linear PIECEWISE FUNCTIONS

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Evaluating Piecewise Functions

example Evaluate f(x) when
a) x = –1 b) x = 0 c) x = 1

$$f(x) = \begin{cases} 2x + 1 & \text{if } x < 1 \\ 4 - x & \text{if } x \geq 1 \end{cases}$$

solution

a) Use the first equation, because –1 < 1 — $f(x) = 2x + 1$

Substitute –1 for x — $f(-1) = 2(-1) + 1$

$f(-1) = -1$

b) Use the first equation, because 0 < 1 — $f(x) = 2x + 1$

Substitute 0 for x — $f(0) = 2(0) + 1$

$f(0) = 1$

c) Use the second equation, because 1 ≥ 1 , — $f(x) = 4 - x$

Substitute 1 for x — $f(1) = 4 - (1)$

$f(1) = 3$

PRACTICE

Evaluate the function for the given value of x

$$f(x) = \begin{cases} 4x - 1 & \text{if } x < 2 \\ -x + 9 & \text{if } x \geq 2 \end{cases} \qquad g(x) = \begin{cases} -2x - 7 & \text{if } x \leq -5 \\ x + 8 & \text{if } x > -5 \end{cases}$$

1. f(– 1)

2. g (0)

3. g (–6)

4. f (0)

5. f (2)

6. g(–5)

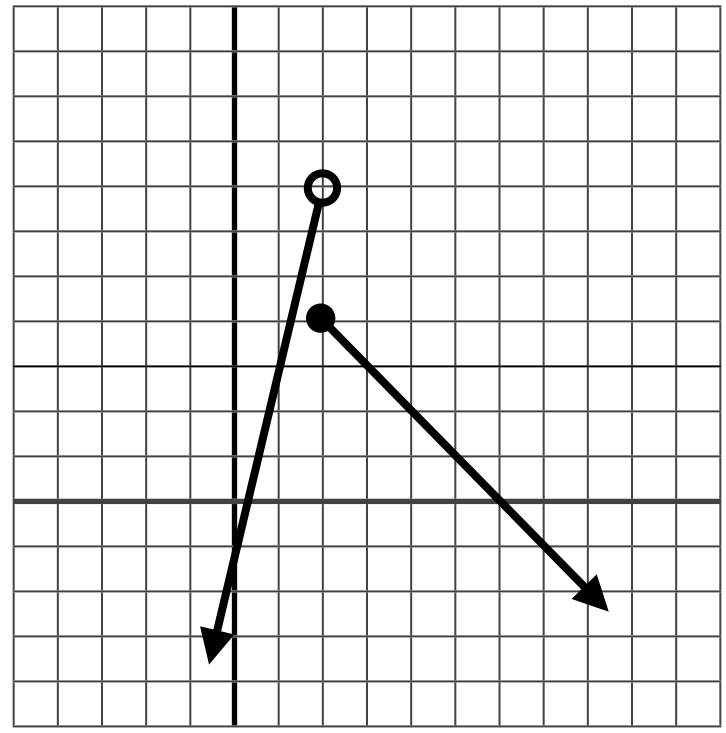
7. f (3)

8. g(–1)

9. g(10)

10. f (– 0.25)

Graphing Piecewise Functions



example Graph the function

$$f(x) = \begin{cases} 4x - 1 & \text{if } x < 2 \\ 6 - x & \text{if } x \geq 2 \end{cases}$$

solution

To the left of x = 2, the graph is defined by y = 4x – 1.

