

Algebra 2

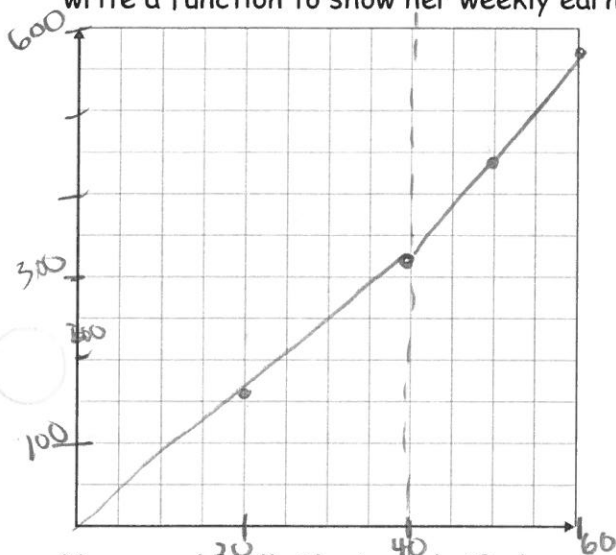
1.3 Piecewise Functions NOTES

Objective: Analyze and graph piecewise functions.

What is a piecewise graph? a function that has different rules for different parts of its domain

Example 1. Model the following with a piecewise graph.

Alani has a summer job as a lifeguard. She makes \$8/hr for up to 40 hours each week. If she works more than 40 hours, she makes 1.5 times her hourly wage for each hour over 40. Make a graph and write a function to show her weekly earnings based on the number of hours worked.



$8x$  if  $x \leq 40$  at  $x=40$   $320$   
 at  $x=40$  she earned 320  
 after 40 every hour after 40  
 already earned  $\rightarrow 320 + 12(x-40)$   $x > 40$   
 $320 + 12x - 480$   
 $12x - 160$   
 so  $P(x) = \begin{cases} 8x & x \leq 40 \\ 12x - 160 & x > 40 \end{cases}$

How much will Alani work if she works 37 hours?

use the right piece

$8(x)$   
 $8(37) = 296$

43 hrs?

$12(43) - 160 = 356$

★ Example 2. Carefully graph each of the following. Identify whether or not the graph is a function. Then, evaluate the graph at any specified domain value.

