Math 60: 8.2 Relations

Objectives

1) Understand relations
2) Find the domain and range of a relation
3) Use interval and set notation correctly

Interval notation: an abbreviation for shaded area on graph

Review and Warm-up smallest endpt, largest endpt

1) $-4 \le x < 4$

a. Write the inequality using interval notation $[-4, 4)$

Use $\ge$ or $\le$ for [ ] included

b. Write the inequality using set notation $\{x : -4 \le x < 4\}$

Use $>$ or $<$ for) or (excluded

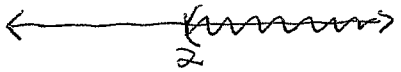
c. Graph the inequality

2) $2 < y$ ← means $y > 2$

a. Write the inequality using interval notation $(2, \infty)$

b. Write the inequality using set notation $\{y : y > 2\}$

c. Graph the inequality

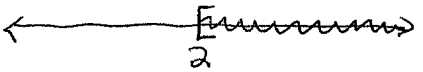


3) $[2, \infty)$

a. Write the interval using an inequality $x \ge 2$

b. Write the interval using set notation $\{x : x \ge 2\}$

c. Graph the interval

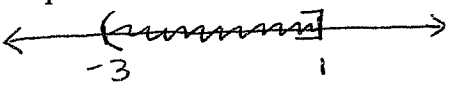


4) $(-3, -1]$

a. Write the interval using inequalities $-3 < x \le -1$

b. Write the interval using set notation $\{x : -3 < x \le -1\}$

c. Graph the interval



An interval where both endpoints are included [a,b] is called a closed interval.
An interval where neither endpoint is included (a,b) is called an open interval.
An interval with one endpoint included and the other not (a,b] or [a,b) is called a half-open interval.

Relation

If the elements of one set ore associated with the elements of another set, this is called a relation.
If x is a number in the first set and y is a number in the second set, then we say

"x corresponds to y", written in math as $x \to y$, or "y depends on x"

A relation can be given as

Venn diagram (circles containing lists) with arrows showing the correspondence, also called a "map"
list of ordered pairs (x, y), often given as a set
graph of ordered pairs, as individual unconnected dots
graph of connected dots (implying every shaded point is included)

There are no requirements on how the elements are related:

Two arrows may point to the same y.
A single x may have two arrows toward two y values.
Each x may have one distinct y.

Domain of a Relation
The first set is called the domain, and is sometimes referred to as the input.
When identifying the domain, we list all elements once (no duplicates).
When using a graph, the domain comes from the x values.

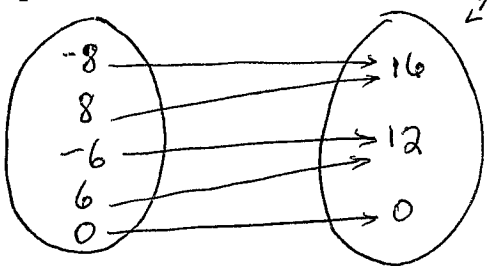
Range of a Relation
The second set is called the range, and is sometimes referred to as the output.
When identifying the range, we list all elements once (no duplicates).
When using a graph, the range comes from the y values.

Practice

a. Write the relation as a map.
b. Write the domain of the relation using set notation.
c. Write the range of the relation using set notation.
d. Why can't we use interval notation?

5) $\{(-8,16),(-6,12),(0,0),(6,12),(8,16)\}$

Map:



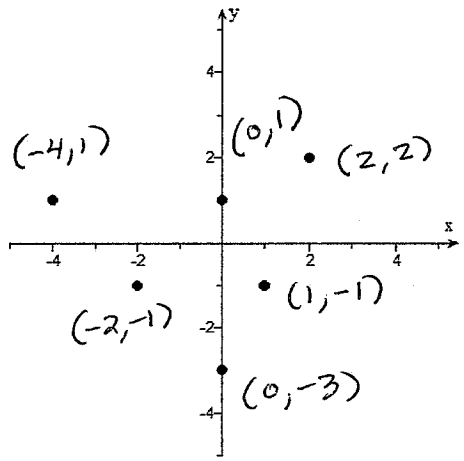
Domain using set notation: $\{-8,-6,0,6,8\}$

