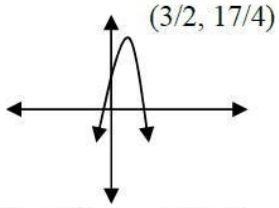
Functions – Finding their Domain and Range.

Domain deals with the acceptable values for the x variable and Range deals with the subsequent values for the y variable. Below are some examples that show some of the various types of problems most students encounter. Mainly two things limit your domain: a fraction, and an even radical. The range is the easiest to determine when looking at a graph of the function. Quadratic Functions

Hint: for the range find the lowest or highest point.

1. $y = -x^2 + 3x + 2$



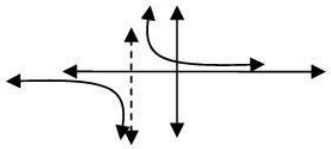
Domain: no limits : $(-\infty,+\infty)$

Range: The y values have a peak but no bottom so the range is $(-\infty, 17/4]$

Rational Functions

Hint: the denominator cannot be zero; thus we set the bottom equal to 0 and solve for x.

2. $y = \dfrac{1}{x+2}$



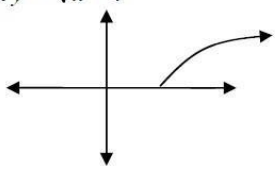
Domain: $(-\infty,-2) \cup (-2,+\infty)$

Range: $(-\infty,0) \cup (0,+\infty)$

Even indexed roots

Hint: these roots have to be greater than or equal to zero if they are not in the denominator.

3. $y = \sqrt[4]{x-4}$

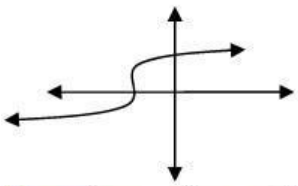


Domain: $[4, +\infty)$

Range: since y never gets less than 0, $[0, +\infty)$

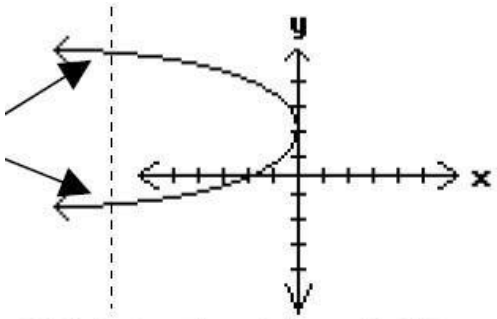
Odd indexed roots No values of x will give undefined values, nor are any values of y not used.
This hold true for any odd index.

4. $y = \sqrt[3]{x+3}$

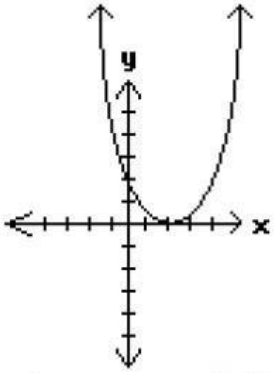


Domain: $(-\infty,+\infty)$
Range: $(-\infty,+\infty)$

Testing whether or not a relation is a function.
A function is a relation where each x value has only one y value. The vertical line test can be used to determine if the graph or a relation is a function. If a vertical line passed through more than one point anywhere on the graph, then it is not a function. See the examples below:



NOT a function: fails vertical line test



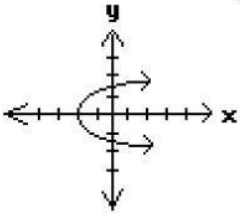
IS a function: passes vertical line test

Test for a Function

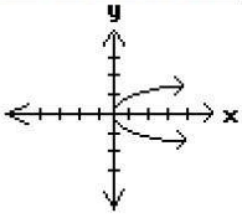
An equation is not a function if there exists:

- A plus or minus symbol on a x expression or
- Even powers of y or
- Y variable expression inside absolute value symbols or • Inequality symbols.

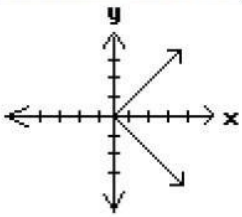
Examples of how each of these 4 cases fail the vertical line test



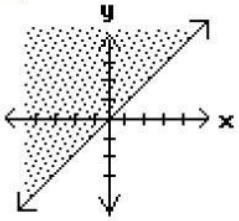
(i) $y = \pm\sqrt{x+2}$



(ii) $x=y^2$



(iii) $x=|y|$



(iv) $y \geq x$

In all other cases the equation is a function.