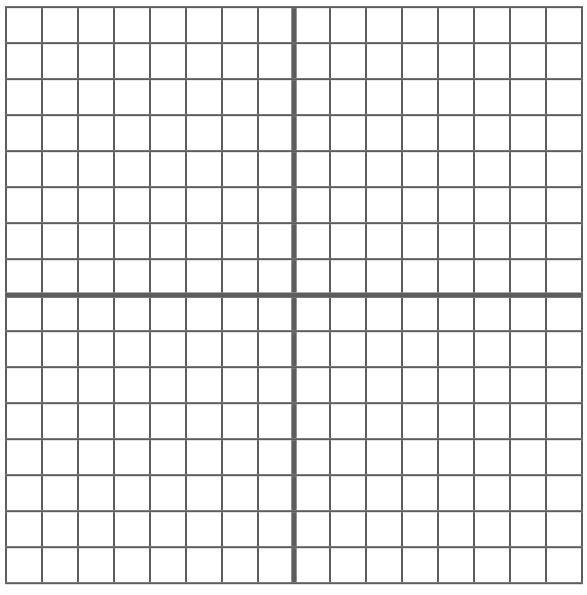
To the right of and including x = 2, the graph is defined by y = 6 – x.

The graph is composed of two rays that do not connect because the value at x = 2 from the left is not the same as the value at x = 2 from the right..

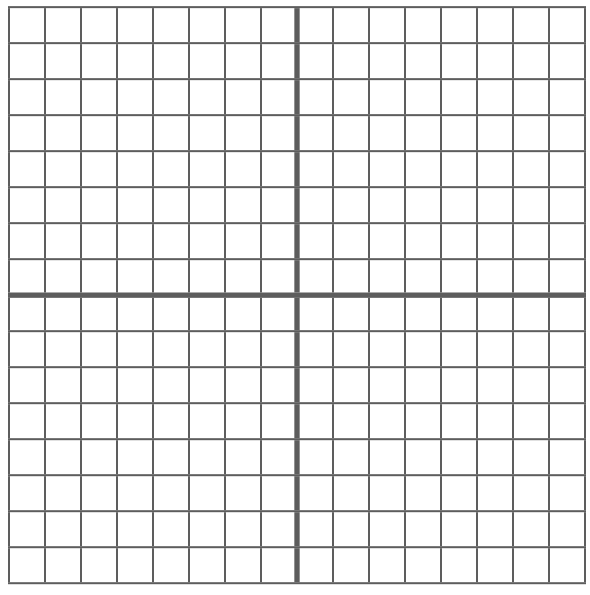
PRACTICE

Graph the functions.

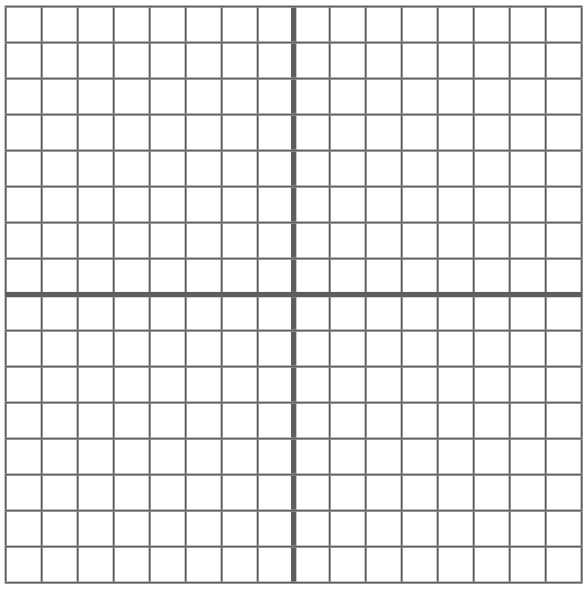
1. $f(x) = \begin{cases} 3x & \text{if } x < 1 \\ -x + 4 & \text{if } x \geq 1 \end{cases}$



