

MATH SPEAK - TO BE UNDERSTOOD AND MEMORIZED

1) **SET OF ORDERED PAIRS** = a *relation* consisting of a group two or more of *ordered pairs*.

e.g. $\{(-2, 7), (-1, 5), (0, 3), (1, 1), (2, -1)\}$

2) **DOMAIN** = the first number of each *ordered pair* in a set of ordered pairs, or all the *input numbers* substituted into the *equation*.

3) **RANGE** = the second number of each *ordered pair* in a set of ordered pairs, or all the *output numbers* produced by the *equation*.

INTRODUCING DOMAIN & RANGE

I) A *RELATION* IS A MATHEMATICAL STATEMENT DESCRIBING A RELATIONSHIP BETWEEN TWO THINGS. A *relation* can be represented as a *SET OF ORDERED PAIRS*, *GRAPH*, *table of values* and as an *EQUATION*.

II) A *SET OF ORDERED PAIRS* is a *relation* consisting of two or more *ORDERED PAIRS*. An *ORDERED PAIR* is a *mathematical statement* consisting of two numbers arranged in a specific order. The order of the numbers is so important that they are given specific names. The first number is called the *DOMAIN* and the second number is called the *RANGE*. *The DOMAIN consists of all the equation's input numbers and is often represented by the x-variable* while the *RANGE consists of all the equation's output numbers and is often represented by the y-variable*.

A) **SAMPLE PROBLEM 1:** Study this example carefully. Be sure you understand and memorize the process used to complete it. **Instructions:** State the *domain* and *range* of this *relation*.

1) $\{(-2, -10), (-1, -3), (0, -2), (1, -1), (2, 6), (3, 25)\}$

Analysis: This is a *set of ordered pairs* \therefore the *domain* consists of the first value of each *ordered pair*, while the *range* consists of the second value of each *ordered pair*.

Solution:

B) **REQUIRED PRACTICE 1:** State the *domain* and *range* of these relations. {Answers are on page 7 of these notes.}

1) $\{(2, -1), (4, -4), (6, -7), (8, -10), (10, -13)\}$

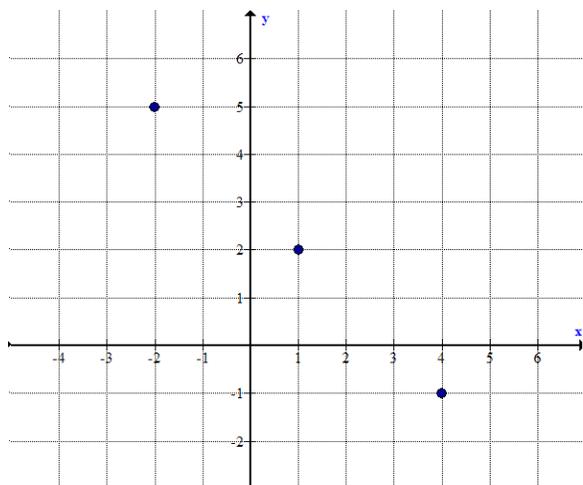
2) $\{(4, 2), (5, 3), (4, 6), (6, 7)\}$

III) A *GRAPH* is a picture of a relation created by plotting points or a line on a *GRID*.

A) Some *graphs* are a series of points while others are straight or curved lines.

- 1) The *domain of a graph* consists of all values of the *x-axis* that are used to make the *graph*. In other words, the *domain* of a *graph* consists of all values of the *x-axis* that are underneath or above it.
- 2) The *range* consists of all values of the *y-axis* that are used to make the *graph*. In other words, the *range* of a *graph* consists of all values of the *y-axis* that are beside it.
- 3) The questions in **SAMPLE POR BLEMS 6** and **REQUIRED PRACTICE 6** found on the next page and pages 2 – 5 of Topic 7 illustrate how to determine the *domain* and *range* of *graphs*.