$\geq \leq$  closed

$\circ$  open  
 $f(x) = \begin{cases} x+5 \\ 2x-3 \end{cases}$

$x < 2$   
 $x \geq 2$

x	y
0	5
1	6
2	7

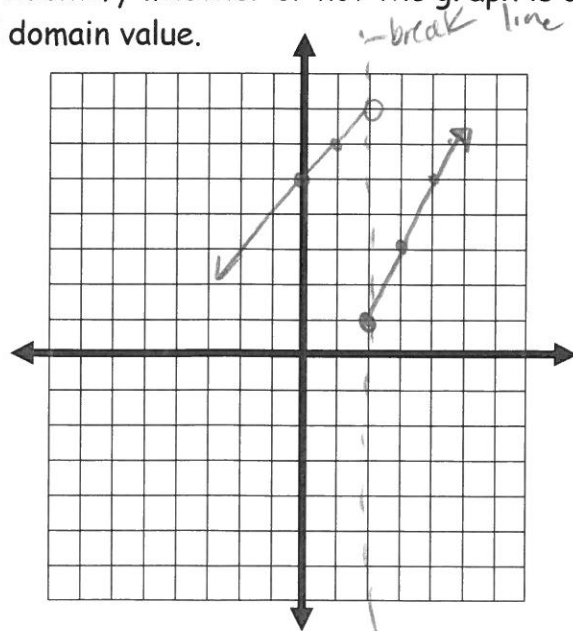
x	y
2	1
3	3
4	5

Function? Yes or No

$f(3) = 2(3) - 3 = 3$

$f(-1) = -1 + 5 = 4$

$f(-2) = -2 + 5 = 3$



★ You try.  $f(x) = \begin{cases} 2x+1 & x \geq 1 \\ -x+3 & x < 1 \end{cases}$

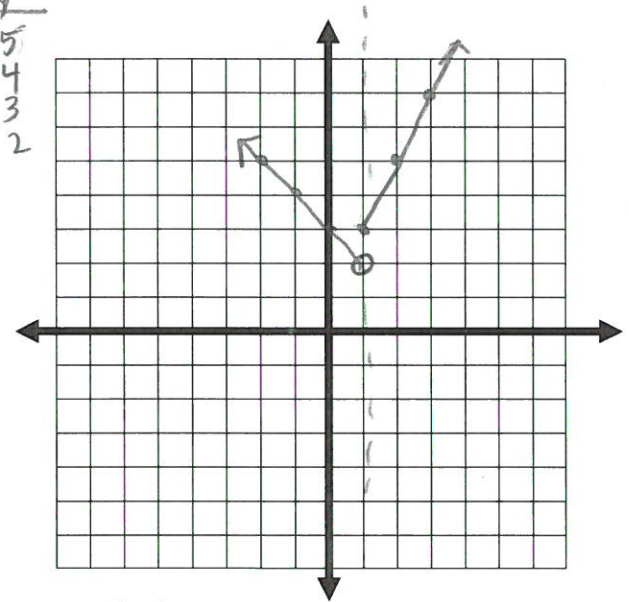
$2x+1$		$-x+3$	
x	y	x	y
1	3	-2	5
2	5	-1	4
3	7	0	3
		0	2

Function? Yes or No

$f(-2) = -(-2) + 3 = 5$

$f(3) = 2(3) + 1 = 7$

$f(1) = 2(1) + 1 = 3$   
 $\uparrow = 1$



★ Example 3. 3 parts.

$f(x) = \begin{cases} -x-1 & x \leq 0 \\ 2x-1 & 0 < x \leq 4 \\ 3 & x > 4 \end{cases}$

$-x-1$		$2x-1$	
x	y	x	y
-2	1	0	-1
-1	0	1	1
0	-1	2	3
		3	5
		4	7

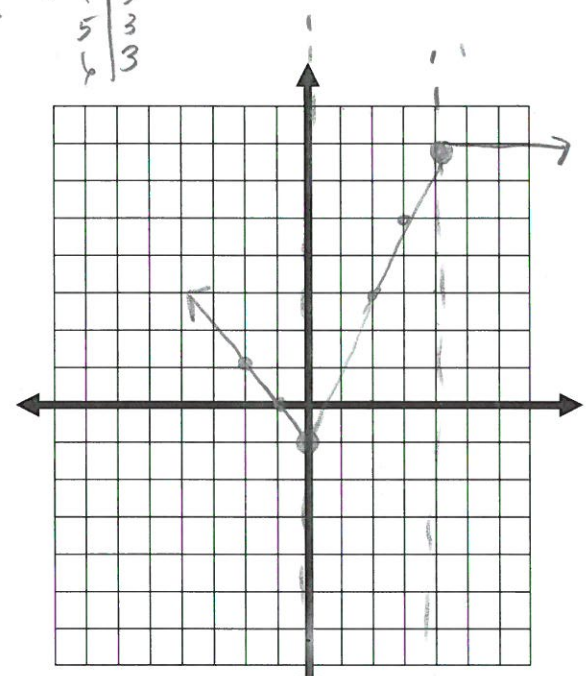
Function? Yes or No continuous

$f(-2) = -(-2) - 1 = 2 - 1 = 1$

$f(0) = -(0) - 1 = -1$

$f(5) = 3$

x	y
4	3
5	3
6	3



Non linear.  $f(x) = \begin{cases} 4x+11 & -10 \leq x < -2 \\ x^2-1 & -2 \leq x \leq 2 \\ x+1 & 2 < x \leq 10 \end{cases}$

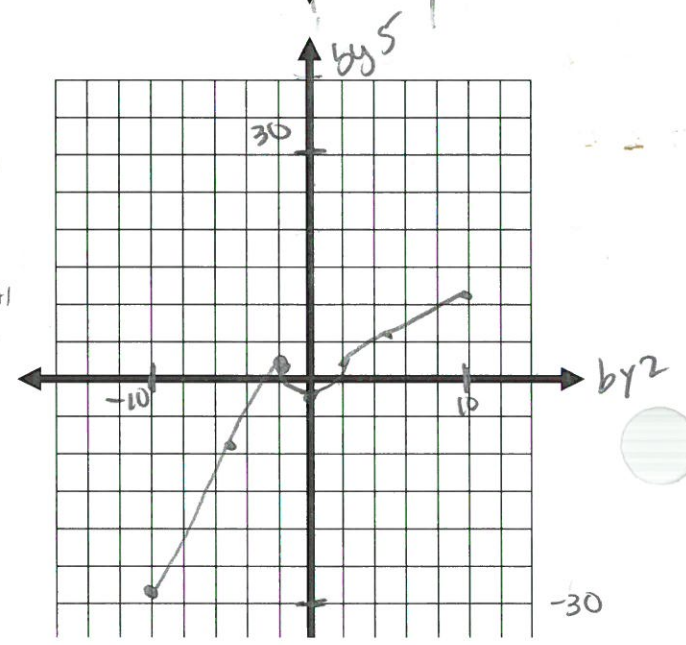
$4x+11$		$x^2-1$		$x+1$	
x	y	x	y	x	y
-10	-29	-2	3	2	3
-5	-9	0	-1	5	6
-2	3	2	3	10	11