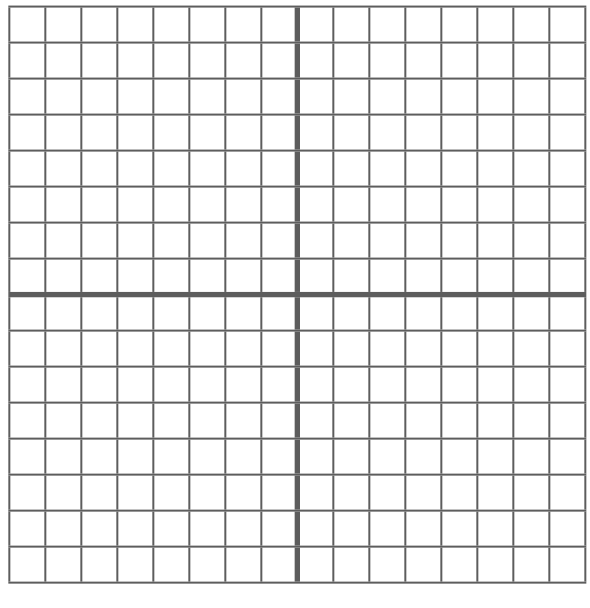
2. $g(x) = \begin{cases} -2x + 3 & \text{if } x \leq 3 \\ 2 & \text{if } x > 3 \end{cases}$



3. $h(x) = \begin{cases} -x - 2 & \text{if } x \leq -2 \\ \frac{1}{2}x - 1 & \text{if } x > -2 \end{cases}$



4. $k(x) = \begin{cases} -3x - 13 & \text{if } x \leq -3 \\ -4 & \text{if } x > -3 \end{cases}$



Writing Piecewise Functions

example

Write a piecewise function for the graph .

solution

To the LEFT of x = 0, the graph is the line

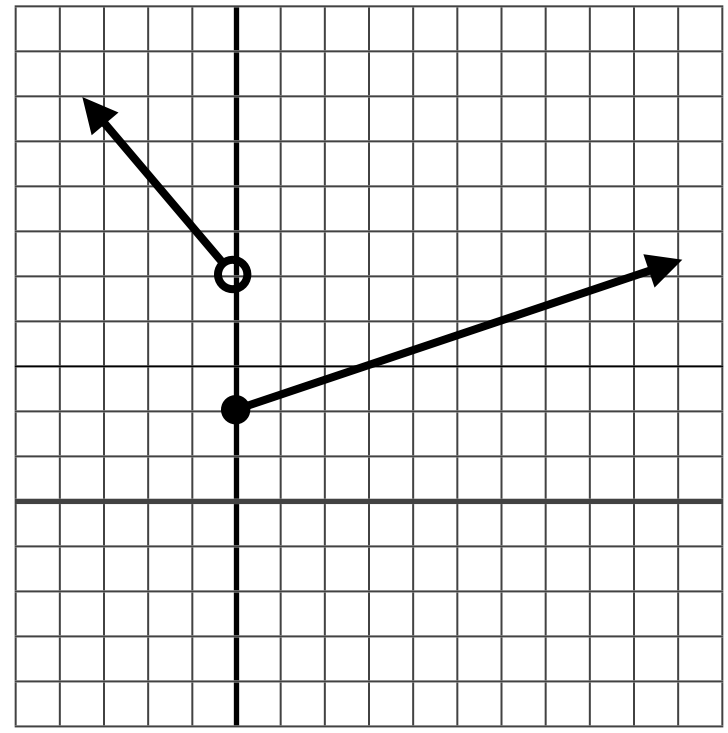
$$y = -x + 5$$

To the RIGHT of and including x = 0, the graph is the line

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

This piecewise function can be represented by

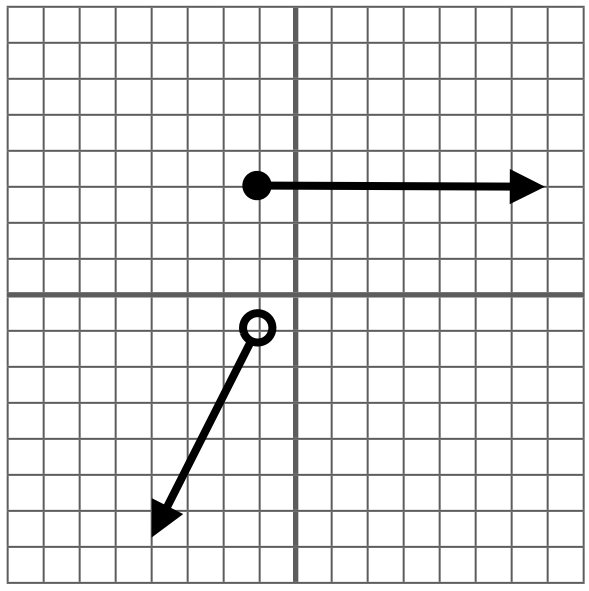
$$f(x) = \begin{cases} -x + 5 & \text{if } x < 0 \\ \frac{1}{3}x + 2 & \text{if } x \geq 0 \end{cases}$$



