Lesson 10: Representing, Naming, and Evaluating Functions

Classwork

Opening Exercise

Study the representations of a function below. How are these representations alike? How are they different?

TABLE:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Input** |  |  |  |  |  |  |
| **Output** |  |  |  |  |  |  |

FUNCTION: DIAGRAM:

0

1

2

3

4

5

1

2

4

8

16

32

Let such that .

SEQUENCE:

Let for where is an integer.

Exercise 1

Let . Complete the following table using the definition of .

Assign each in to the expression .

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

What are , , , , , and ?

What is the range of ?

Exercise 2

The squaring function is defined as follows:

Let be the function such that , where is the set of all real numbers.

What are , , , , , , , and ?

What is the range of ?

What subset of the real numbers could be used as the domain of the squaring function to create a range with the same output values as the sequence of square numbers from Lesson 9?

Exercise 3

Recall that an equation can either be true or false. Using the function defined by such that , determine whether the equation is true or false for each in the domain of .

|  |  |  |
| --- | --- | --- |
|  | **Is the equation**  **true or false?** | **Justification** |
|  | True | Substitute 0 into the equation.  The on the left side comes from the definition of , and the value of is also 1, so the equation is true. |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

If the domain of were extended to all real numbers, would the equation still be true for each in the domain of ? Explain your thinking.

Exercise 4

Write three different polynomial functions such that .

Exercise 5

The domain and range of this function are not specified. Evaluate the function for several values of . What subset of the real numbers would represent the domain of this function? What subset of the real numbers would represent its range?

Let

Lesson Summary

**Algebraic Function:**  Given an algebraic expression in one variable, an *algebraic function* is a function such that for each real number in the domain , is the value found by substituting the number into all instances of the variable symbol in the algebraic expression and evaluating.

The following notation will be used to define functions going forward. If a domain is not specified, it is assumed to be the set of all real numbers.

For the squaring function, we say Let .

For the exponential function with base , we say Let .

When the domain is limited by the expression or the situation to be a subset of the real numbers, it must be specified when the function is defined.

For the square root function, we say Let for .

To define the first triangular numbers, we say Let for where is an integer.  
  
Depending on the context, one either views the statement “ ” as part of defining the function or as an equation that is true for all in the domain of or as a formula.

Problem Set

1. Let , and let . Find the value of each function for the given input.
   1. j.
   2. k.
   3. l.
   4. m.
   5. n.
   6. o.
   7. p.
   8. q.
   9. r.
2. Since a variable is a placeholder, we can substitute letters that stand for numbers in for . Let , and let , and suppose ,,, and are real numbers. Find the value of each function for the given input.
   1. h.
   2. i.
   3. j.
   4. k.
   5. l.
   6. m.
3. What is the range of each function given below?
   1. Let .
   2. Let .
   3. Let .
   4. Let .
   5. Let such that is a positive integer.
   6. Let for .
4. Provide a suitable domain and range to complete the definition of each function.
   1. Let .
   2. Let .
   3. Let , where is the number of calories in a sandwich containing grams of fat.
   4. Let , where is the number of bacteria at time hours over the course of one day.
5. Let , where and are the set of all real numbers, and and are real numbers.
   1. Find a function such that the equation is not true for all values of and .   
      Justify your reasoning.
   2. Find a function such that equation is true for all values of and .   
      Justify your reasoning.
   3. Let Find a value for and a value for that makes a true number sentence.
6. Given the function whose domain is the set of real numbers, let if is a rational number, and let   
    if is an irrational number.
   1. Explain why is a function.
   2. What is the range of ?
   3. Evaluate for each domain value shown below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

* 1. List three possible solutions to the equation .