Range using set notation: $\{0,12,16\}$

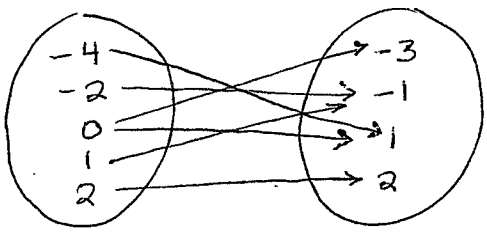
Reason we can't use intervals:

Separate values of x are listed, not including the values in between. (x = -7 is missing, as are -7.5, -7.25 and all the decimal values!)

6)



Map:



Domain using set notation: $\{-4,-2,0,1,2\}$

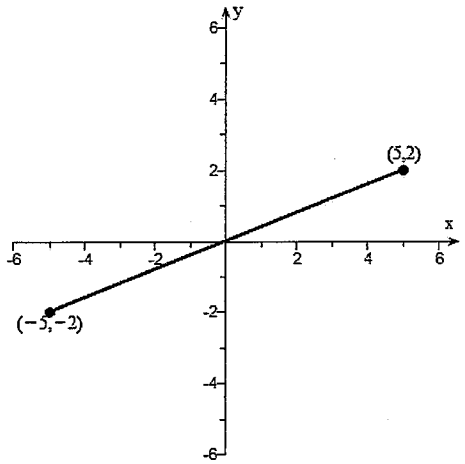
Range using set notation: $\{-3,-1,1,2\}$

Reason we can't use intervals:
Individual dots are not connected, so values in between are not included.

For the remaining questions,

a. Write the domain of the function using interval notation
b. Write the domain of the function using set notation.
c. Write the range of the relation using interval notation.
d. Write the range of the relation using set notation.

7)



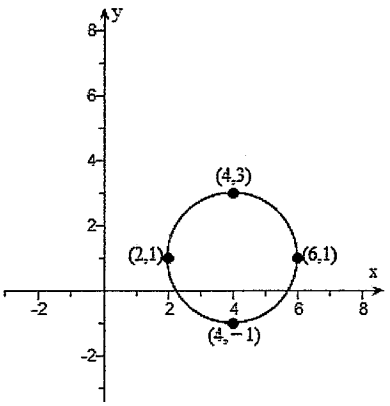
Domain (interval) $[-5, 5]$

Domain (set) $\{x : -5 \leq x \leq 5\}$

Range (interval) $[-2, 2]$

Range (set) $\{y : -2 \leq y \leq 2\}$

8)



