1-1 Study Guide and Intervention

Functions

Describe Subsets of Real Numbers The set of real numbers includes the rationals $\mathbb{Q}$, irrationals $\mathbb{I}$, integers $\mathbb{Z}$, wholes $\mathbb{W}$, and naturals $\mathbb{N}$.

One way to describe a subset of the real numbers is to use **set-builder notation.** With set-builder notation, you choose a variable, list the properties of the variable, and tell to which set of numbers the variable belongs.

Another way is to use **interval notation**. With interval notation, you use brackets if an endpoint is included and parentheses if an endpoint is not included. Use ∞ to indicate positive infinity and $-\infty$ to indicate negative infinity.

Example **Describe $x > 18$ using set-builder notation and interval notation.**

The set includes all numbers that are greater than 18 but are not equal to 18.

Set-builder notation: $\{x \mid x > 18, x \in \mathbb{R}\}$

The vertical line | means "such that." The symbol $\in$ means "is an element of." Read the expression as *the set of all x such that x is greater than 18 and x is an element of the set of real numbers.*

Interval notation: $(18, \infty)$

Use parentheses on the left because 18 is not included in the set. Use parentheses with infinity since it never ends.

Exercises

Write each set of numbers in set-builder and interval notation, if possible.

1. $\{17, 18, 19, 20, \ldots\}$

2. $x \leq -2$

3. $x > -8.8$

4. $5 < x < 15$

5. $x < -11$ or $x \geq 1$

6. $\{\ldots, -10, -9, -8, -7\}$

1-1 Study Guide and Intervention *(continued)*

Functions

Identify Functions A **relation** is a rule that relates, or pairs, the elements in set A with the elements in set B. Set A contains the inputs, or the **domain**, and set B contains the outputs, or the **range**. A **function *f*** from set A to set B is a relation that assigns to each element x in set A *exactly one* element y in set B. To evaluate a function, replace the **independent variable** with the given value from the domain and simplify.

Example 1 **Find each function value.**

a. If $f(x) = 4x^3 + 6x^2 + 3x$, find $f(-2)$.

$f(x) = 4x^3 + 6x^2 + 3x$	Original function
$f(-2) = 4(-2)^3 + 6(-2)^2 + 3(-2)$	Substitute -2 for x.
$= -32 + 24 - 6$ or -14	Simplify.

b. If $g(x) = \begin{cases} \sqrt{x} + 1 \text{ if } x \leq 4 \\ 3x \text{ if } 4 < x < 10 \\ 2x^2 - 15 \text{ if } x \geq 10 \end{cases}$**, find $g(6)$ and $g(10)$.**

Look at the "if" statements to see that 6 fits into the second rule, so $g(6) = 3(6)$ or 18.
The value 10 fits into the third rule, so $g(10) = 2(10)^2 - 15$ or 185.

Example 2 **State the domain of $f(x) = \dfrac{3 + x}{x^2 - 6x}$.**

When the denominator of $\dfrac{3 + x}{x^2 - 6x}$ is zero, the expression is undefined.
Solving $x^2 - 6x = 0$, the excluded values in the domain are $x = 0$ and $x = 6$.
The domain is $\{x \mid x \neq 0, 6, x \in \mathbb{R}\}$.

Exercises

Find each function value.

1. If $f(x) = 5x^2 - 4x - 6$, find $f(3)$.

2. If $h(x) = 9x^9 - 4x^4 + 3x - 2$, find $h(t)$.

3. If $g(x) = \begin{cases} x + 45 \text{ if } x \leq -1 \\ 81 - x \text{ if } x > -1 \end{cases}$, find $g(-5)$ and $g(36)$.

4. If $f(x) = \begin{cases} \sqrt{2x} \text{ if } x < 3 \\ 2x + 10 \text{ if } 3 \leq x < 8 \\ 42 \text{ if } x \geq 8 \end{cases}$, find $f(3)$ and $f(8.5)$.