Lesson D

Problem Solving Skills: Using Step Functions

Use after Lesson 6-3

In a **step function,** there are breaks in the graph of the function. You cannot trace the graph of a step function without lifting your pencil. Graphs of step functions are often used to model real-world problems.
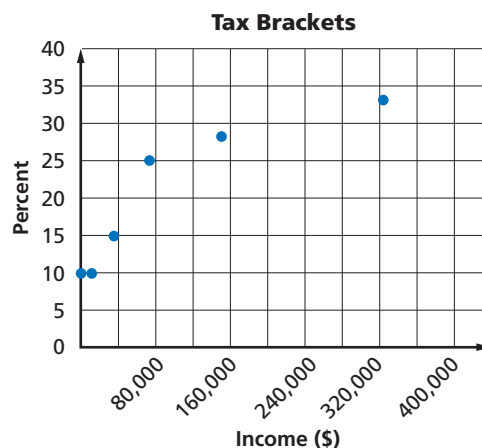
PROBLEM

The amount of income taxes that a single taxpayer owes depends upon his or her income. The table shows the tax brackets for different levels of income for a recent year.

Income x	Tax Bracket
$0 \leq x \leq \$7300$	10%
$7300 < x \leq \$29{,}700$	15%
$29{,}700 < x \leq \$71{,}950$	25%
$71{,}950 < x \leq \$150{,}150$	28%
$150{,}150 < x \leq \$326{,}450$	33%
$326{,}450 < x$	35%

Make a graph of the tax brackets.

Problem Solving Strategies

- Guess and check
- Look for a pattern
- Solve a simpler problem
- Make a table, chart or list
- ✔ Use a picture, diagram or model
- Act it out
- Work backwards
- Eliminate possibilities
- Use an equation or formula

Solve the Problem

In a step function graph, a dot means that the point is included in the graph. A circle means the point is not included in the graph.

Tax Brackets

You can use this graph to determine the tax bracket of an individual with a given income. For example, a person with an income of $100,000 is in the 28% bracket.

◣ TRY THESE EXERCISES

Use the graph to determine the tax bracket of an individual with each income.

1. $60,000   **2.** $200,000   **3.** $25,000   **4.** $400,000

5. **TAXES** The table at the right shows the tax brackets for married couples filing jointly for a recent year. Make a graph of the tax brackets.

Income x	Tax Bracket
$0 \le x \le$ \$14,600	10%
\$14,600 $< x \le$ \$59,400	15%
\$59,400 $< x \le$ \$119,950	25%
\$119,950 $< x \le$ \$182,800	28%
\$182,800 $< x \le$ \$326,450	33%
\$326,450 $< x$	35%

◣ PRACTICE EXERCISES

6. **PARKING** A parking lot charges $2 for the first hour and $1 for each additional hour or part of an hour. Draw a graph of a function that represents this situation. Use the graph to find the cost of parking there for $4\frac{1}{2}$ hours.

7. **RENTALS** The table at the right shows the charges for renting a bicycle from a rental shop at a state park. Make a graph showing the charges.

Bicycle Rentals

Time	Price
$\frac{1}{2}$ hour	$6
1 hour	$10
2 hours	$16
Daily	$24

8. **POSTAGE** The cost of mailing a letter is $0.39 for the first ounce and $0.23 for each additional ounce or portion thereof. Draw a graph of a function that represents this situation.

9. **SHIPPING** Trevor can purchase items at the local store and pay 8% sales tax. He can also order items. If he orders an item, he does not pay sales tax, but he does pay shipping and handling charges as listed at the right. On the same coordinate plane, graph the amount Trevor will pay for an item that costs x dollars if he buys it at the store and if he orders the item.

Shipping and Handling Charges

Amount of Purchase	Charges
Up to $30.00	$5
$30.01 to $60.00	$7
$60.01 to $90.00	$9
$90.01 and up	$11

10. **BUSINESS** A rental company rents chain saws for a maximum of 5 days. The rental fee for one day, or any portion thereof, is $20. The rental fee for over one day and up to 3 days is $30. For anything over 3 days, the fee is $40. Draw a graph of the situation.

11. **TELEPHONE RATES** Masao has a long-distance telephone plan where she pays 10¢ for each minute or part of a minute that she talks, regardless of the time of day. Graph a step function that represents this situation. How much would a call cost that lasts 9 minutes and 40 seconds?

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