Functions 1

Reporting Category   Functions

Topic   Investigating relations and functions

Primary SOL   A.7   The student will investigate and analyze function (linear and
quadratic) families and their characteristics both algebraically and
graphically, including
a) determining whether a relation is a function;
b) domain and range;
e) finding the values of a function for elements in its domain.

**Related SOL**   A.1, A.4

Materials
* Function Sort Cards (attached)
* Scissors

Vocabulary
*domain, range, independent variable, dependent variable, input, output, relation, function,
function notation* (A.7)

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

1. Review domain and range from Grade 8 mathematics (SOL 8.17). Relate domain and range
    to independent and dependent variables as well as input and output.

2. Display the following scenario:
    "Eleanor stayed home from school
    yesterday because she had a fever. The
    graph at right charts her temperature
    throughout the day." Have students
    write a brief story about the course of
    Eleanor's illness yesterday.

3. Have a few students share their stories
    and discuss the relationship between
    the time of day and Eleanor's
    temperature. Direct students to
    identify a reasonable domain and
    range for this function. Remind
    students of the mathematics term *relation* (any set of ordered pairs; for each first member,
    there may be many second members). Ask whether Eleanor's temperature represents a
    relation, and ask why or why not.
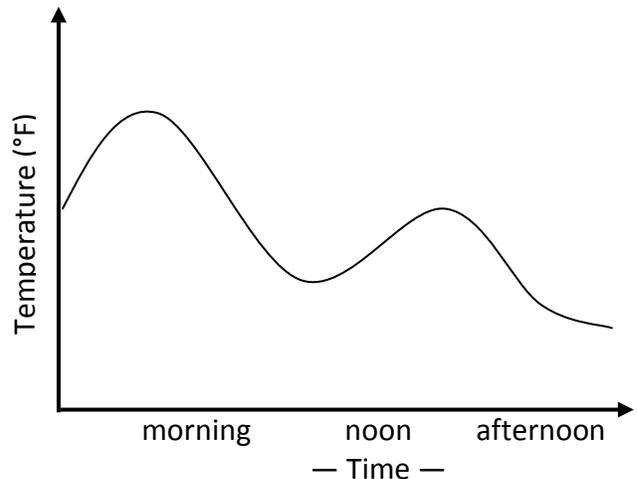
4. Display the following problem. "The value of a car decreases every year that it is used. In the following table, what is the dependent variable and what is the independent variable? Is this situation a relation? Why, or why not?"

Age of Car (years)	Value of Car (dollars)
0	15,000
1	11,000
2	8,000
3	6,000
4	5,000
5	4,000

5. Display a mapping for the same car age-value data. Ask students which variable represents the domain and which variable represents the range.

Age of Car (years)   **Value of Car (thousand $)**
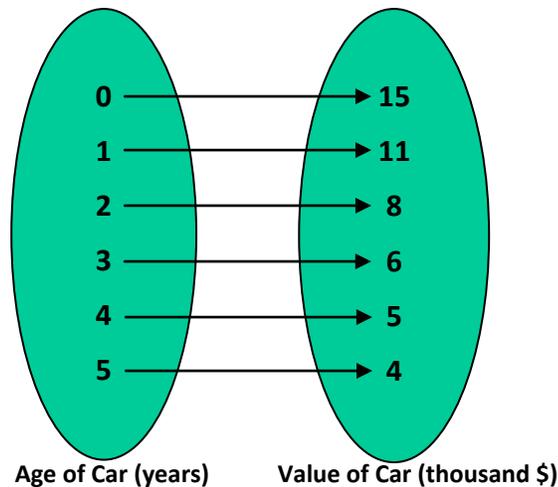
6. Tell students that both of these relations are also functions. Review the mathematics term *function* (a relation in which each element of the domain is matched to exactly one element in the range). Ask students whether all mathematical relations are functions. Ask for examples of relations that are not functions.

7. Distribute scissors and copies of the Function Sort Cards. Working in pairs, have students cut out the mathematical relations and place them into two groups—those that are functions and those that are not. Instruct partners to discuss and note down exactly why they decide to place each relation in a certain group.

8. Lead a class discussion of the relations on the Function Sort Cards. Have students explain their groupings, justifying why each relation is or is not a function. Ask whether anyone changed a representation in order to decide whether a relation was a function or not, e.g., whether anyone turned an equation or verbal situation into a graph or table.

9. Explain to students that equations that represent functions can be written in function notation in which **x represents domain elements** and **f(x) represents range elements**. For example, the function $y = 3x + 2$ would be written as $f(x) = 3x + 2$ in function notation, and the function $y = x^2$ would be written as $f(x) = x^2$.

10. Have students consider the function $f(x) = 3x - 7$. Ask them to find $f(6)$. After discussing the solution, ask them to find $f(-2)$ and $f(0.31)$. Note: It is a common misunderstanding that the parentheses in function notation indicate multiplication. Be sure to bring up this matter if students do not and clarify it.

11. Have students create their own function written in function notation, along with some elements of the function to find, given various domain values. Then, have students exchange functions with their partners and find solutions. Finally, have partners check the solutions.

Assessment
- **Questions**
  - ○ How can you determine whether a graph represents a function?
  - ○ How can you determine whether a table of values represents a function?
- **Journal/Writing Prompts**
  - ○ Compare and contrast relations and functions.
  - ○ Explain function notation to someone who does not know about it.
- **Other**
  - ○ Have students create their own examples and non-examples of functions for classmates to sort.

Extensions and Connections (for all students)
- Show students the vertical line test. Have them explain why it works.

Strategies for Differentiation
- Give students Function Sort Cards that have already been cut out. Have students sort the cards into function or relation.
- Have students create a chart showing characteristics of functions and characteristics of relations that are not functions.
- Provide students with a diagram or other graphic organizer with information on characteristics of functions and relations. Allow students to use this during the function sort activity.
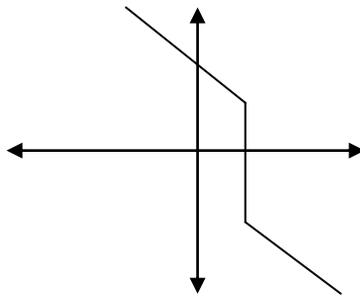
Function Sort Cards
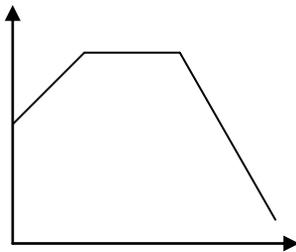
Cut out cards on the dotted lines.

x	y
1	–2
3	4
5	10

A grocery store is selling peaches for $0.98 per pound.
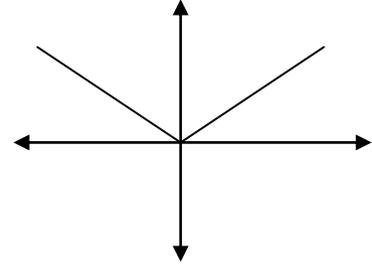
x	y
2	–1
2	–3
2	–5

You visit a yard sale with your friends Pete, Sharon, and Brandon. Brandon buys 4 old CDs for $8.00, and Sharon buys 3 old CDs for $6.00. Pete talks to the seller and makes a deal to buy 4 CDs for $7.00.

$y = 3x + 2$

x	y
–2	10
0	6
2	10

$y = x^2$

x	y
5	1
6	1
7	1