Note that – x + 5 does not include a value for f(x) when x = 0 because there is an open endpoint at (0, 5).

PRACTICE Write a piecewise function for each graph.

1.



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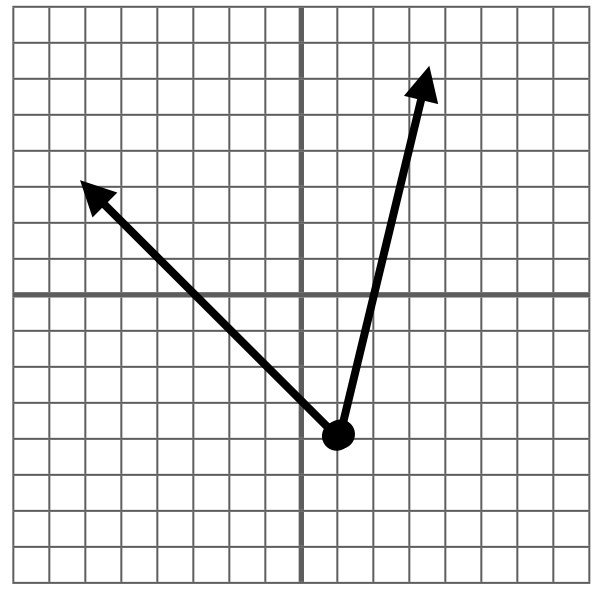

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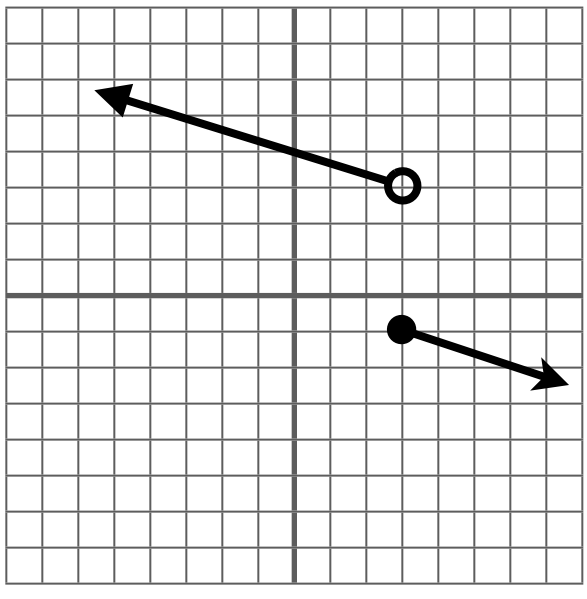

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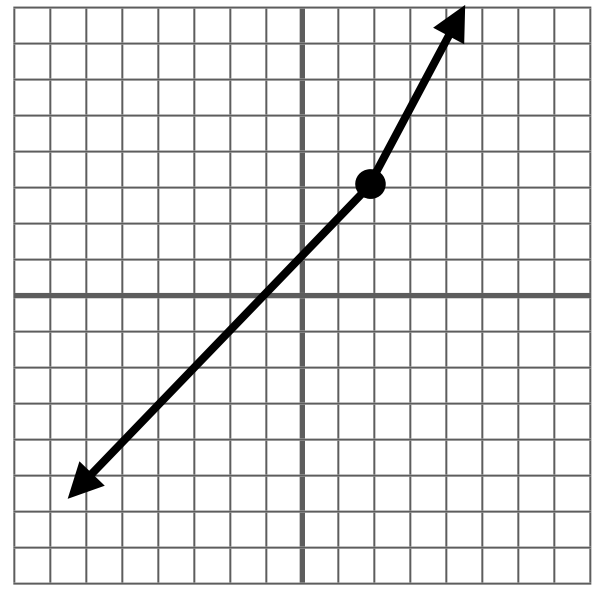