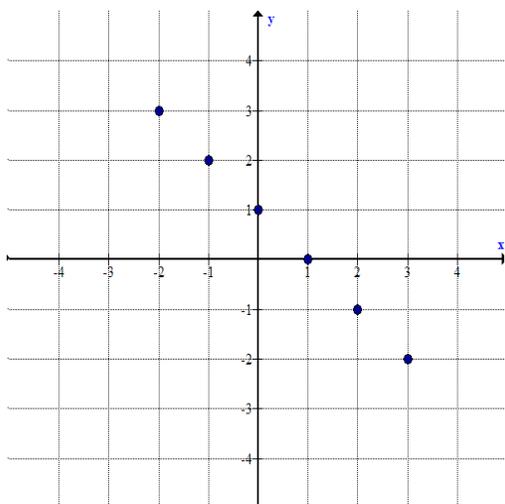
- B) **SAMPLE PROBLEM 2:** Study this example carefully. Be sure you understand and memorize the process used to complete it. **Instructions:** State the *domain* and *range* of this graph.



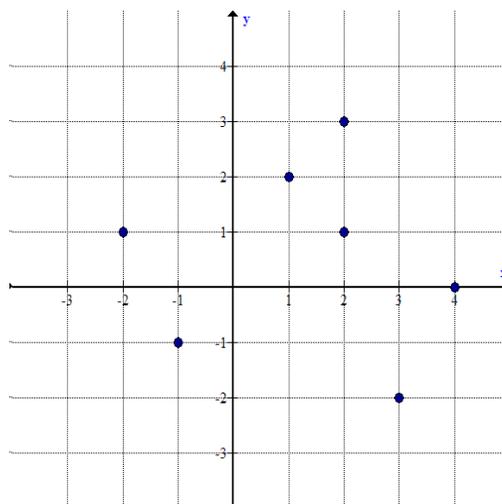
NOTICE that the *domain* represents all the values of the *x*-axis that are part of the graph, the points, and the *range* represents all the values of the *y*-axis that are part of the graph, the points.

- C) **REQUIRED PRACTICE 2:** State the *domain* and *range* of these *relations*. {Answers are on page 7 of these notes.}

1)



2)

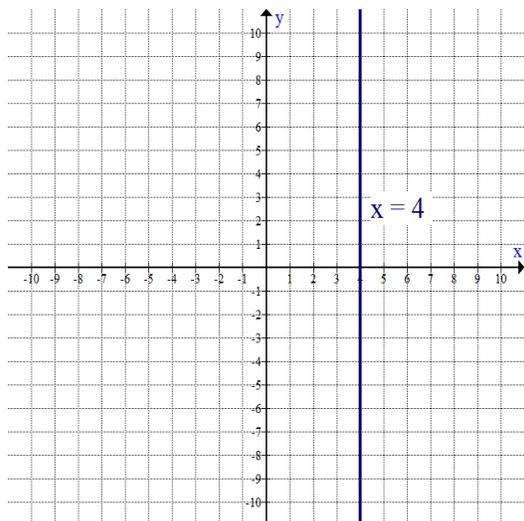


DOMAIN AND RANGE OF CONTINUOUS LINE GRAPHS

- 1) A **GRAPH** is a picture of a relation created by plotting points or a line on a **GRID**. Some **graphs** are a series of points while others are straight or curved lines.
- A) The **domain** of a graph consists of all values of the *x*-axis that are used to make the graph. In other words, the **domain** of a graph consists of all values of the *x*-axis that are underneath or above it.
- B) The **range** consists of all values of the *y*-axis that are used to make the graph. In other words, the **range** of a graph consists of all values of the *y*-axis that are to the left or right of it.
- C) The **SAMPLE PORBLEMS** and **REQUIRED PRACTICE** found on pages 3 – 6 illustrate how to determine the **domain** and **range** of graphs consisting of continuous lines.

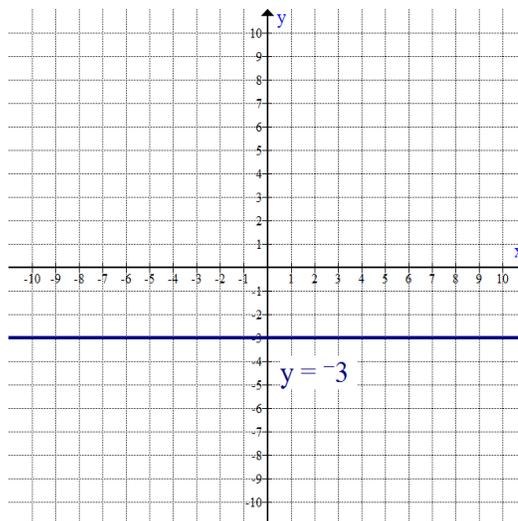
D) **SAMPLE PROBLEMS 3:** Study these examples carefully. Be sure you understand and memorize the process used to complete them. **Instructions:** Determine the *domain* and *range* of these graphs.

