin{cases} -|x+2|+1, & x < 0 \\ 3x-3, & 0 \leq x < 2 \\ x+2, & x \geq 2 \end{cases}$$

7. Complete the related table for f(x)

x	Work for f(x)	f(x)
-3	$-\|-3+2\|+1 = -\|-1\|+1 = -1+1$	(-3, 0)
-2	$-\|-2+2\|+1 = -\|0\|+1 = 0+1$	(-2, 1)
-1	$-\|-1+2\|+1 = -\|1\|+1 = -1+1$	(-1, 0)
0	$-\|0+2\|+1 = -2+1 = -1$	(0, -1)
0	$3(0)-3 = 0-3$	(0, -3)
1	$3(1)-3 = 3-3 = 0$	(1, 0)
2	$3(2)-3 = 6-3 = 3$	(2, 3)
2	$(2)+2 = 4$	(2, 4)
3	$(3)+2 = 5$	(3, 5)

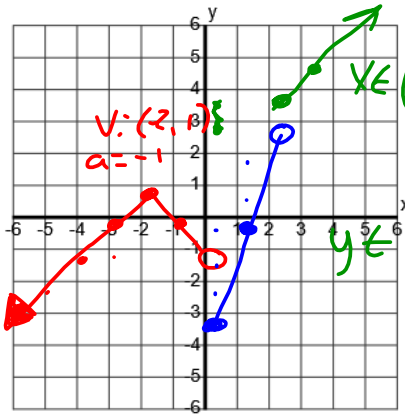
Open point

Closed point

Open

Closed

Graph of Piecewise Function 1



Domain: $x \in (-\infty, \infty)$

Range: $y \in (-\infty, 3) \cup [4, \infty)$

Is this continuous?

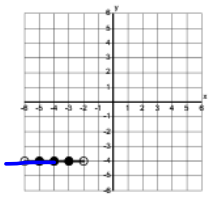
What is...

g(-3) $= -|-3+2|+1 = 0$

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

g(2) $= (2)+2 = 4$

Graph 3



Graph the function $y = -4$

Then, erase the part of the function that is not in the domain:

$-6 < x < -2$

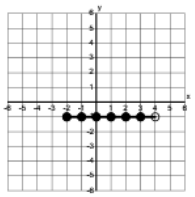
Range in Interval notation for graph 3

$y \in \{-4\}$

Range using inequality for graph 3

$y = -4$

Graph 4



Write the Related function with domain restriction for Graph 4

$y = -1 \quad -2 \le x < 4$

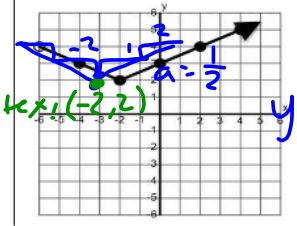
Range in Interval notation for graph 4

$y \in \{-1\}$

Range using inequality for graph 4

$y = -1$

Graph 5



Write the Related function with domain restriction for Graph 5 (use vertex form)

Vertex: $(-2,2)$ $a = \frac{1}{2}$

$y = \frac{1}{2}|x+2|+2$

$-6 < x < \infty$ or $x > -6$

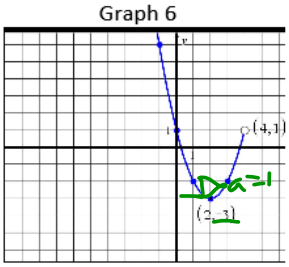
Range in set notation for graph 5

$y \in [2, \infty)$

Range using inequality for graph 5

$2 \le y < \infty$ or $y \ge 2$

Graph 6



Write the Related function with domain restriction for Graph 6

Quadratic

Use absolute value function in vertex form

$y = 1(x-2)^2 - 3$

$x < 4$ or $-\infty < x < 4$

Range in set notation for graph 6

$y \in [-3, \infty)$

Range using inequality for graph 6

$-3 \le y < \infty$

Graph each of the following piecewise functions and determine the related function values. Use the table for any algebraic work necessary.

Piecewise Function 1

$$g(x) = \begin{cases} -|x+2|+1, & -3 \le x < -2 \\ 3x-3, & -2 \le x < 2 \\ -x+2, & x \ge 2 \end{cases}$$

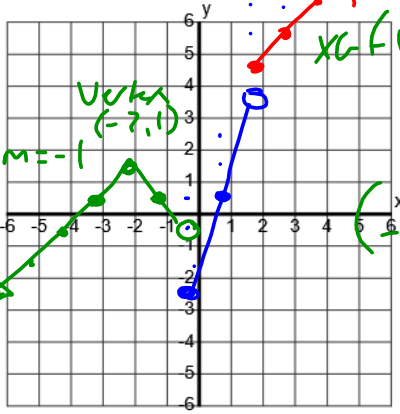
7. Complete the related table for f(x)

