

### Content and Language Objective:

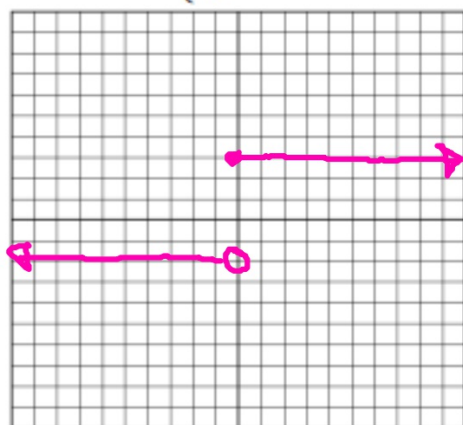
Students will learn about a step function to build upon their knowledge of piecewise functions in order to be able to graph a variety of piecewise functions.

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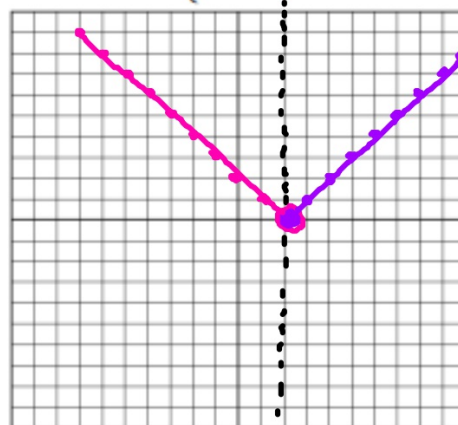
### Warm-Up

Graph the following piecewise functions.

$$7. f(x) = \begin{cases} -2, & x < 0 \\ 3, & x \geq 0 \end{cases}$$



$$8. g(x) = \begin{cases} -x + 2, & x < 2 \\ x - 2, & x \geq 2 \end{cases}$$



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Let's read through the objective and fill in the statements below:

Students will learn about a step function

In order to graph a variety of piecewise functions

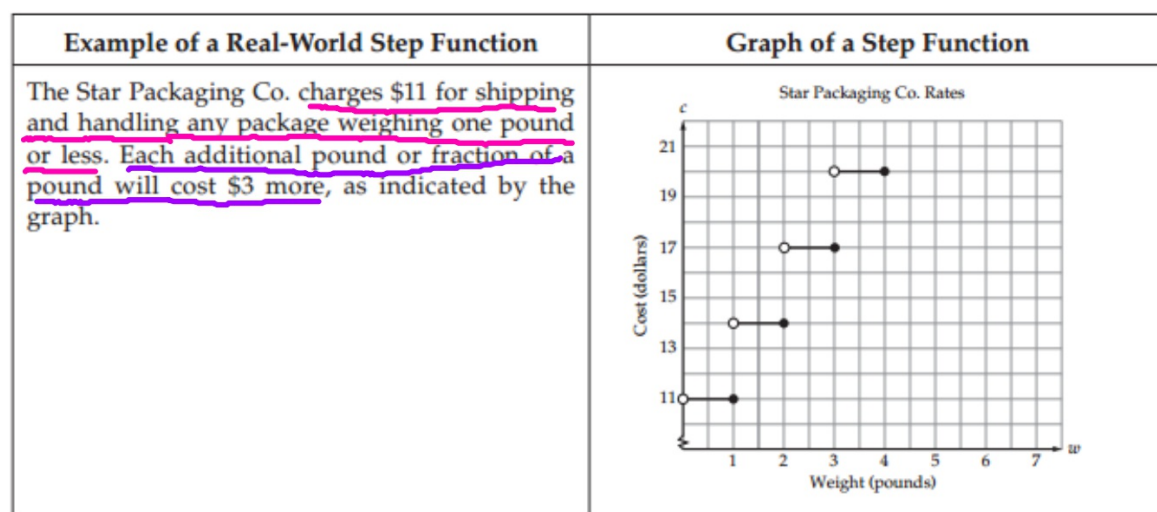
So they can build upon their knowledge of piecewise functions

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Another type of piecewise function is called a **step function**.