1)



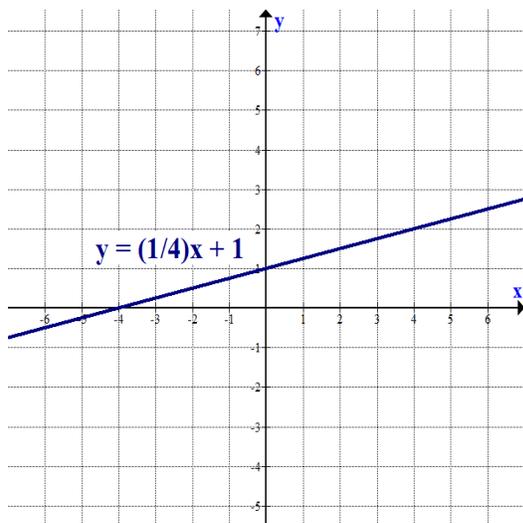
Since 4 is the only value of the *x-axis* that was used to make the *graph*, the *domain*: $x = 4$. **NOTICE** that the *graph* is as long as the entire *y-axis*. This means that all values of the *y-axis* were used to make the *graph*. Since all values of the *y-axis* that were used to make the *graph*, the range is all real numbers, which is recorded as: *range*: $y \in \mathbb{R}$.

2)



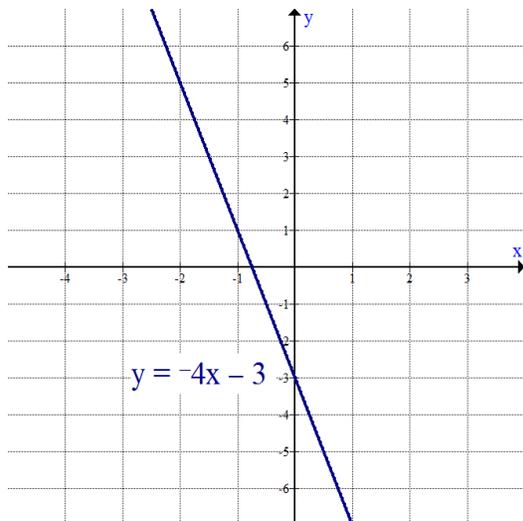
NOTICE that the *graph* is as long as the entire *x-axis*. This means that all values of the *x-axis* were used to make the *graph*. Since all values of the *x-axis* that were used to make the *graph*, the *domain is all real numbers*, which is recorded as: *domain*: $x \in \mathbb{R}$. Since -3 is the only value of the *x-axis* that was used to make the *graph*, the *range*: $y = -3$.

3)



NOTICE that the *graph* is as long as the entire *x-axis*. This means that all values of the *x-axis* were used to make the *graph*. Since all values of the *x-axis* that were used to make the *graph*, the *domain is all real numbers*, which is recorded as: *domain*: $x \in \mathbb{R}$. Because the *graph* continues forever in both directions, its right side continues to move higher and higher in the *y-direction* and its left side continues to move lower and lower in the *y-direction*. This means that the *graph* is as long as the entire *y-axis*. This means that all values of the *y-axis* were used to make the *graph*. Since all values of the *y-axis* that were used to make the *graph*, the range is all real numbers, which is recorded as: *range*: $y \in \mathbb{R}$.

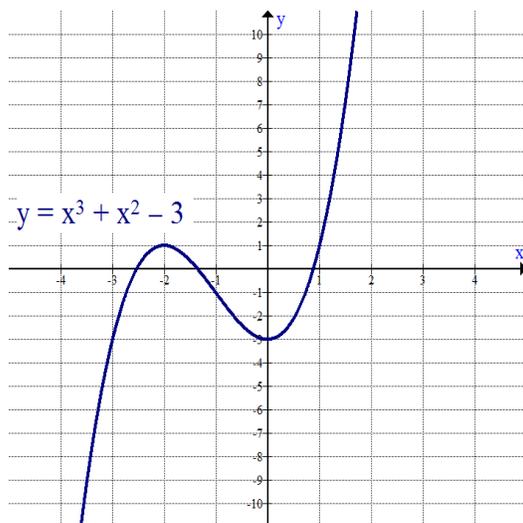
4)



