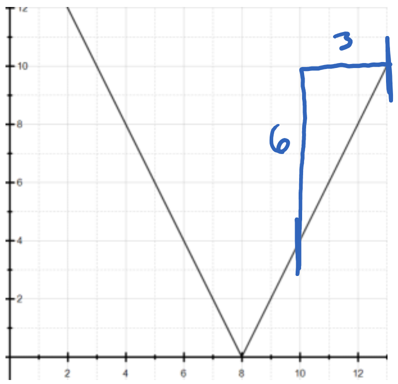
5.2 Piecewise-Defined Functions

Monday, September 23, 2019 7:46 AM

Warm Up

What is the rate of change over the interval $10 \leq x \leq 13$?



$\frac{6}{3} = \boxed{\frac{2}{1}}$

Essential Question

What are the key features of piecewise-defined functions?

Needed Vocab:

- **Piecewise-Defined Function**

Goal: "I can...

Graph and apply piecewise-defined functions."

In a relay race, each runner carries a baton for an equal distance before handing off the baton to the next runner.

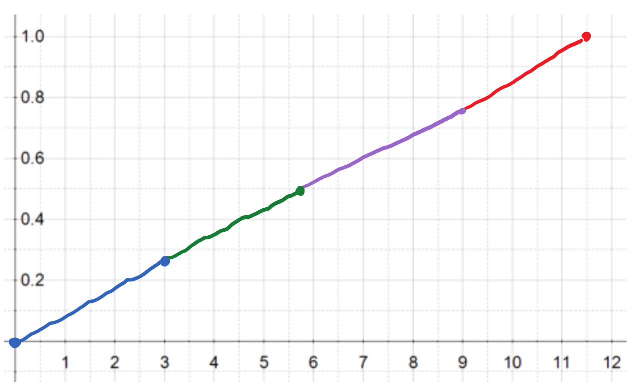
Path of the Baton

	Time (min)	Total Distance (mi)
Start	0	0
Runner 1	3	0.25
Runner 2	5.75	0.50
Runner 3	9	0.75
Runner 4	11.50	1.00

R1 ≈ 0.083
R2 ≈ 0.091
R3 ≈ 0.076
R4 ≈ 0.100

A. Graph the distance traveled by the baton as a function of time. How is the speed of each runner represented in the graph?

B. Who is the fastest runner? R4, R2, R1, R3



Example 1

How is $f(x) = 2|x|$ related to a linear function?

slope=-2 slope=2 to combine these two

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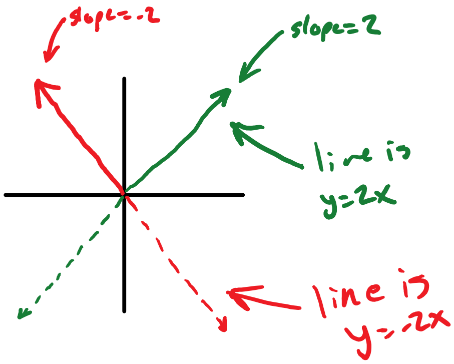

to combine these two equations we need to limit the domain for each line.
limit $y=-2x$ to only $x \leq \emptyset$.
Limit $y=2x$ to only $x \geq \emptyset$
Doing this gives us only the parts that are in the absolute.

the piecewise is then $\boxed{f(x) = \begin{cases} -2x, & x \leq \emptyset \\ 2x, & x \geq \emptyset \end{cases}}$

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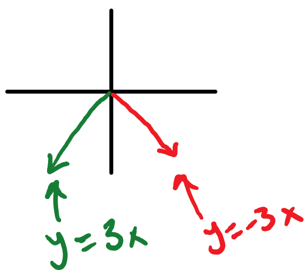
1. Express $f(x) = -3|x|$ as a piecewise-defined function.

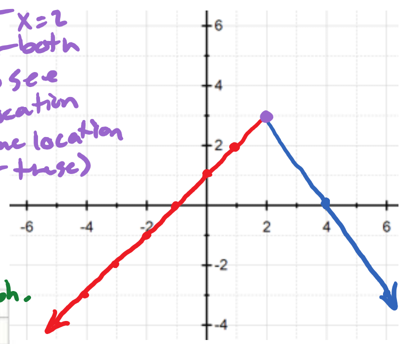


this means we need $y=3x$ before $\emptyset$ and $y=-3x$ after.
so our piecewise is $\boxed{f(x) = \begin{cases} 3x, & x \leq \emptyset \\ -3x, & x \geq \emptyset \end{cases}}$

Example 2

A. What is the graph of $f(x) = \begin{cases} x+1, & x \leq 2 \\ -\frac{3}{2}x+6, & x > 2 \end{cases}$?

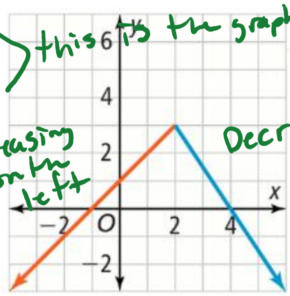
② graph this for
plot x=2 ① for both to see location (same location for these)
graph this for