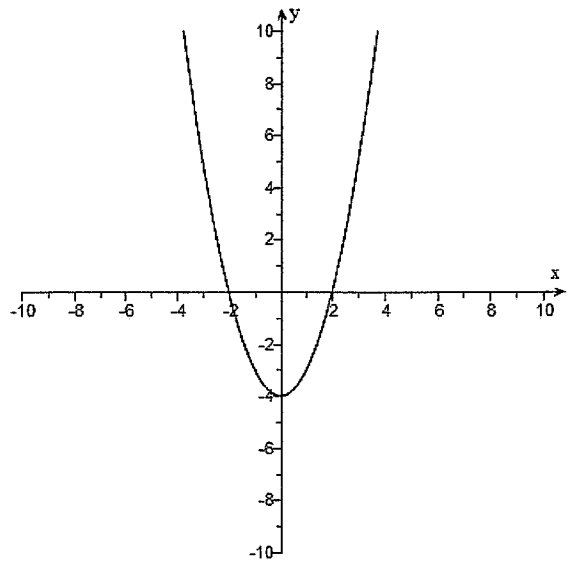
Domain (interval) $[2, 6]$

Domain (set) $\{x : 2 \leq x \leq 6\}$

Range (interval) $[-1, 3]$

Range (set) $\{y : -1 \leq y \leq 3\}$

9) $y = x^2 - 4$



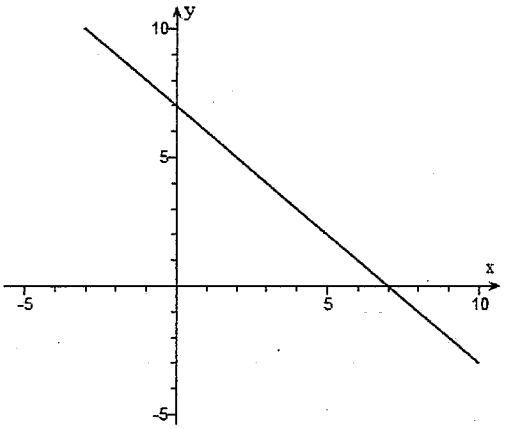
Domain (interval) $(-\infty, \infty)$

Domain (set) $\{x : x \text{ is a real \#}\}$

Range (interval) $[-4, \infty)$

Range (set) $\{y : y \geq -4\}$

11) $y = -x + 7$



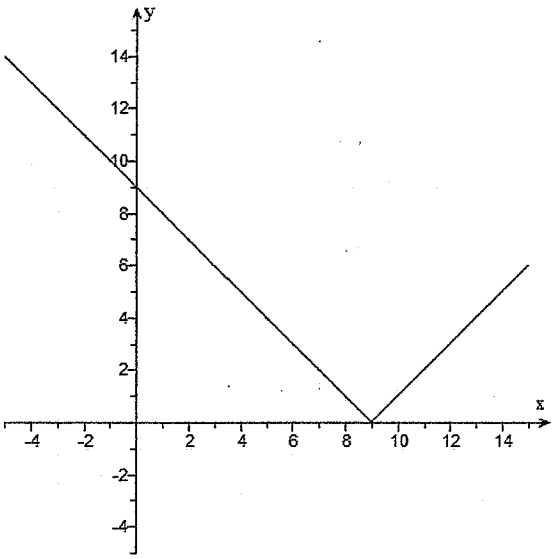
Domain (interval) $(-\infty, \infty)$

Domain (set) $\{x : x \text{ is a real \#}\}$

Range (interval) $(-\infty, \infty)$

Range (set) $\{y : y \text{ is a real \#}\}$

12) $y = |x - 9|$



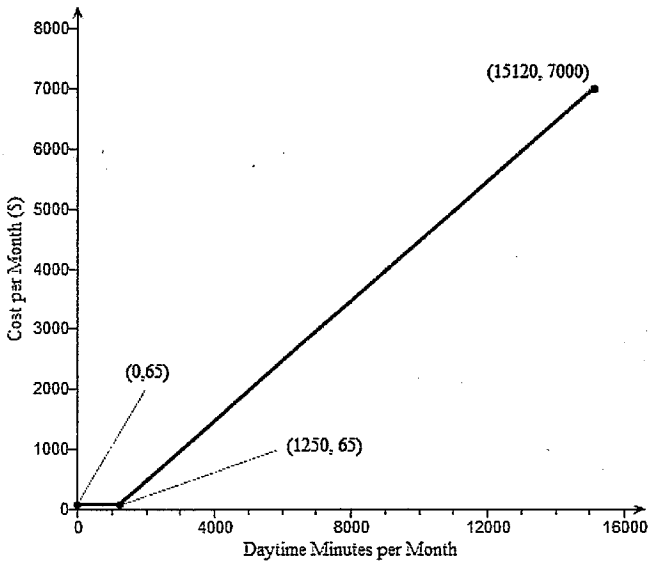
Domain (interval) $(-\infty, \infty)$

Domain (set) $\{x : x \text{ is a real \#}\}$

Range (interval) $[0, \infty)$

Range (set) $\{y : y \geq 0\}$

13) Expensive cell phone plan



Domain (interval) $[0, 15120]$

Domain (set) $\{x : 0 \leq x \leq 15120\}$

Range (interval) $[65, 7000]$

Range (set) $\{y : 65 \leq y \leq 7000\}$