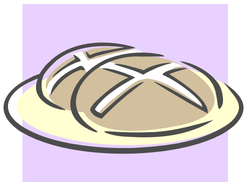
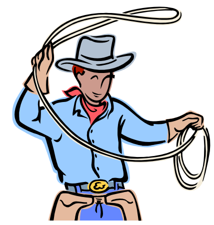
Domain and Range

Domain and range relate to *x* values and *y* values, respectively. The words are in alphabetical order, just like x and y are.



You might remember **domain** (*x*) as in *dough* – like hot crossed (*x*) buns.

You might remember **range** (*y*) as in *cowboy on the range.*

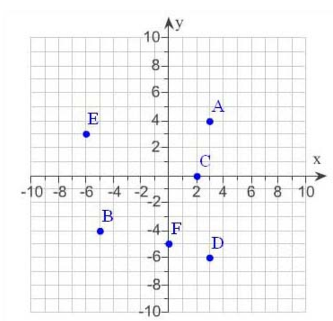


How to identify domain (*x*) and range (*y*):

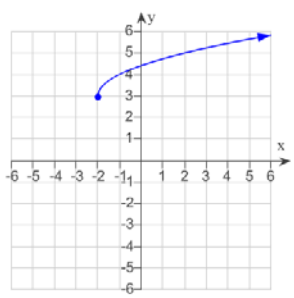
From ordered pairs: The domain is the x values & range is the y values. (list them from low to high, and write repeated values only once)

$\{(1,4)(2,3)(5,1)(3,2)\}$ **Domain:** $\{x \mid x = 1, 2, 3, 5\}$
Range: $\{y \mid y = 1, 2, 3, 4\}$

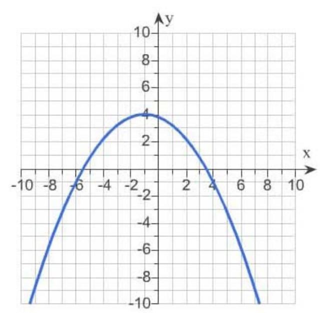
From a graph: For the domain (*x* values), mark/darken the part(s) of the *x*-*a*cess used and identify, from left to right, what values are included. For the range (*y* values), do the same along the *y-axis*, and identify from bottom to top, what values are included. Learn to identify domain and range from points, segments/vectors, and continuous lines.



Points
$\{x \mid x = -6, -5, 0, 2, 3\}$
$\{y \mid y = -6, -5, -4, 0, 3, 4\}$



Segment/vectors
$\{x \mid x \geq -2\}$
$\{y \mid y \geq 3\}$



Continuous line
$\{x \mid x$ is a real number$\}$
$\{y \mid y \leq 4\}$

From an equation: Begin with the idea that *x* or *y* can be anything ("all real numbers") and then look for anything they can't be (limits). In early algebra, the domain and range of many equations will *be* {x | x is a real number} and {y | y is a real number}. (The domain and range of inequalities will be evident)

Common limits:

- Fractions: The denominator cannot equal 0. Find those values.
- Even numbered exponents: There will be a maximum limit to the range, such as in the continuous line graph above.
- Even numbered roots: The value within the radical cannot be negative, so there will be a limit to the domain, and in many cases to the range as well.

How to write domain (*x*) and range (*y*) in set notation:

From ordered pairs: List x values from negative to positive{x | x = __, __, __}
Do the same for the y values.

From a graph: Identify the type of information on the graph:
Points: Identify x values from negative to positive and list: {x | x = __, __, __}
Segment: Identify the beginning and end points, note if the end points are included, and write in ___ $\le x \le$ ___ (or use < if not included). I call this "between" notation.
Vector: If the vector points positively, write x $\ge$ ___ or x > ___. If the vector points negatively, write x $\le$ ___ or x < ___.
Continuous line: If you would be shading the entire axis, then "x is a real number." If there is a limit, then write it similar to the vector notation.

*** Use the same method for range, but use "y" rather than x.**
** If there are breaks in the domain or range, then union notation is needed.

From an equation: Begin with the idea of {x | x is a real number} (same for y) and then look for limits. Depending on the type of limit, you might use exclusions ($\ne$) or use inequality signs (<, $\le$, >, $\ge$).

Common limits:

- Fractions: e.g. $y = \frac{7}{x+4}$ Domain: {x | x is a real number, and x $\ne -4$}
  Range: {y | y is a real number}

- Even numbered exponents:
  e.g. $y = x^2 - 4x + 4$ Domain {x | x is a real number}
  Range {y | y $\ge$ 2}

- Even numbered roots:
  e.g. $y = \sqrt{x}$ Domain {x | x $\ge$ 0}
  Range {y | y $\ge$ 0}

How to write domain (*x*) in interval notation:

First, remember that <, >, -∞, ∞ use ( ) and $\le$, $\ge$ use [ ].
Look at your graph or equation. Interval notation for "all real numbers" is (-∞, ∞).
Otherwise:

- For *x* < __ use (-∞, __) For x > __ use (__, ∞)
- For x $\le$ __ use (-∞, __] For x $\ge$ __ use [__, ∞)
- For __ < x < __ use (__, __) For __ $\le$ x $\le$ __ use [__, __]

** these can be mixed, and so could be (__, __] or [__, __)