Student: _____ Class: _____ Date: _____

Using Functions in Models and Decision Making: Step and Piecewise Functions

V.C Student Activity Sheet 11: Making Decisions from Step and Piecewise Models

When electricity became widely distributed during the early part of the 20th century, state governments regulated the electricity industry as a monopoly. One electric company had the rights to generate and distribute electricity for a city or a certain part of the state. In return, the government laid out a set of rules for what the electric company could and could not do.

During the 1990s and early 21st century, many states deregulated electricity. As a result, numerous electric companies can now provide electricity for a particular area. One such company is Lights and Power. To attract customers, Lights and Power is advertising a special:

1. According to the advertisement, how much does the first 1,000 kilowatt-hours (kWh) of electricity cost a customer?

2. Suppose Mrs. Brown uses 1,200 kilowatt-hours of electricity. How much does she pay for the first 1,000 kilowatt-hours?

   How much does she pay for the next 200 kilowatt-hours of electricity?

   How much does she pay altogether for 1,200 kilowatt-hours of electricity?

3. Use the information in Lights and Power's advertisement to determine the cost of electricity for the amounts listed in the table.

Amount of Electricity (kWh)	Process	Cost ($)
700	700(0.11)	77
800		
900		
1,000		
1,100		
1,200	1,000(0.11) + (1,200 – 1,000)(0.18)	146
1,300		
1,400		
1,500		
1,600		
1,700		
1,800		
1,900		

4. Write an equation to describe the cost (***y***) of the number of kilowatt-hours of electricity (***x***) to 1,000 kilowatt-hours.

5. For what domain does your function model the cost of the first 1,000 kilowatt-hours of electricity?

6. Write an equation to describe the cost (***c***) of the number of kilowatt-hours of electricity (***x***) from 1,001 to 1,500 kilowatt-hours.

7. For what domain does your function model the cost of 1,001 to 1,500 kilowatt-hours of electricity?

8. Write an equation to describe the cost (***m***) of the number of kilowatt-hours of electricity (***x***) more than 1,500 kilowatt-hours.

9. For what domain does your function model the cost of more than 1,500 kilowatt-hours of electricity?

10. Write three piecewise functions, including limitations on the domain, that describe the cost of purchasing electricity from Lights and Power.

11. Use your graphing calculator to make a scatterplot of cost versus amount of electricity. Describe the axes and scaling and sketch your graph.

12. Graph your piecewise functions over your scatterplot. Use the domain restrictions. How well do the functions model the data generated by the electricity plan?

13. The function $y = 0.11x$ has a domain of all real numbers. Why is the domain of the function as it is applied in this situation restricted?

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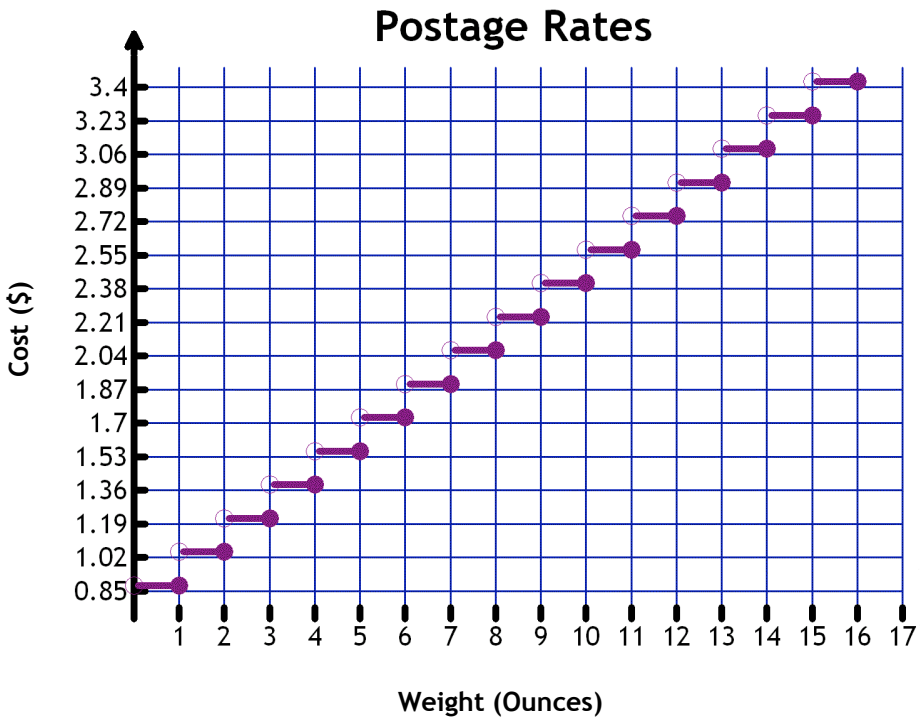
As of May 2009, the U.S. Postal Service adjusted its rates so that mailing a large envelope costs $0.88 for the first ounce and $0.17 for each additional ounce. There is a weight limit for all first-class mail—letters and parcels mailed first class cannot exceed 13 ounces.

Consider the graph below.



14. What type of function is represented by the graph? How do you know?

15. Is this type of function appropriate to represent the U.S. Postal Service rates for sending large envelopes by first-class mail? Why or why not?

16. How well does the graph represent the U.S. Postal Service rates for sending large envelopes by first-class mail? How do you know?

17. How could you modify the graph to better represent the situation?

18. **REFLECTION:** What types of situations can a step function be used to model?

19. **REFLECTION:** How are step functions similar to piecewise functions? How are they different?

20. **EXTENSION:** Research taxicab fares for your city or a city that you want to visit. What type of function is most appropriate to represent those fares? Generate a graph to show the fares and present your findings to the class.

21. **EXTENSION:** Research to determine an appropriate response to the following question. Prepare a short presentation of your findings.

    Would federal income taxes be better modeled with a step function or a piecewise function?