1. A long distance telephone charges 99 cents for any call up to 20 minutes in length and 7 cents for each additional minute. Use bracket notation to write a formula for the cost, C, of a call as a function of its length time, t, in minutes. Graph the function. How much does it cost to talk for 10 minutes? 25 minutes?

$$f(t) \begin{cases} .99 & , \ 0 < t \le 20 \\ .99 + .07(t-20) & , \ t > 20 \end{cases}$$

$$f(10) = .99 \, ¢ \qquad f(25) = \$1.34$$

2. Suppose a carpet store sells carpet for $10 per square yard for the 100 sq yards purchased, and then lowers the price to $7 per square yard after the first 100 yards have been purchased. Find a function, C = f(x), that gives the cost of purchasing any number of square yards of carpet between 0 and 200 square yards. How much does it cost for 50 square yards? 150 square yards?

$$f(x) \begin{cases} 10x & , \ 0 < x \le 100 \\ 1000 + 7(x-100) & , \ 100 < x \le 200 \end{cases}$$

$$f(50) = \$500 \qquad f(150) = \$1350$$

3. A company charges $200 a month to organize a company's payroll for up to 20 employees and an additional $100 a month for each 20 employees over 20. Find a function, P = f(x), that gives the payroll amount for 100 employees in one month. ~~Graph the function.~~

$$f(x) \begin{cases} 200 & , \ 0 < x \le 20 \\ 300 & , \ 20 < x \le 40 \\ 400 & , \ 40 < x \le 60 \\ 500 & , \ 60 < x \le 80 \\ 600 & , \ 80 < x \le 100 \end{cases}$$

Investigation: Step Functions

A step function is a piecewise constant function. In other words, each piece is a function whose values do not vary and are thus constant. This is sometimes called a staircase function.

1. Sketch the graph of the function below. What values of x will make this function true? In other words, where is this function defined, or what is its domain? Why is the range not all real numbers? What do you notice that is different from the first two functions. Graph on your calculator to check your work.

$$f(x) = \begin{cases} 1, & 0 \le x < 1 \\ 3, & 1 \le x < 3 \\ 5, & 3 \le x < 5 \\ 7 & 5 \le x < 7 \end{cases}$$
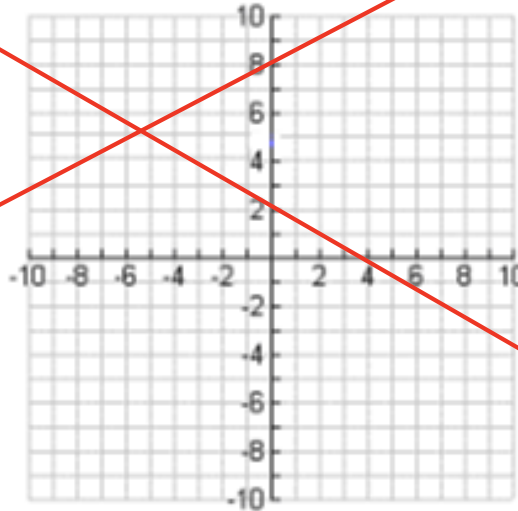
2. Every avid ebayer knows that shipping is an important consideration when listing an item for auction. For infrequent selling, there is not much money to be gained or lost on the transaction, but for the diehard, inaccurate shipping costs can lead to stacked losses over time. Knowing the postal rate scale and what to charge for a given item is paramount. The cost C (in dollars) of sending priority mail, depending on the weight (in ounces) of a package up to five pounds is given by the function below

$$C(x) = \begin{cases} 13.65, & 0 < x \le 15 \\ 17.00, & 15 < x \le 30 \\ 20.25, & 30 < x \le 55 \\ 23.50, & 55 < x \le 70 \\ 26.25, & 70 < x \le 80 \end{cases}$$
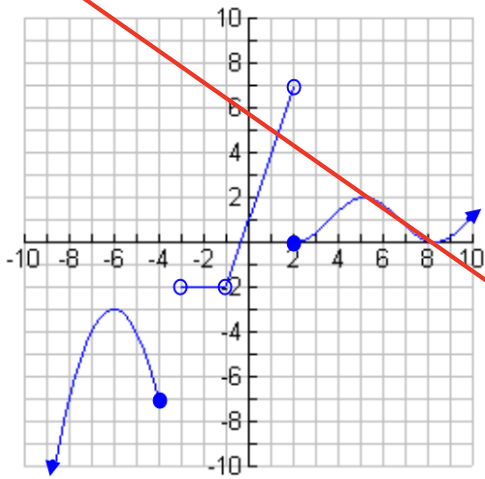
Graph the function and identify the domain and range.
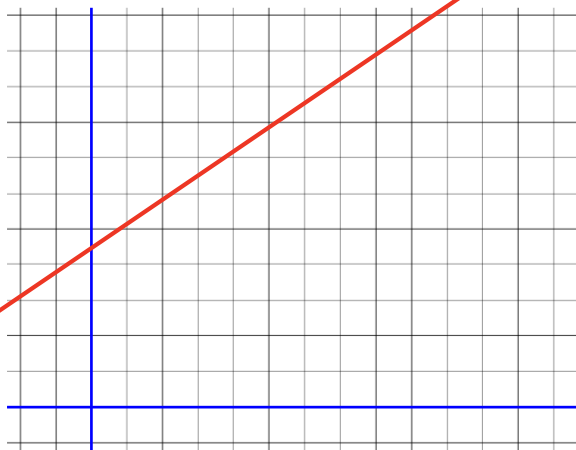
3. Given the graph of this step function, find a piecewise constant function that matches the graph.
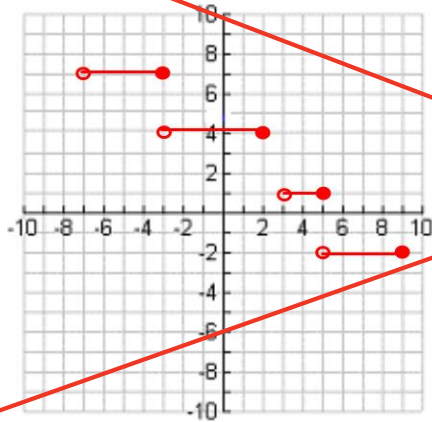
4. **Extension:**

a. Given the graph of this function, write the piecewise function $f(x)$ that matches the graph.

b. Give the domain and range of the function.

c. Describe the end behavior of $f(x)$ using infinity notation and/or words.