Domain and Domain Issues

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The *domain of a function* is the set of all first elements of the ordered pairs that constitute the function. Huh?

- A *relation* is a set of ordered pairs: $T = \; -1,3 \;,\; 1,6 \;,\; 3,9 \;,\; x,y \;,\; 1,7$
- A function is a special kind of relation wherein each x or first element is loyal to exactly one y or second element. What pair would we remove in T above to make it a function? (We will call the function T_1.)
- The *domain of a function* is the set of all first elements from each ordered pair that comprise the function. For T_1 above, domain = $-1,\ 1,\ 3,\ x$

The domain of a function is usually chosen from the set of real numbers. Unless the function involves one of the three issues that follow, the domain **is** the set of real numbers. This set is commonly designated by the letter $\mathfrak{R}$.

The three issues are:

1. Division by zero is not allowed; denominators must not equal zero.

Because the denominator of $\dfrac{7x}{x^2-16}$ includes a variable, the denominator might equal zero.

We prevent this by writing $x^2-16 \neq 0$, so $x^2 \neq 16$, and $x \neq \pm 4$

So the domain statement is, "x can be any real number except ± 4"

In less plain English, "x is an element of the set $\mathfrak{R}$ so that $x \neq \pm 4$"

Also, the domain is the set of all x in $\mathfrak{R}$ so that $x \neq \pm 4$.

In symbols, the domain = $x \in \mathfrak{R} \mid x \neq \pm 4$

2. Square roots of negative numbers are not allowed. For $\sqrt{n}$, n must be greater than or equal to zero.

For $\sqrt{1-x}$, $1-x$ must be greater than or equal to zero.

$1-x \geq 0$

$-x \geq -1$. domain = $x \in \mathfrak{R} \mid x \leq 1$

$x \leq 1$

3. Logarithms only exist for positive numbers. For $\log_b n$, $n > 0$.

For $\log_b \; 2y+10$, $2y+10>0$, so $y>-5$. Domain: $y \in \mathfrak{R} \mid y > -5$

Again, domain is $\mathfrak{R}$ unless you see variables (a) in denominators, (b) inside square roots symbols, or (c) in logarithm arguments. Then DO THE WORK.