Write

Any part of a linear piecewise function is written in the form $ax + b$. Describe the possible a- and b-values that define a step function.

Remember

A discontinuous graph is a graph that is continuous for some values of the domain with at least one disjoint area between consecutive x-values. A step function is a piecewise function on a given interval whose pieces are discontinuous constant functions.

Practice

1. A department store offers store credit but has the listed rules.
   - For a bill less than $15 the entire amount is due.
   - For a bill of at least $15 but less than $50, the minimum due is $15.
   - For a bill of at least $50 but less than $100, the minimum due is $20.
   - For a bill of $100 or more, a minimum of 25% of the bill is due.
   a. Write a piecewise function, $f(x)$, for the minimum amount due for the amount of the bill, x.
   b. Graph the function. Be sure to label the axes.
   c. Is your piecewise function a step function? Why or why not?
   d. Describe the rate of change when $0 \leq x < 15$. What does it mean in terms of this problem situation?
   e. A customer comes in the store to pay the minimum amount on his bill of $100. The customer thinks he owes $20, but the cashier tells him he owes $25. Who is correct? Explain your reasoning.

2. A department store has an online site that customers can order from. The shipping rates are calculated as listed.
   - A package that weighs no more than 10 pounds costs $5.
   - A package that weighs more than 10 pounds but no more than 20 pounds costs $10.
   - A package that weighs more than 20 pounds but no more than 30 pounds costs $15.
   - A package that weighs more than 30 pounds but no more than 40 pounds costs $20.
   - A package that weighs more than 40 pounds but no more than 50 pounds costs $25.
   a. Write a piecewise function, $f(x)$, for the shipping cost for the weight of the package, x.
   b. Graph the function. Be sure to label the axes.
   c. Is this piecewise function a step function? Why or why not?
   d. Rewrite the step function as a greatest integer function. How do the shipping costs change for a 10-pound package?

Stretch

After the first statistics test of the year, a professor asked her students to write down the number of hours they studied for the test. A student created the graph to show the relationship between the grade earned and the number of hours studied.

1. Describe why this graph does not represent a piecewise function.
2. Write the situation as a piecewise function.
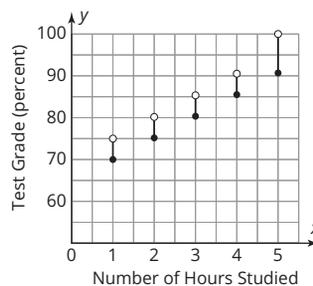
Review

1. Arnav is saving money to buy a used car in six months, or 24 weeks. He already has $550 saved. For four weeks in a row, he is able to put $100 into the account. He goes through a period of three weeks during which he is unable to add to the account. The next seven weeks after that, he is able to put in $75 each week. For the next four weeks, he has to take out $50 a week to pay some bills. For the remaining weeks he is able to once again put $100 a week into the account.

   a. Write a piecewise function to model the problem situation and then create a graph.

   b. Determine how much money he will have in his account after 15 weeks. Identify the function you used and explain the reason.

2. A company sells paper popcorn cones to movie theaters. The cones are 9 inches high and have a diameter of 4.5 inches. How much popcorn does a cone hold? Use 3.14 for π and round your answer to the nearest tenth if necessary.

3. A spherical balloon that is filled with air has a diameter of 28 centimeters. What volume of air is inside the balloon? Use 3.14 for π and round your answer to the nearest tenth if necessary.

4. The value of a car, y, and its relationship to the age of the car, x, is represented by the graph. Determine the x- and y-intercepts of the graph, and explain their meanings in terms of this problem.

5. LaQuan has picked up a friend and they are on a road trip. The graph represents the relationship between the distance LaQuan is from his home and the number of hours he and his friend have traveled. Determine the slope and the y-intercept of the graph, and explain their meanings in terms of the problem.