The graphs of these functions appear to "step" from one change to another, usually horizontally because they appear to be a constant function at each interval.



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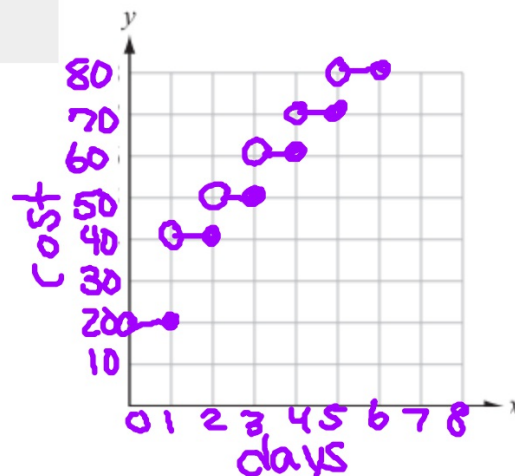
### Practice!!

**MP 2** At Eagle Nest Golf Club, golf clubs are rented by the day, and you pay for the whole day even if you return your clubs early. The first day is \$20, and then \$20 more for a second day. For every day after the second day, the rental is only \$10. Construct a graph that shows the cost of renting golf clubs for different periods of time.

- a What should we label the  $x$ - and  $y$ -axes?
- b How will the ordered pairs appear, and what will they mean?  $(1,20)(2,40)(3,50) \dots$
- c What are the independent and dependent variables? **IV: Days DV: Cost**
- d What is the cost of renting clubs for 2 days? for 3.5 days? How long can you rent the clubs if you have only \$75?
- e Define the rental as a piecewise function.

d. 2 days = \$40 3.5 days = \$60  
\$75 - 5 days

$$C(d) = \begin{cases} 20 & 0 < d \leq 1 \\ 40 & 1 < d \leq 2 \\ 50 & 2 < d \leq 3 \\ 60 & 3 < d \leq 4 \\ 70 & 4 < d \leq 5 \end{cases}$$

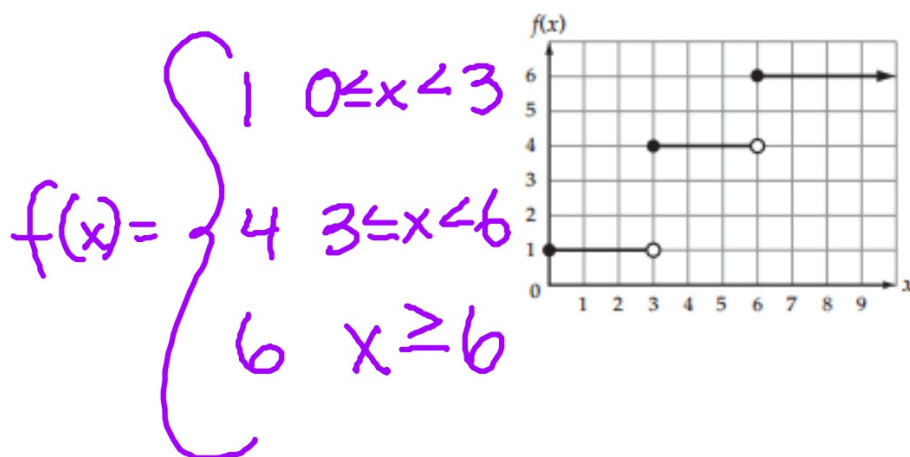


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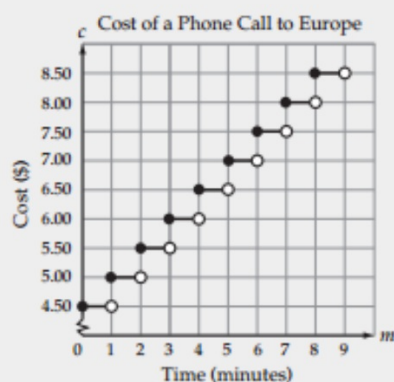
The following graph of  $f(x)$  is a typical illustration of a step function.  
Describe the set of rules for this graph.