B. Over what part of the domain is the function

$f(x) = \begin{cases} x+1, & x \leq 2 \\ -\frac{3}{2}x+6, & x > 2 \end{cases}$ this is the graph.

increasing? Decreasing?



increasing on the left

Decreasing on the right

Increasing $x \leq \emptyset$
Decreasing $x \geq \emptyset$

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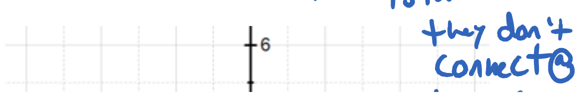
2. Graph the following function. $f(x) = \begin{cases} x-2, & x \leq 1 \\ -2x+3, & x \geq 1 \end{cases}$

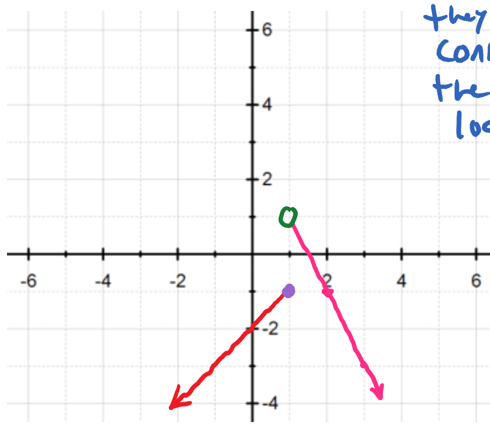
this is an instance where they don't connect ☹



they don't connect @ the same location.

Over what interval is the graph increasing? Decreasing?

Inc. $x \le 1$ Dec. $x > 1$



Example 3

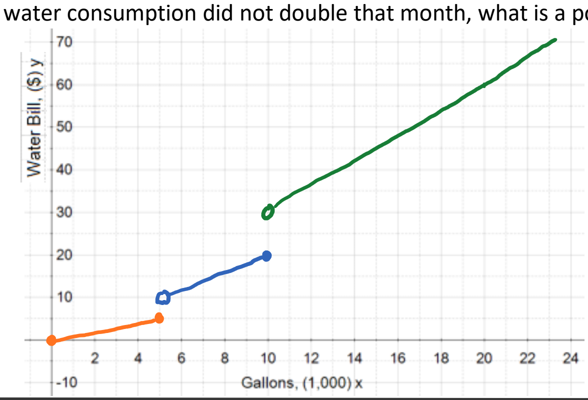
Cheyenne's mother is reviewing the monthly water bills from the summer. Each Monthly bill includes a graph like the one shown, which reflects the different rates charged for water based usage.

Several relatives visited Cheyenne's family in July and their water bill more than doubled. Assuming that the water consumption did not double that month, what is a possible explanation for the increase?

Tier 3

Tier 2

Tier 1



The amount of H_2O used changed the tier they are usually in, so it changed the rate at which they are being charged.

3. Make a conjecture about why a utility company might charge higher rates for greater levels of water consumption.

- Perhaps to deter people from over consumption.

- many answers would be acceptable here.

Example 4

A gym owner wants to purchase custom wristbands for a marketing promotion. She thinks she will need about 75 bands. Her assistant insists that ordering over 100 wristbands will be less expensive than ordering 75. How can the assistant convince the gym owner?

Cost of Custom Wristbands Order

0 to 50 wristbands........... \$2.00 each + \$20 Shipping
51 to 100 wristbands.........\$1.00 each + \$10 Shipping
over 100 wristbands.........\$0.50 each + free Shipping

Create equations for piecewise function. use # of wristbands as domain.

$$f(x) = \begin{cases} 2x + 20, & 0 \le x \le 50 \\ x + 10, & 51 \le x \le 100 \\ \frac{1}{2}x, & x > 100 \end{cases}$$

75

101

$f(75) = 75 + 10$
$f(75) = 85$

$f(101) = \frac{1}{2} \cdot 101$
$f(101) = 50.5$

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4. Recall that the cost per number of wristbands is:

$$f(x) = \begin{cases} 2x + 20, & 0 \le x \le 50 \quad \text{0 to 50 wristbands} \\ x + 10, & 50 < x \le 100 \quad \text{51 to 100 wristbands} \\ 0.5x, & x > 100 \quad \text{over 100 wristbands} \end{cases}$$

What is the difference in cost between one order of 200 wristbands, two orders of 100 wristbands each, and four orders of 50 wristbands each?

1 order of 200
$.5(200) = \boxed{\$100}$

2 orders of 100
$f(100) = 100 + 10$
$f(100) = 110$
$2 \cdot 110 = \boxed{\$220}$

4 orders of 50
$f(50) = 2(50) + 20$
$f(50) = 100 + 20$
$f(50) = 120$
$4 \cdot 120 = \boxed{\$480}$

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https://tinyurl.com/vp9vnqt

Homework

Pg. 195
14-22 even, 24, 25, 30