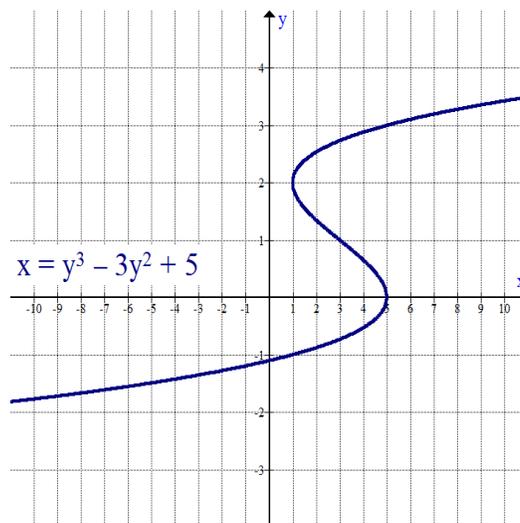
Because the **graph** continues forever in both directions, its right side continues to move farther and farther right in the ***x-direction*** and its left side continues to move farther and farther left in the ***x-direction***. This means that the **graph** is as long as the entire ***x-axis***. This means that all values of the ***x-axis*** were used to make the **graph**. Since all values of the ***x-axis*** that were used to make the **graph**, the **domain is all real numbers**, which is recorded as: **domain: $x \in \mathbb{R}$** . NOTICE that the **graph** could cover the entire ***y-axis***. This means that all values of the ***y-axis*** were used to make the **graph**. Since all values of the ***y-axis*** that were used to make the **graph**, the range is all real numbers, which is recorded as: **range: $y \in \mathbb{R}$** .

E) **REQUIRED PRACTICE 3:** State the **domain** and **range** of these **relations**. {Answers are on page 7 of these notes.}

1)

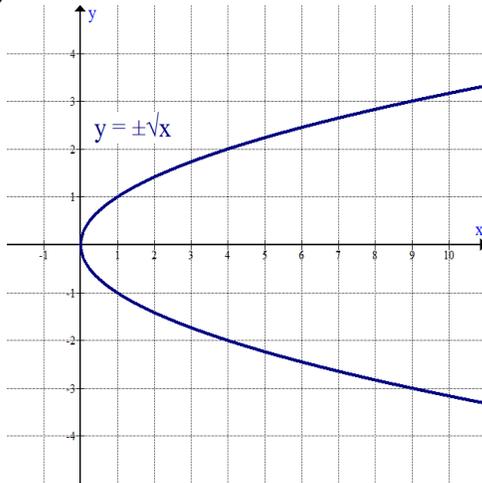


2)



F) **SAMPLE PROBLEMS 4:** Study these examples carefully. Be sure you understand and memorize the process used to complete them. **Instructions:** Determine the *domain* and *range* of these graphs.

1)

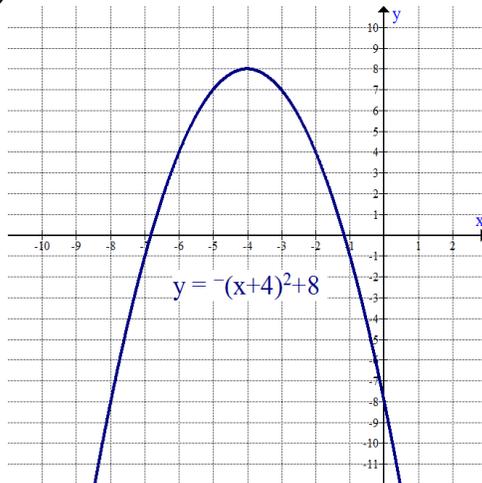


NOTE: This graph is **CONTINUOUS** because each end continues forever in the direction it points.

Analysis: Since the **graph** continues forever in the positive ***x-direction***, the **domain** includes all values of the ***x-axis*** that are larger than and include 0, thus the **domain** : $x \geq 0$. Since the **graph** continues forever in both the positive and negative ***y-directions***, the **range** includes all values of the ***y-axis*** \therefore **range** : $y \in \mathbb{R}$. $y \in \mathbb{R}$ means all real numbers

Solution:

2)



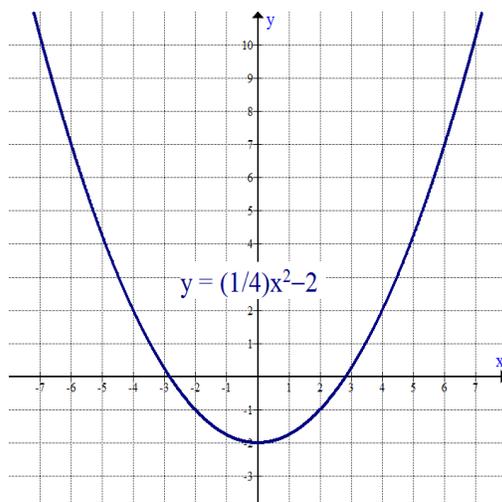
NOTE: This graph is **CONTINUOUS** because each end continues forever in the direction it points.

