

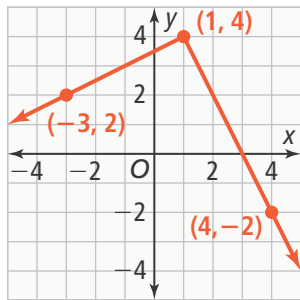


UNDERSTAND

- Generalize** Describe two ways you could express the function $f(x) = |x|$.
- Look for Relationships** How are the pieces of a piecewise-defined function related to the domain? Explain.
- Error Analysis** Describe and correct the error a student made in expressing the function $f(x) = 3|x|$ as a piecewise-defined function.

$f(x) = 3|x|$
 $f(x) = \begin{cases} 3x, & x \leq 0 \\ -3x, & x > 0 \end{cases}$

- Communicate Precisely** A piecewise-defined f is shown. Use function notation to describe the function and determine the x - and y -intercepts.



- Reason** A piecewise-defined function is shown.

$$f(x) = \begin{cases} x - 1, & x < n \\ -x + 4, & x \geq n \end{cases}$$

- If $n = 5$, what is the range of f ?
 - Does changing the value of n change the range? Explain.
- Higher Order Thinking** For a given piecewise-defined function, the pieces of the function are defined for intervals of the domain, $x \leq 1$ and $x > 1$.
 - Explain how you could find the y -intercept for the intervals over the intervals $x \leq 1$ and $x > 1$.
 - In general, how could you find the y -intercept for two pieces over the intervals $x \leq n$ and $x > n$?

PRACTICE

Express each absolute value function as a piecewise-defined function. SEE EXAMPLE 1

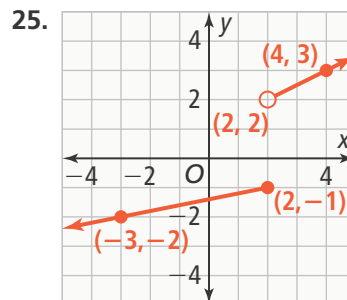
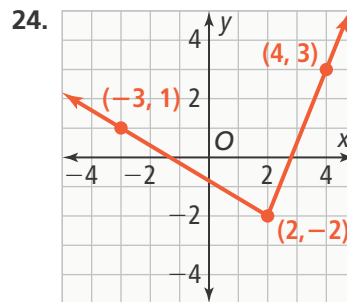
- $f(x) = 6|x|$
- $f(x) = -|x|$
- $f(x) = \frac{1}{2}|x|$
- $f(x) = -1.5|x|$

Graph each function. Identify the intervals where the function is increasing, decreasing, or constant. SEE EXAMPLE 2

- $f(x) = \begin{cases} x + 1, & x < 1 \\ -x - 3, & x \geq 1 \end{cases}$
- $f(x) = \begin{cases} -\frac{4}{3}x + 4, & x \leq 6 \\ 2x - 8, & x > 6 \end{cases}$
- $f(x) = \begin{cases} x - 3, & x \leq -2 \\ x, & -2 < x \leq 2 \\ -2x + 2, & x > 2 \end{cases}$

- A cell phone company charges \$0.10 per text message if a customer sends up to 100 messages per month. The company charges \$0.08 per text if a customer sends between 101–200 messages, and \$0.06 per text if the customer sends between 201–300 messages. Today is the last day of the month. Tamira has sent 200 text messages, is it worth it for her to send 1 more text message? Explain. SEE EXAMPLES 3 AND 4

Write a piecewise-defined function for each graph. SEE EXAMPLE 4



APPLY

26. Model With Mathematics Selena needs at least 22 subway rides for the month. She has two options for buying subway cards. Write a function that represents the situation. Can she buy more than 22 rides and save money? Explain.

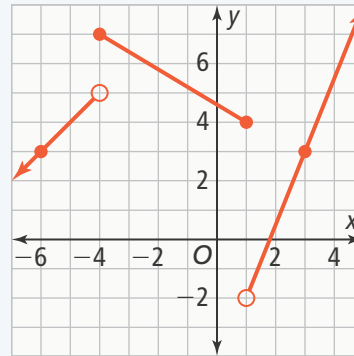


- 27. Make Sense and Persevere** Reagan had \$122 in his savings account. He deposited \$70 each week from his job for the first five weeks of summer. In the sixth week, Reagan got a raise and increased his weekly deposits by \$12.
- Write a piecewise-defined function to represent his bank balance.
 - Find $f(8)$.
 - What does $f(8) - 122$ mean in terms of the situation?
- 28. Make Sense and Persevere** A group of friends eat at Jae's Cafe. They have an online coupon. The costs of their main courses, before applying the coupon, are \$13.99, \$16.99, \$19.99, and \$21.99. The total cost of their drinks is \$12.00. What will their bill be before tax and tip?



ASSESSMENT PRACTICE

29. The graph of function f is shown.



The domain of f is _____. The range of f is _____. There are ____ values in the domain where $f(x) = 4$ and $f(1) =$ _____.

30. SAT/ACT Which function has the same graph as $f(x) = 0.1|x|$?

- $f(x) = \begin{cases} 0.1x, & x < 0 \\ -0.1x, & x > 0 \end{cases}$
- $f(x) = \begin{cases} 0.1x, & x \leq 0 \\ -0.1x, & x > 0 \end{cases}$
- $f(x) = \begin{cases} 0.1x, & x > 0 \\ -0.1x, & x < 0 \end{cases}$
- $f(x) = \begin{cases} 0.1x, & x \geq 0 \\ -0.1x, & x < 0 \end{cases}$
- $f(x) = \begin{cases} -0.1x, & x \geq 0 \\ 0.1x, & x < 0 \end{cases}$

31. Performance Task Sue charges \$15 for the first hour of babysitting and \$10 for each additional hour, with each fraction of an hour counting as a whole hour. The rates that Vic charges for x hours of babysitting are modeled by the function shown.

$$f(x) = \begin{cases} 12.5x, & 0 \leq x < 4 \\ 10x, & 4 \leq x < 8 \\ 9.5x, & x \geq 8 \end{cases}$$

Part A Who will charge more to babysit for 10 hours? Justify your response.

Part B What is the rate of change for each function over the interval $7 \leq x \leq 11$?

Part C Which average rate of change is more meaningful? Explain.