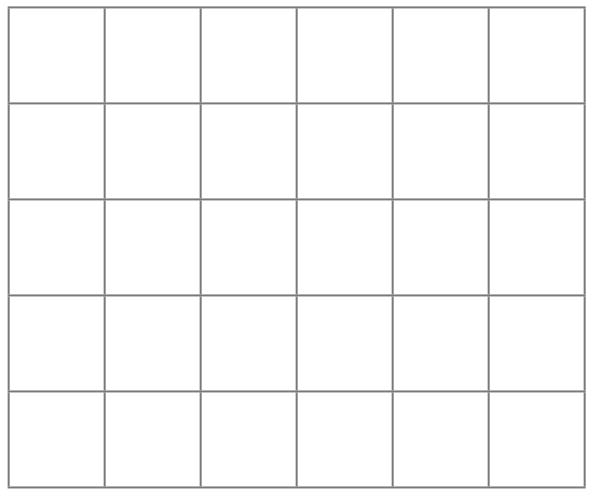
Piecewise and Step Functions in Real Life

1. The sign shows the cost to rent bikes.

a)Write a piecewise function to represent the charges for bike rentals.

b) Graph the piecewise function to represent the charges for bike rentals.

c) What is the cost to rent a bike for 8 hours?

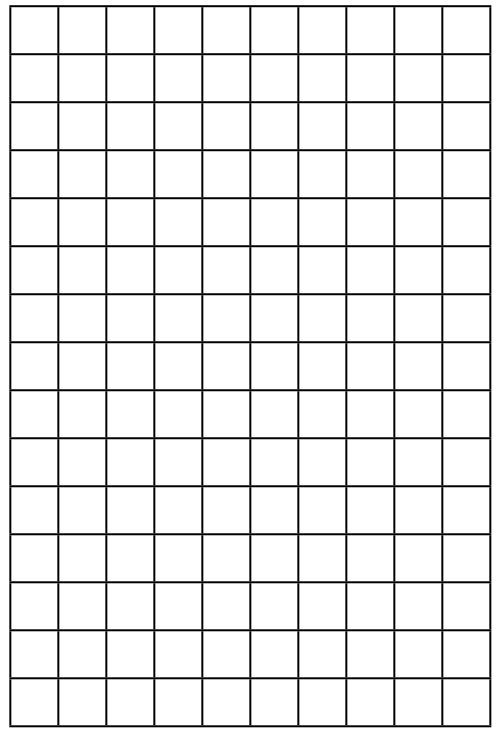


2. Sign Spinners get paid by the hour to advertise for stores by spinning signs on street corners. They can be paid “time and a half “ if they work more than 6 hours during a day. If their hourly rate is $10, they will be paid $10 per hour for hours 1 - 6 and $15 per hour for any hours beyond the 6 hours.

a)Write a piecewise function to represent the salary for a Sign Spinner that was contracted to work for $10 an hour.

b) Graph the piecewise function to represent the salary of the Sign Spinner.

c) How much would a sign spinner earn for working 8 hours?



3. BLUE MOBILE, a phone provider charges $0.05 per text for the first 1000 texts in a month and $0.10 per text message after that.

a) Write a piecewise function to represent the cost for text messages.

b) Graph the piecewise function.

4. RED MOBILE, a phone provider charges a flat rate of $25.00 for customers that send and receive between 0 – 1000 texts in a month. This company charges $50.00 from customers that send and receive more than 1000 texts each month.

a) Write a piecewise function to represent the cost for sending and receiving text messages.

b) Graph the piecewise function on the same grid.

5.

a) Describe a scenario that can be represented by a piecewise or step function.