Scale the graph. Function? Yes or No

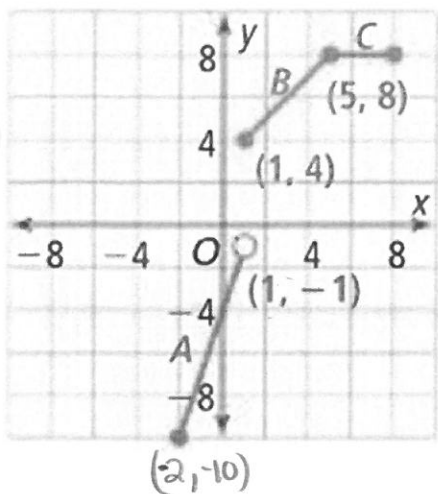
$f(-3) = 4(-3) + 11 = -1$

$f(-1) = (-1)^2 - 1 = 0$

$f(+2) = 2^2 - 1 = 3$



Example 4. Write an equation for a piecewise graph.



$$x < 1 \quad m = \frac{-10 - (-1)}{-2 - 1} = \frac{-9}{-3} = 3 \quad y = 3x - 4$$

$$1 \leq x \leq 5 \quad (1, 4) (5, 8) \quad \frac{8 - 4}{5 - 1} = \frac{4}{4} = 1$$

$$5 \leq x \leq 8 \quad y = 8$$

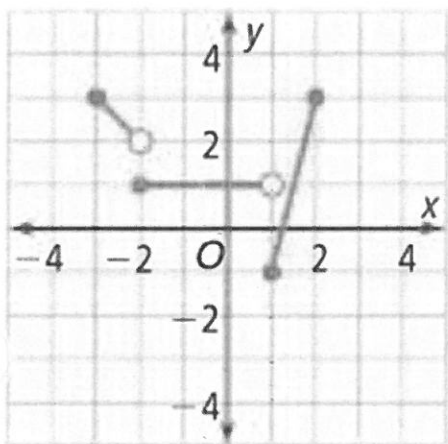
$$y - 4 = 1(x - 1)$$

$$y - 4 = x - 1$$

$$y = x + 3$$

$$\text{SO } f(x) = \begin{cases} 3x - 4 & x < 1 \\ x + 3 & 1 \leq x \leq 5 \\ 8 & 5 \leq x \leq 8 \end{cases}$$

You try.



$$[-3, -2) \rightarrow m = -1 \quad b = 0 \quad y = -x$$

$$[-2, 1) \rightarrow y = 1$$

$$[1, 2] \quad m = 4 \quad b = -5 \quad y = 4x - 5$$

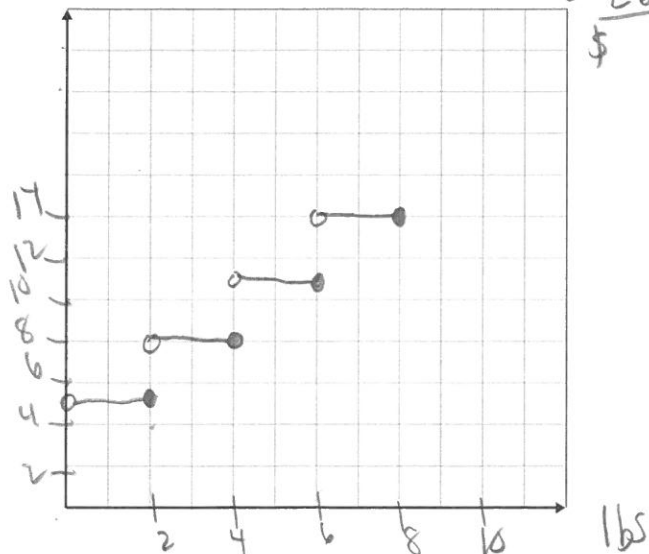
$$\text{SO } f(x) = \begin{cases} -x & -3 \leq x < -2 \\ 1 & -2 \leq x < 1 \\ 4x - 5 & 1 \leq x \leq 2 \end{cases}$$

Graph a step function.

Example 5. The shipping cost of items purchased from an online store is dependent on the weight of the items. The table represents shipping costs  $y$  based on weight  $x$ . Graph the function. What are the domain and range of the function? What are the maximum and minimum values.

lb $[0, 2]$	$[2, 4]$	$[4, 6]$	$[6, 8]$
\$ 5	8	11	14

rounded to nearest tenth



Domain  $(0, 8]$   
Range  $\{5, 8, 11, 14\}$

Warmup next time. Pg 28 3,6,7,9