**Finding the Domain**

**Definition of Domain:** For any equation, the values of \( x \) make up the domain (it's what \( x \) can be).

**Examples:** If \( g(x) = \{(3.5), (-2.7), (8,0)\} \) the \( x \) values make up the domain so \( \{3,-2,8\} \) is the domain of \( g \).

**EXAMPLES ON HOW TO FIND THE DOMAIN:**

1. **Radicals of even root:** The radicand can never be negative so to find what \( x \) can be, set the radicand to \( \geq 0 \).

   \[
   \begin{align*}
   y &= \sqrt{x-4} \\
   x - 4 &\geq 0 \\
   x &\geq 4 \\
   \text{domain is } [4, \infty)
   \end{align*}
   \]

   \[
   \begin{align*}
   y &= \sqrt{x^2 + 7x + 12} \\
   x^2 + 7x + 12 &\geq 0 \\
   (x + 3)(x + 4) &\geq 0 \\
   \text{domain is } (-\infty,-4] \cup [-3, \infty)
   \end{align*}
   \]

2. **Fractions:** (With a variable in denominator) the denominator can never equal zero, so set the denominator to zero to find what \( x \) can't be.

   \[
   \begin{align*}
   f(x) &= \frac{3x+1}{x-2} \\
   x - 2 &= 0 \\
   x &= 2 \\
   \text{domain is all } \#s \text{ except } 2 \\
   \text{the interval is } (-\infty,2) \cup (2, \infty)
   \end{align*}
   \]

   \[
   \begin{align*}
   g(x) &= \frac{4}{x^2 - 9} \\
   x^2 - 9 &= 0 \\
   (x - 3)(x + 3) &= 0 \\
   x &= 3 \text{ or } x = -3 \\
   \text{domain is all } \#s \text{ except } -3 \text{ and } 3 \\
   \text{the interval is } (-\infty,-3) \cup (-3,3) \cup (3, \infty)
   \end{align*}
   \]

3. The domain is \( (-\infty, \infty) \) in the following examples:

   a) any linear equation such as \( f(x) = 3x + 7 \)
   b) any polynomial such as \( y = x^2 + 2x - 3 \)
   c) where \( x \) is within the absolute value bars such as \( y = | -3x + 7 | \)
   d) if either variable is under a radical with an odd root such as \( y = \sqrt[3]{x - 6} \)
   e) if either variable is to an odd exponent such as \( y^3 = x + 4 \) or \( y = x^5 \)
   f) if it is an inequality such as \( y > x + 8 \)