

# Greetings

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**Reporting Category** Equations and Inequalities

**Topic** Writing a function to describe an inequality and solving the inequality

**Primary SOL** A.5 The student will solve multistep linear inequalities in two variables, including

- solving multistep linear inequalities algebraically and graphically;
- justifying steps used in solving inequalities, using axioms of inequality and properties of order that are valid for the set of real numbers and its subsets;
- solving real-world problems involving inequalities.

**Related SOL** A.7

## Materials

- Graph paper
- Graphing calculators

## Vocabulary

*function rule*

## Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

1. Display the following problem: “The school choir purchased customized cards from a company that charges a \$100 setup fee and \$2 per box of cards. The choir members will sell the cards at \$3 a box. What will be the choir’s profit,  $p$ , if they sell  $x$  boxes of cards?” Have students write a function describing the choir’s profit,  $p$ , for selling  $x$  boxes of cards.
  - Have students answer the following questions:
  - What does  $p$  represent?
  - What does the word *profit* mean?
  - What does  $x$  represent?
  - What does the 3 in the expression  $3x$  represent?
  - Why are parentheses used in the function rule?
  - How can you use the distributive property to simplify the expression?
  - What do the expressions “ $3x$ ” and “ $100 + 2x$ ” mean in this situation?
  - How much money will the choir make if they sell 200 boxes? Explain your solution strategy.
  - How many boxes must the choir sell to make a \$200 profit? Explain how you found your answer.
  - How many boxes must the choir sell to make a \$500 profit? Use a different strategy to find the solution.
  - What does it mean to “break even”?
  - How many boxes will the choir have to sell to break even?
  - What properties of inequality were used to solve this problem?

### Properties of Equality and Inequality

Let  $a$ ,  $b$ , and  $c$  be real numbers.

Property	Equality	Inequality
<b>addition</b>	If $a = b$ , then $a + c = b + c$ .	If $a < b$ , then $a + c < b + c$ . If $a > b$ , then $a + c > b + c$ .
<b>subtraction</b>	If $a = b$ , then $a - c = b - c$ .	If $a < b$ , then $a - c < b - c$ . If $a > b$ , then $a - c > b - c$ .
<b>multiplication</b>	If $a = b$ , then $ac = bc$ .	If $a < b$ and $c > 0$ , then $ac < bc$ . If $a < b$ and $c < 0$ , then $ac > bc$ . If $a > b$ and $c > 0$ , then $ac > bc$ . If $a > b$ and $c < 0$ , then $ac < bc$ .
<b>division</b>	If $a = b$ and $c \neq 0$ , then $\frac{a}{c} = \frac{b}{c}$ .	If $a < b$ and $c > 0$ , then $\frac{a}{c} < \frac{b}{c}$ . If $a < b$ and $c < 0$ , then $\frac{a}{c} > \frac{b}{c}$ . If $a > b$ and $c > 0$ , then $\frac{a}{c} > \frac{b}{c}$ . If $a > b$ and $c < 0$ , then $\frac{a}{c} < \frac{b}{c}$ .

- Tell students that the choir will not consider this project unless they can raise at least \$1,000. Have students write and solve an inequality that will help them determine whether the choir should do this project. Then, have them graph the inequality in the coordinate plane, using paper and pencil and also using graphing calculators.

### Assessment

- Questions**
  - How would the greeting card problem be different if the \$100 setup fee were to be waived?
  - For another problem similar to the greeting card problem, the profit is represented by  $p = 3x - (30 + 2.5x)$ . Describe the cost and selling process for this situation. Under what conditions would this situation be better than the greeting card situation?
- Journal/Writing Prompts**
  - Ten choir members will be attending the International Concert. The total cost of this trip is \$7,500 for the group. Two of the members will not be able to sell greeting cards. Describe how the remaining eight members will sell enough greeting cards to cover the cost of this trip. Be specific in describing each member's responsibility.

### Extensions and Connections (for all students)

- Have students research the cost and profit involved with selling a product similar to the greeting cards. Have them compare and contrast the profit from selling this product to the profit from selling the greeting cards.

**Strategies for Differentiation**

- Encourage students to use multiple ways to present information, including graphs, pictorial models, mathematical notation, and manipulatives.
- Direct students to make a table like the one below for the data in the greeting card problem. This will build on the patterns concept established in the lower grades. The equation then becomes the rule that goes with the pattern.

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