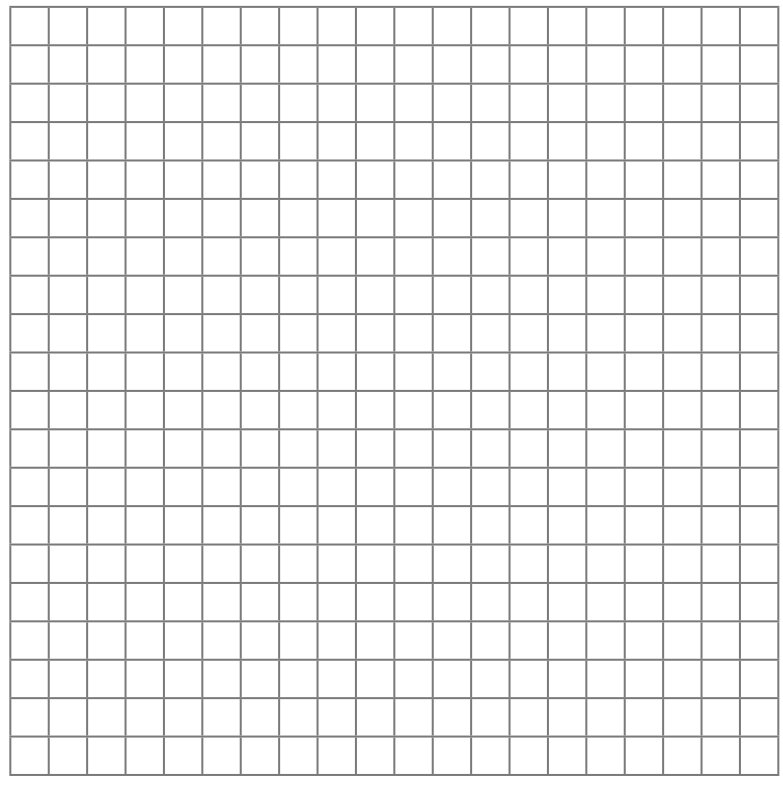
b)Write a piecewise function to represent the situation.

c) Graph the piecewise function to represent the situation.

a)

b)

c)

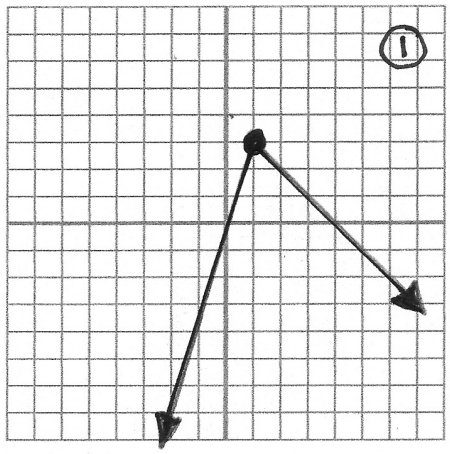


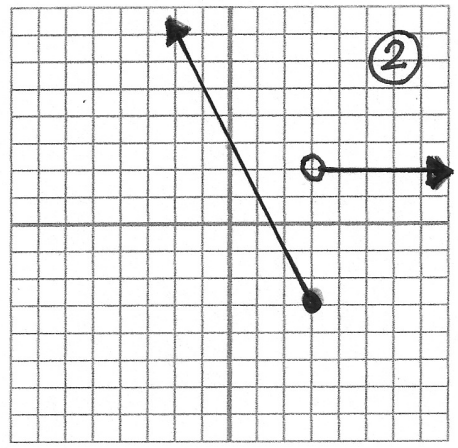
ANSWER KEY for LINEAR PIECE-WISE FUNCTIONS