Analysis: Since the **graph** continues forever in both the positive and negative ***x-directions***, the **domain** includes all values of the ***x-axis***, thus the **domain** : $x \in \mathbb{R}$. Since the **graph** continues forever in the negative ***y-direction***, the **range** includes all values of the ***y-axis*** that are less than 8 \therefore **range** : $y \leq 8$. $y \leq 8$ means all real numbers

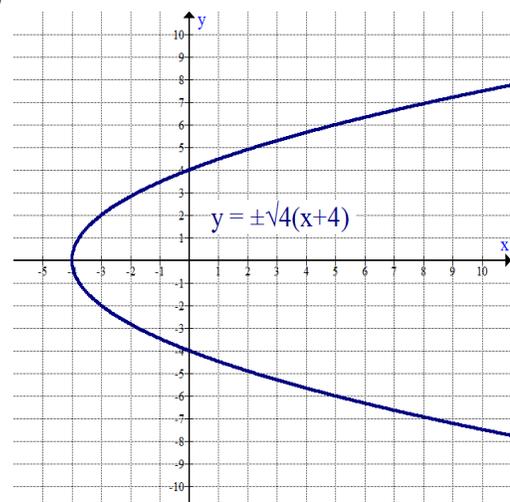
Solution:

G) **REQUIRED PRACTICE 4:** State the *domain* and *range* of these *relations*. {Answers are on page 7 of these notes.}

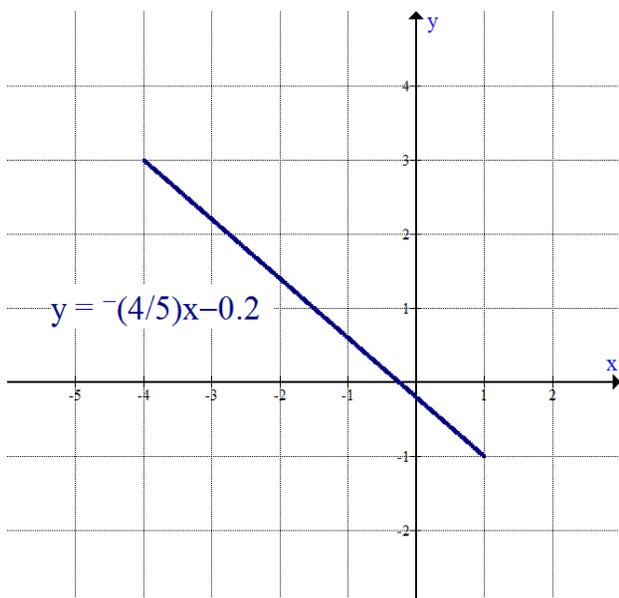
1)



2)



H) **SAMPLE PROBLEM 5:** Study this example carefully. Be sure you understand and memorize the process used to complete it. **Instructions:** State the *domain* and *range* of this graph.



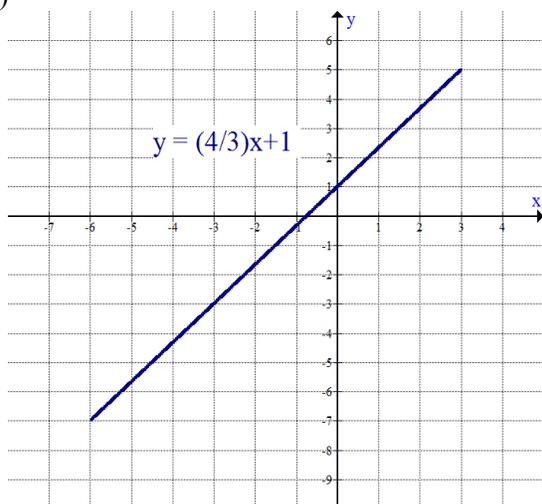
The domain represents all the values of the x-axis that are part of the graph. The *graph* lies BETWEEN $x = -4$ and $x = 1$. Mathematicians describe the *graph's domain* as $-4 \leq x \leq 1$, which is read all values of the x-axis between and including -4 and 1 .

