St. Peter Catholic High School
MCR3U
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§1.4 Determining Domain and Range

When looking at a graph, the domain is simply the set of values for which there are existing x values. Likewise, the range is simply the set of existing f(x) values.

Once you know all the x values that exist you write a domain statement that reads:

$\{x \in R | x > 6\}$

In this case, it reads "x is an element ($\in$) of all Real (R) numbers such that (|) x is greater than 6".

$\{x \in N\}$

In this case, it reads "x is an element of all Natural numbers".

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Likewise when writing a range statement you write:

$\{f(x) \in W | x \neq 14\}$

In this case, it reads "f(x) is an element ($\in$) of all Whole (W) numbers such that (|) x cannot equal 14".

$\{f(x) \in R | f(x) < 0\}$

In this case, it reads "f(x) is an element of all real numbers such that f(x) is less than 0".

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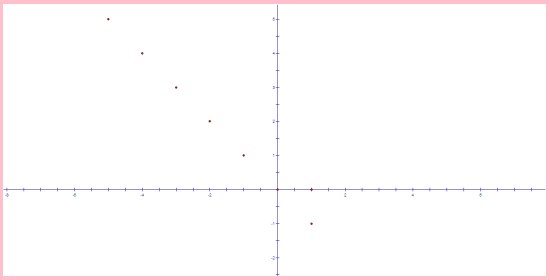
Example: Find the domain and range. Is this a function?



In this example, we only have points, so the domain statement will read $\{x \in I | -5 \leq x \leq 1\}$. The range statement will similarly read $\{f(x) \in I | -1 \leq x \leq 5\}$. This is a function.

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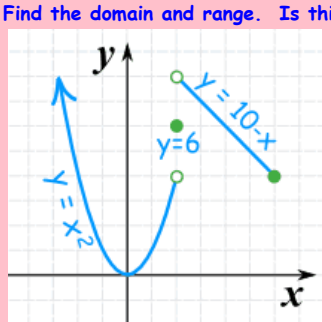
Example: Find the domain and range. Is this a function?



In this example, we have a piecewise function. The domain statement will read $\{x \in R | -\infty \leq x \leq 6\}$. The range statement will read $\{f(x) \in R | f(x) \geq 0\}$. This is a function due to vertical line test.

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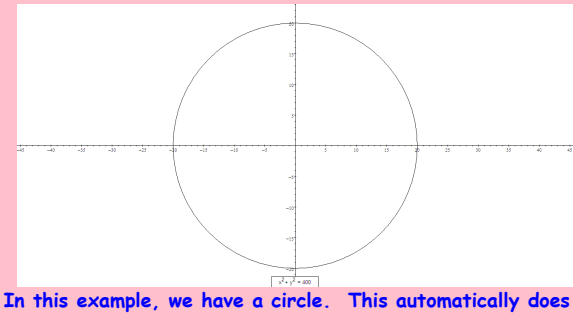
Example: Find the domain and range. Is this a function?



In this example, we have a circle. This automatically does not pass the vertical line test; therefore, it is a relation but not a function. The domain statement will read $\{x \in R | -20 \leq x \leq 20\}$. The range statement will read $\{f(x) \in R | -20 \leq f(x) \leq 20\}$.

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Example: Determine the domain and ranges from the following equations:

a) $f(x) = 4x - 7$

b) $g(x) = -2(x-4)^2 + 3$

c) $h(x) = (5-x)^{½}$

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Solution a) $f(x) = 4x - 7$

The domain will be $\{x \in R\}$ and the range will be $\{f(x) \in R\}$ because this is a linear function. There are no restrictions on either x or f(x).

Solution b) $g(x) = -2(x-4)^2 + 3$

The domain will be $\{x \in R\}$ and the range will be $\{f(x) \in R | x \leq 3\}$ because this is a quadratic function. There are no restrictions on either x but since the vertex is at (4,3) and the parabola opens downwards, $f(x) \leq 3$.

Solution c) $h(x) = (5-x)^{½}$

The domain will be $\{x \in R | x \leq 5\}$ and the range will be $\{f(x) \in R | x \geq 0\}$ because this is a square root function. Since square roots cannot have negative input values, x cannot exceed 5. Ergo, the range values will always be either zero or positive.

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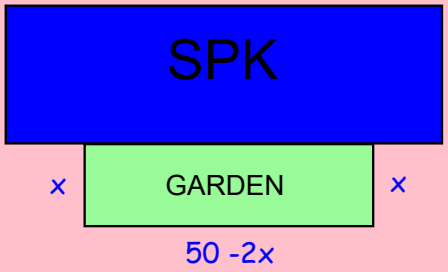
The SPK gardening club is building a fence around their garden which is adjacent to one of the school's exterior walls. They have been allotted 50 m of fencing to complete this task.

a) Express the area of the garden as a function of its width.

b) Determine the domain and range of the area function.



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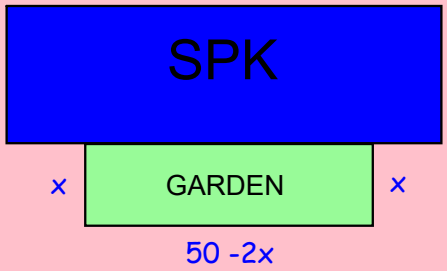
Solution: a) Express the area of the garden as a function of its width.

$A(w) = lw$

$A(w) = w(50-2w)$

$A = 50w - 2w^2$



Solution: b) Determine the domain and range of the area function.

Domain Statement: $\{w \in R | 0 < w < 25\}$

Range Statement: $\{A(w) \in R | 0 < A(w) < 312.5\}$

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There are times when theoretical mathematics needs to take a break and we must allow for reality to set in. In this case, the domain and range function must take reality in consideration despite the function that we have. The consequence would be that we would get a zero area value? or negative width values?

Hence, we know that the domain must be greater than zero and the maximum width would be less than 25m; ergo the domain.

Likewise, our range (the area) must be greater than zero but must be less than the optimal width. Recall that this is a parabola so the maximum will be between the two zeros (0 and 25), hence 12.5. The area with a width of 12.5 is 312.5, hence the domain.

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HOMEWORK: §1.4#1-3,5,9,15,16

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