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**MP 2, 4** A long-distance phone call to a city in Eastern Europe initially costs \$4.50 up to the first minute. For one full minute up to two minutes, the cost increases by \$0.50; it increases by another \$0.50 for two full minutes up to three minutes, and so on. The greatest integer step function graphed below illustrates this pricing.



- What is the cost of a 5-minute-and-40-second call?
- What is the difference between the cost of the call in part a and the cost of an 8-minute call?
- About how many minutes could you talk for on a phone call that cost \$7.50? Give two possible answers.
- Write the function  $c(m)$  to represent the cost for any given time.

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Get out your problems that you were supposed to finish for homework last night, make sure they are all done. I will come around to check completion, we will then go over the answers

$$|x+5|$$

left 5

$$|x|-7$$

down 7

$$(x+2)^2$$

left 2

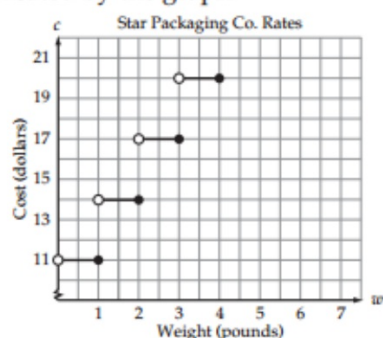
$$f(x) = -7x + 2$$

$$f(3) = -7(3) + 2$$
$$-21 + 2$$

$$f(3) = -19$$

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The Star Packaging Co. charges \$11 for shipping and handling any package weighing one pound or less. Each additional pound or fraction of a pound will cost \$3 more, as indicated by the graph.

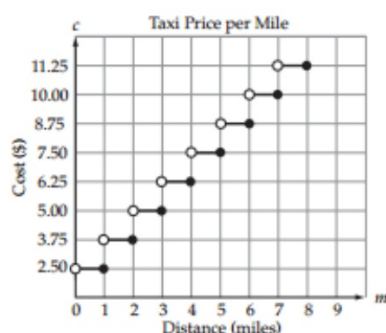


- What is the total cost of sending three separate packages weighing 1.8 pounds, 3.7 pounds, and 4 pounds?
- If it costs \$17 to send a particular package, what could have been the weight of that package?
- Mary reasons that since an additional pound costs \$3, an additional half-pound will cost \$1.50. Is this true? Justify your response.



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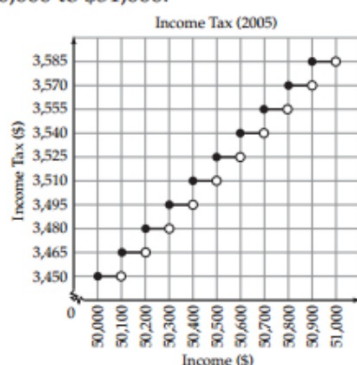
On a city taxi meter, the cost begins at \$2.50 per person for the first mile plus \$1.25 for every additional mile or fraction of a mile thereafter. The following step function graph illustrates this distance/cost relationship. Using the graph, answer the following:



- a If Mark takes the city taxi and travels a distance of 3.7 miles, what is his cost for the taxi ride?
- b If the cost to travel from the airport to his office is \$8.75, how many miles did he travel? If he also gave a 15% tip to the driver, what did it cost him (rounded to the nearest dollar)? *Practice Problems continue*

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**MP 2, 3, 4** The following step function graph represents a section of the income tax table of Center City for those earning \$50,000 to \$51,000.



Using the graph above, answer the following questions.

- If Stacy Johnson earned \$50,825 in 2005, how much was her income tax?
- What was the approximate tax rate she paid (taxes paid/income earned)?
- Her brother, Thomas, paid \$3,510 in taxes. Express his income as an inequality.
- If Stacy's dad's taxes came to \$3,540, which of the following could *not* represent his earnings: \$50,610, \$50,675, \$50,701, or \$50,695? Explain your reasoning.

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**MP 1** Construct the graph that illustrates this step function.

a  $f(x) = \begin{cases} -2 & \text{if } -5 < x \leq -1 \\ 1 & \text{if } -1 < x < 2 \\ 5 & \text{if } x \geq 2 \end{cases}$