x	Work for f(x)	f(x)
-3	$-\|-3+2\|+1 = -\|-1\|+1 = -1+1$	$(-3,0)$
-2	$-\|-2+2\|+1 = -\|0\|+1 = -0+1$	$(-2,1)$
-1	$-\|-1+2\|+1 = -\|1\|+1 = -1+1$	$(-1,0)$
0	$-\|0+2\|+1 = -\|2\|+1 = -2+1$	$(0,-1)$
0	$3(0)-3 = 0-3 = -3$	$(0,-3)$
1	$3(1)-3 = 3-3 = 0$	$(1,0)$
2	$3(2)-3 = 6-3 = 3$	$(2,3)$
2	$(2)+2 = 4$	$(2,4)$
3	$(3)+2 = 5$	$(3,5)$

open point

closed point

Graph of Piecewise Function 1



Domain: $x \in (-\infty, \infty)$

Range: $(-\infty, 3) \cup [4, \infty)$

Is this continuous? No

What is...

$g(-3) = 0$

$g(0) = -3$

$g(2) = 4$

Pencil is picked up to draw it

there are jumps or breaks in the graph

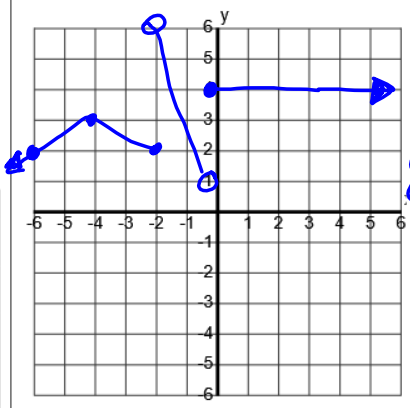
Piecewise Function 2

$$g(x)=\begin{cases}-\frac{1}{2}|x+4|+3 & x \le -2\\ \frac{-5}{2}x+1, & -2<x<0\\ 4, & x \ge 0\end{cases}$$

8. Complete the related table for g(x)

x	Work for g(x)	g(x)
-6	$-\frac{1}{2}\lvert -6+4\rvert+3=-\lvert+3$	(-6,2)
-4	$-\frac{1}{2}\lvert -4+4\rvert+3=0+3$	(-4,3)
-2	$-\frac{1}{2}\lvert -2+4\rvert+3=-\lvert+3$	(-2,2)
-2	$-5/2(-2)+1=5+1$	(-2,6)
0	$-5/2(0)+1=0+1$	(0,1)
0	4	(0,4)
2	4	(2,4)
3	4	(3,4)

Graph of Piecewise Function 2



Domain: $x\in(-\infty,\infty)$

Range: $y\in(-\infty,6)$

Is this continuous? NO

Is this a function? Yes

What is...

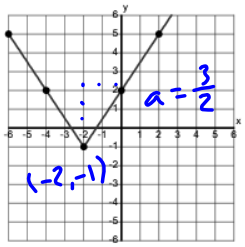
g(-2) = 2

g(0) = 4

g(5) = 4

Rewriting absolute value functions as piecewise functions

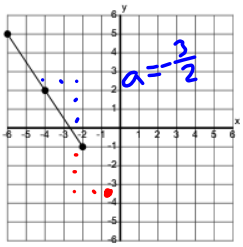
Absolute value function



9. Write the this absolute function in vertex form

$f(x)=\frac{3}{2}|x+2|-1$

Left side

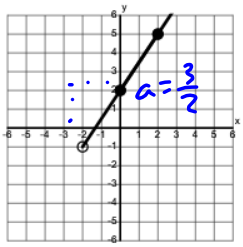


10. Write this function as a function with a domain restriction

$y=-\frac{3}{2}(x+2)-1=-\frac{3}{2}x-3-1$

if $x\le -2$ $=-\frac{3}{2}x-4$

Right Side



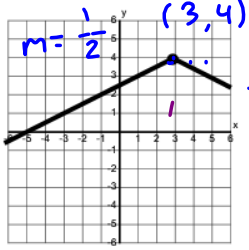
11. Write this function as a function with a domain restriction

$y=\frac{3}{2}x+2$ if $x>-2$

12. Write the absolute value function above as a two piece piecewise function:

$$f(x)=\begin{cases}-\frac{3}{2}(x+2)-1, & x\le -2\\ \frac{3}{2}x+2, & x>-2\end{cases}$$

13. Write the absolute value function below in vertex form.



$f(x)=-\frac{1}{2}|x-3|+4$

14. Write the absolute value function to the left as a two piece piecewise function

$$f(x)=\begin{cases}\frac{1}{2}(x-3)+4, & x\le 3\\ -\frac{1}{2}(x-3)+4, & x>3\end{cases}$$

