|  |  |
| --- | --- |
| **Radical Expressions, Functions, and Modeling (7.1)** | **Math 098** |

, so 3 is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of 9.  
  
, so -3 is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of 9.

*Perfect Squares*

Definition: The number *c* is a square root of *a* if 

Find the square roots of 49.

Definition: The *principle square root* of a nonnegative number is its nonnegative square root. The symbol  is called a *radical sign* and is used to indicate the principal square root of a number over which it appears.  
  
Simplify

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

Definition: Any expression containing radicals is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Let’s graph 

|  |  |  |
| --- | --- | --- |
| Table | Domain | Graph |

Consider the functions  and .

|  |  |
| --- | --- |
| 1. Evaluate | 1. Evaluate |
| 1. What is the domain of *f*? | 1. What is the domain of *g*? |

Evaluate (carefully)

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

Definition: For any real number *a*, . That is, the principal square root of  is the absolute value of *a*.

Simplify

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

Simplify, assuming the variables are non-negative

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

So far we have been strictly interested in squares and square roots. Now let’s broaden our scope.

, so 3 is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of 27.  
  
, so -3 is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of 27.

Definition: The number *c* is the cube root of *a* if . In symbols, we write  to denote the cube root of *a*.

Let’s graph 

|  |  |  |
| --- | --- | --- |
| Table | Domain | Graph |

If , then *b* is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of *a*.

Evaluate

|  |  |  |
| --- | --- | --- |
|  |  | Perfect Cubes |
|  |  |
|  |  |  |

Method: Simplifying *n*th roots

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| Even | Positive | Positive | |*a*| (or *a*) |
| Negative | Not a real number | |*a*| (or -*a*) |
| Odd | Positive | Positive | *a* |
| Negative | Negative | *a* |

Now that we understand radicals, let’s focus on radical functions – functions that can be described by radical expressions.

|  |  |
| --- | --- |
|  | Be very careful when entering roots into your calculator. |

Find the domain of the given functions algebraically, then use the graph to determine the range.

1. 
2. 
3. 
4. 

Determine whether a radical function would be a good model (eye ball the model).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| a.) The following table lists the average size of United States’ farms for various years from 1940 to 2002 | |  | b.) The following table lists the amount of federal funds allotted to the National Cancer Institute for cancer research in the United States from 2003 to 2007. | |
| Year | Average Farm Size (in acres) |  | Year | Funds (in billions) |
| 1940 | 175 |  | 2003 | 4.59 |
| 1960 | 303 |  | 2004 | 4.74 |
| 1980 | 426 |  | 2005 | 4.83 |
| 1997 | 431 |  | 2006 | 4.79 |
| 2002 | 441 |  | 2007 | 4.75 |