The range represents all the values of the y-axis that are part of the graph. The *graph* lies BETWEEN $y = -1$ and $y = 3$. Mathematicians describe the *graph's range* as $-1 \leq y \leq 3$ which is read all values of the y-axis between and including -1 and 3 .

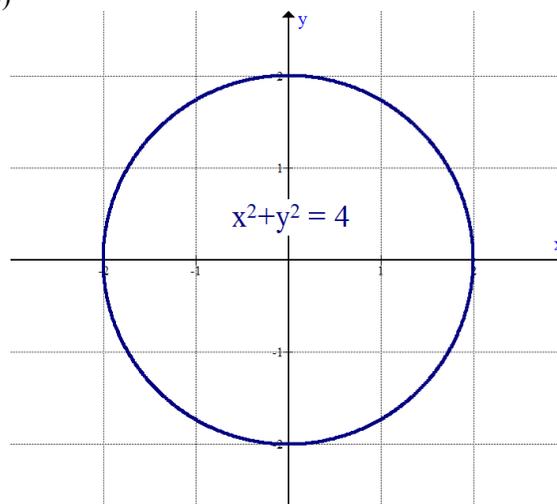
Thus the answer is:

I) **REQUIRED PRACTICE 5:** State the *domain* and *range* of these *relations*. {Answers are on page 7 of these notes.}

1)



2)



II) **REQUIRED PRACTICE 6:** State the *domain* and *range* of these *relations*. {Answers are on page 7 of these notes.}

- 1) Graph on page 293.
- 2) Bottom graph on page 296.
- 3) Bottom graph on page 298.
- 4) Green graph in question 1b on page 347.
- 5) Horizontal graph in the grid on page 336.
- 6) Graphs in question 1 on page 360.

ANSWERS TO THE REQUIRED PRACTICE**Required Practice 1 from page 1**

1) *domain:* $x = 2, 4, 6, 8, 10$ *range:* $x = -13, -10, -7, -4, -1$ 2) *domain:* $x = 4, 5, 6$ *range:* $y = 2, 3, 6, 7$

Required Practice 2 from page 3

1) *domain:* $x = -2, -1, 0, 1, 2, 3$ *range:* $y = -2, -1, 0, 1, 2, 3$

2) *domain:* $x = -2, -1, 1, 2, 3, 4$ *range:* $y = -2, -1, 0, 1, 2, 3$

Required Practice 3 from page 4

1) *domain:* $x \in \mathbb{R}$ *range:* $y \in \mathbb{R}$ 2) *domain:* $x \in \mathbb{R}$ *range:* $y \in \mathbb{R}$

Required Practice 4 from page 5

1) *domain:* $x \in \mathbb{R}$ *range:* $y \geq -2$ 2) *domain:* $x \geq -4$ *range:* $y \in \mathbb{R}$

Required Practice 5 from page 6

1) *domain:* $-6 \leq x \leq 3$ *range:* $-7 \leq y \leq 5$ 2) *domain:* $-2 \leq x \leq 2$ *range:* $-2 \leq y \leq 2$

Required Practice 6 from page 6

1) *domain:* $x \in \mathbb{R}$ *range:* $y \in \mathbb{R}$ 2) *domain:* $x \in \mathbb{R}$ *range:* $y \in \mathbb{R}$ 3) *domain:* $x = 2$ *range:* $y \in \mathbb{R}$

4) *domain:* $x = 4$ *range:* $y \in \mathbb{R}$ 5) *domain:* $x \in \mathbb{R}$ *range:* $y = 4$

5) 1a) *domain:* $x \in \mathbb{R}$ *range:* $y \in \mathbb{R}$ 1b) *domain:* $-4 \leq x \leq 4$ *range:* $x \leq 4$

1c) *domain:* $x \in \mathbb{R}$ *range:* $x \leq 0$ 1d) *domain:* $x \in \mathbb{R}$ *range:* $y \geq -3$

1e) *domain:* $x \in \mathbb{R}$ *range:* $y \in \mathbb{R}$ 1f) *domain:* $x \in \mathbb{R}$ *range:* $-1 \leq y \leq 1$