★ Do not over/under restrict Domain

ex. f(3) can only be used for one function

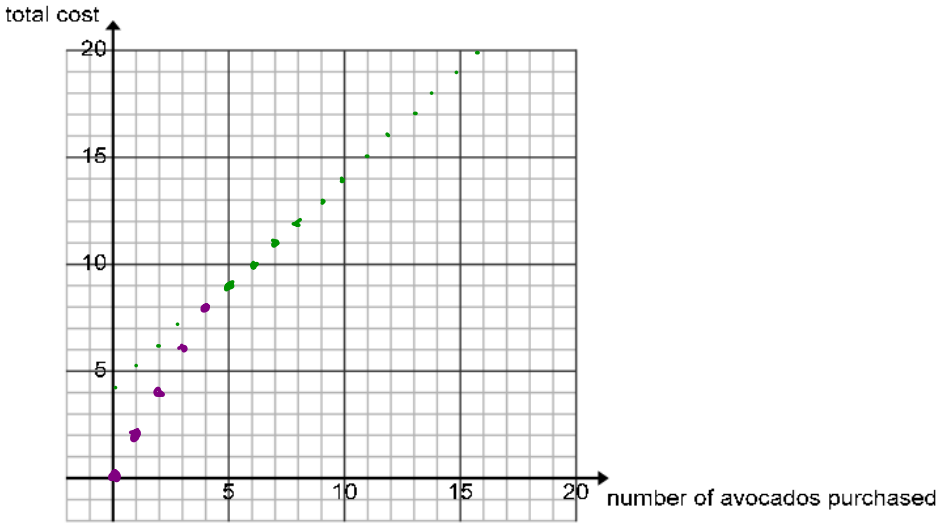
can't have $x\le 3$ And $x\ge 3$

Applications of Piecewise functions

1. A local farmer's market offers up to 4 avocados for $2 each and after that each avocado is half price
   a. Write the piecewise function for the total price, f(x), in terms of x, total number of avocados purchased.

$$f(x) = \begin{cases} 2x & , \ 0 \le x \le 4 \\ 1x+4 & x > 4 \\ 1(x-5)+9 & \end{cases}$$

   b. Sketch the graph related to this scenario on the provided grid



   c. How much do you pay for 8 avocados?
   (Be sure that this is what your piecewise function will yield for x = 8 as well)

$12 $f(8) = 1(8)+4 = 8+4 = 12$

   d. You sister, an avid avocado fan, plans on spending all her money on avocados.
   How many avocados can she purchase for $11?

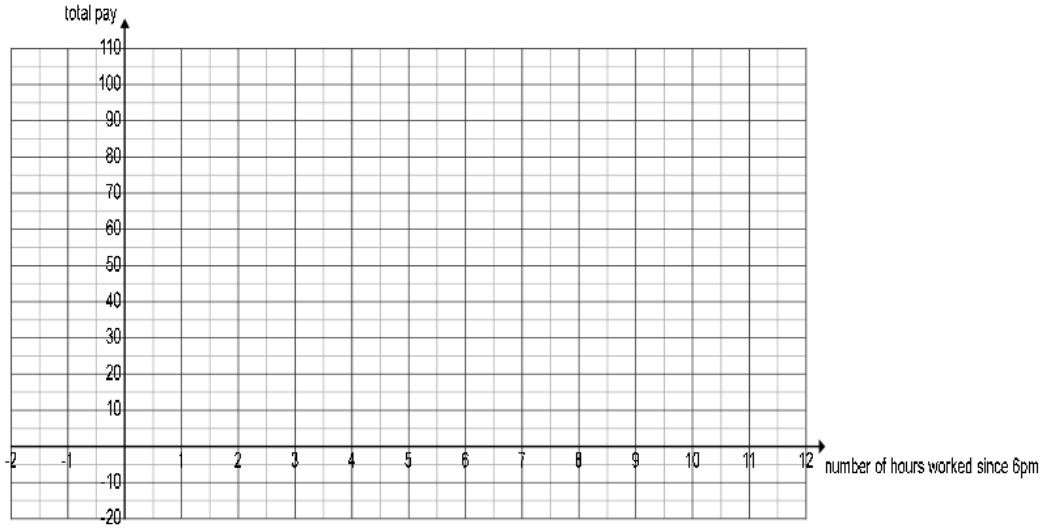
7 avocados $11 = 1x+4 \rightarrow 7 = x$, $x = 7$

   e. Is the set of possible domain values the set of all positive real numbers or the set of all positive integers (a.k.a. the set of natural numbers)? Explain your choice

The set of natural #s because you wouldn't purchase a fraction of an avocado nor a negative amount of avocados

2. You are babysitter for one of your neighbors. They are willing to pay you $10 an hour for all time you babysit before midnight, and $15 an hour for all time of the time you babysit after midnight.
   a. Typically you start this babysitting job at 6:00pm each time you babysit, so if you and your neighbors have agreed to round UP to the nearest hour to make the math easier, then write a piecewise model for your total pay, f(x), in terms of x, in total hours that you are babysitting

   b. Sketch the graph related to this scenario on the provided grid



   c. The last time you babysat, your neighbors had car trouble and the tow truck took a long time to get them home. If you started at 6:00pm like normal and they did not get home until 2:50am, then what did you earn for babysitting that night? (Be sure that this is what your piecewise function will yield for this amount of time as well)

   d. Based on your agreement with your neighbors, if you started babysitting at 6:00pm like normal, when would they have to return home for you to earn exactly $100? Is it possible? Explain your answer