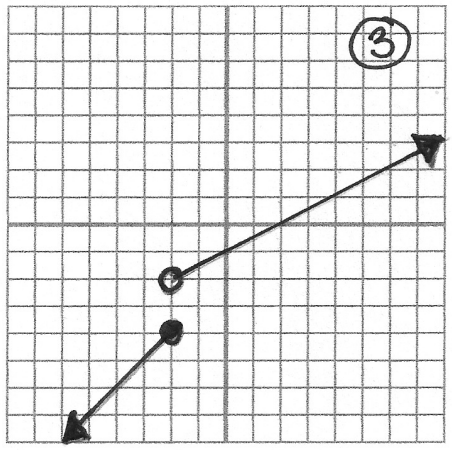
EVALUATING PIECE-WISE FUNCTIONS

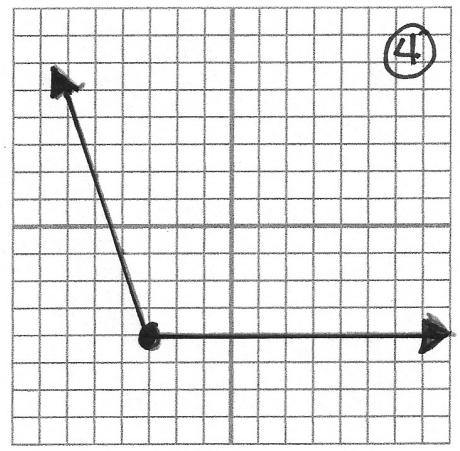
1. $f(-1) = -5$
2. $g(0) = 8$
3. $g(-6) = 5$
4. $f(0) = -1$
5. $f(2) = 7$
6. $g(-5) = 3$
7. $f(3) = 6$
8. $f(-1) = 7$
9. $f(10) = 18$
10. $f(-0.25) = -2$

GRAPHING PIECE-WISE FUNCTIONS









WRITING PIECE-WISE FUNCTIONS

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

2. $f(x) = \begin{cases} -x - 3 & x < 1 \\ 4x - 8 & x \geq 1 \end{cases}$

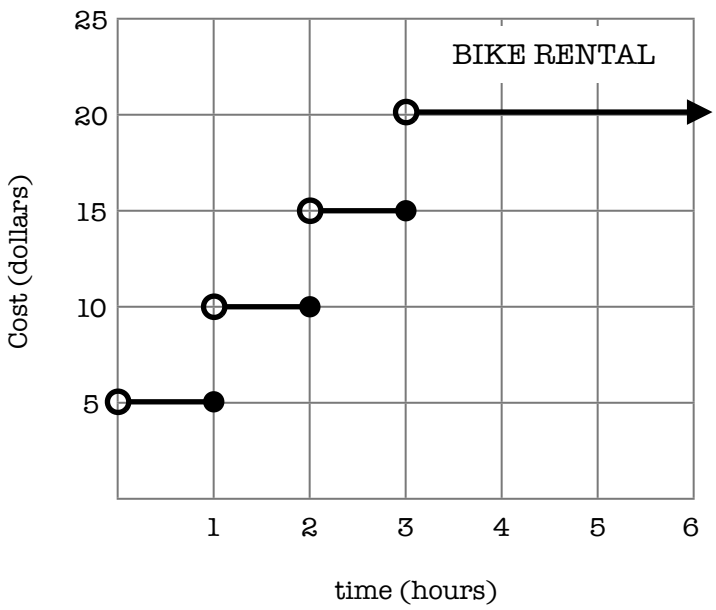
3. $f(x) = \begin{cases} -\frac{1}{3}x + 4 & x < 3 \\ -\frac{1}{3}x & x \geq 3 \end{cases}$

4. $f(x) = \begin{cases} x + 1 & x \leq 2 \\ 2x - 1 & x > 2 \end{cases}$

ANSWER KEY for LINEAR PIECE-WISE FUNCTIONS

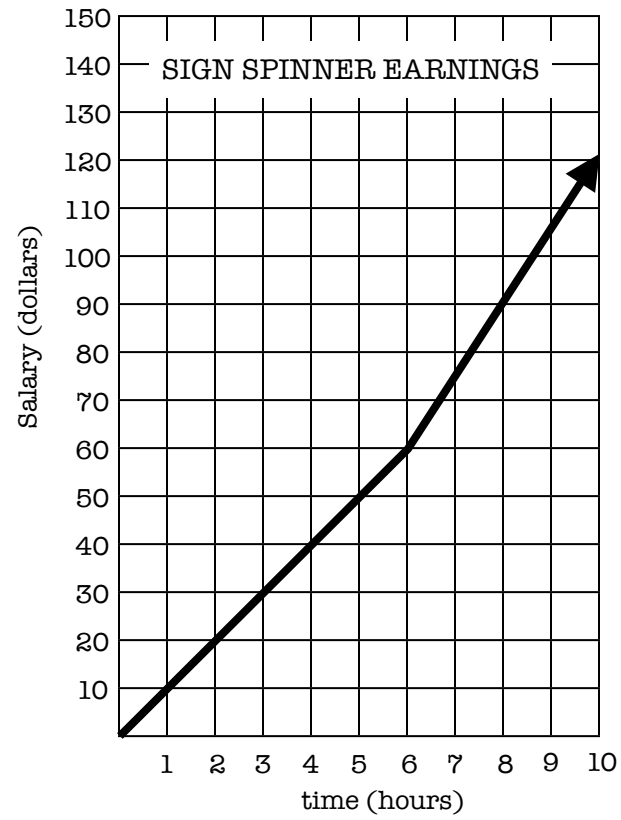
PIECE-WISE and STEP FUNCTIONS in Real Life

1. $C(h) = \begin{cases} 5h & x \le 4 \\ 20 & x > 4 \end{cases}$



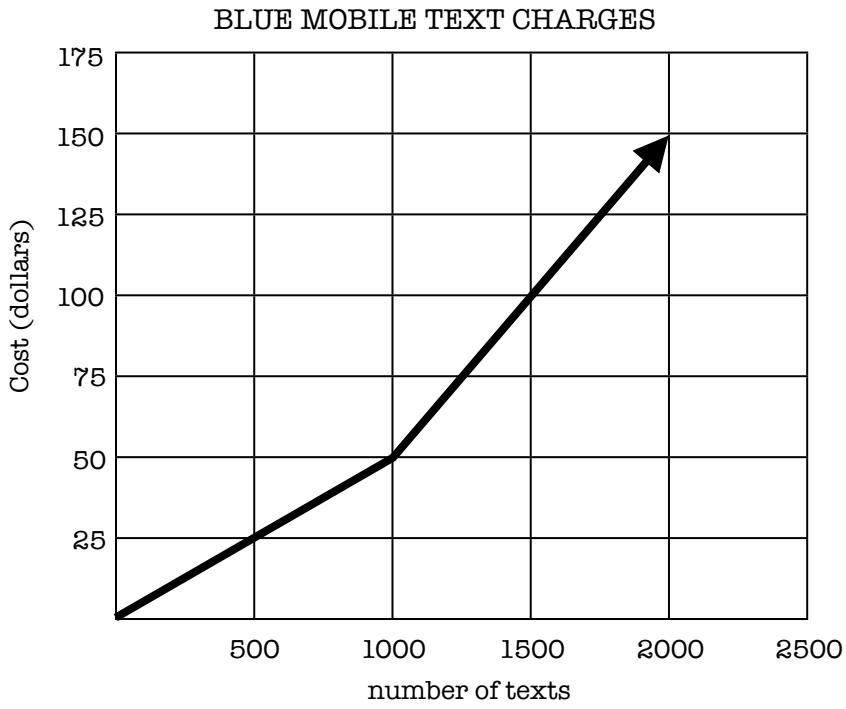
The cost to rent a bike for 8 hours would be $20.

2. $S(h) = \begin{cases} 10h & x \le 6 \\ 15\,(h - 6) - 30 & x > 4 \end{cases}$



A sign spinner would earn $90 for working 8 hours.

3. $C(t) = \begin{cases} 0.05\,t & t \le 1000 \\ 0.10\,(t - 1000) + 50 & t > 1000 \end{cases}$



4. $C(t) = \begin{cases} 25 & t \le 1000 \\ 50 & t > 1000 \end{cases}$