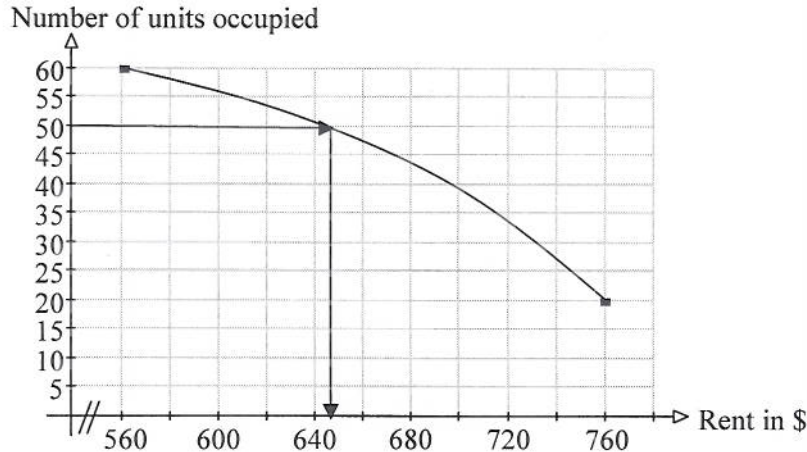


**MAT 012 Review/Lec. Notes Ch 3.6 & 7.1 (1<sup>st</sup> & 2<sup>nd</sup> page): Introduction to Functions**

Look to the right from  $y = 50$  until you hit the graph, then down to the  $x$ -axis.



If 50 units are occupied, the rent is about \$645 per unit.

**To find an  $x$ -value for a given  $y$ -value** using a graph located in the first quadrant: Move right from the given  $y$ -value on the  $y$ -axis to the graph and then down to the  $x$ -axis (over and down).

**END OF REVIEW**

\*\*\*\*\*

**MAT 012 LEC. NOTES Ch 3.6 & 7.1(1<sup>st</sup> and 2<sup>nd</sup> page): Introduction to Functions**

**Function:** Relationship of two variables. For every value of the first variable there is only one corresponding value of the second variable.

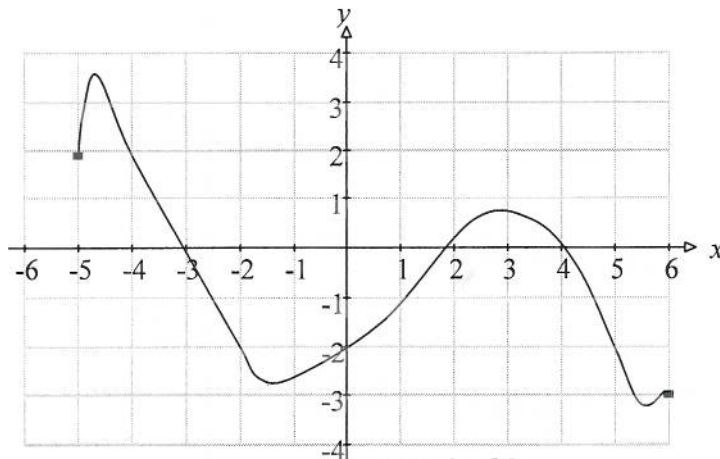
**Function “name” and function notation:**

A function can be named with the dependent variable name or expressed in function notation. In Algebra classes we usually use the dependent variable  $y$  or  $f(x)$  (Read: “ $f$  of  $x$ ”) to represent the function.  $f(x)$  is preferred by mathematicians, because it addresses the independent variable in the “name.”

For example,  $f(x) = 3x - 7$  is the same as writing  $y = 3x - 7$ . Every value  $x$  has a value of  $y$  assigned to it.

**Reading function values from a graph:**

*Example:* Give specific values for the following function graph below:



- a)  $f(6) = -3$
- b)  $f(0) = -2$
- c)  $f(-4) = 2$
- d)  $f(4) = 0$
- e) Give all values of  $x$  for which  $f(x) = -2$

$x = -2, x = 0, x = 5$

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## Evaluating Functions

Example: Let  $f(x) = 3x^2 - x - 18$ , evaluate  $f(-2)$

$$f(-2) = 3(-2)^2 - (-2) - 18 = 3 \cdot 4 + 2 - 18 = 12 + 2 - 18 = -4$$

Example: Let  $H(t) = -t^2 + 7t - 3$

Evaluate  $H(1) = -1^2 + 7 \cdot 1 - 3 = -1 + 7 - 3 = 3$

$$H(0) = \underbrace{-0^2 + 7 \cdot 0}_{\text{optional}} - 3 = -3$$

$$H(-3) = -(-3)^2 + 7(-3) - 3 = -9 - 21 - 3 = -33$$

Example: Let  $f(x) = x^2 - 5x + 9$

Find  $f(a-1)$  and simplify

$$\begin{aligned} f(a-1) &= (a-1)^2 - 5(a-1) + 9 \\ &= (a-1)(a-1) - 5a + 5 + 9 \\ &= a^2 - a - a + 1 - 5a + 14 \\ &= a^2 - 7a + 15 \end{aligned}$$

Example: Let  $f(x) = -x^2 + 4x - 3$

Find  $f(a-1)$  and simplify

$$\begin{aligned} f(a-1) &= -(a-1)^2 + 4(a-1) - 3 \\ &= -((a-1)(a-1)) + 4a - 4 - 3 \\ &= -(a^2 - a - a + 1) + 4a - 7 \\ &= -(a^2 - 2a + 1) + 4a - 7 \\ &= -a^2 + 2a - 1 + 4a - 7 \\ &= -a^2 + 6a - 8 \end{aligned}$$

## MAT 012 Review/Lec. Notes Ch 3.6 & 7.1 (1<sup>st</sup> & 2<sup>nd</sup> page): Introduction to Functions

Example: Let  $f(x) = \frac{x-1}{x+3}$ .  $x \neq -3$

If defined, evaluate  $f(-2)$ ,  $f(-3)$ , and  $f(0)$ . If the function is not defined for this value  $x$ , say so.

$$f(-2) = \frac{-2-1}{-2+3} = \frac{-3}{1} = -3$$

$f(-3)$  is undefined

$$f(0) = \frac{0-1}{0+3} = -\frac{1}{3}$$

### Domain and Range

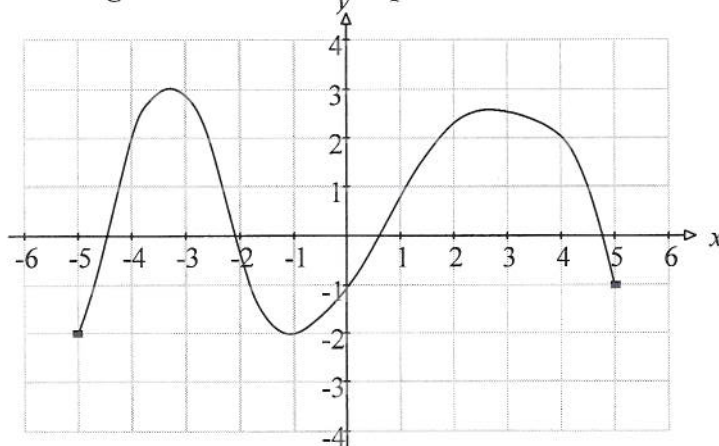
**Domain:** The domain of a function is the set of values for which the independent variable  $x$  is defined. (In some applied problems the domain may have to be restricted to a smaller interval.)

**Range:** The range of a function consists of the values of the dependent variable  $y$  that correspond to the values in the domain, i.e. which outputs are created by the  $x$ -values?

The domain of a function can be found by looking at the graph or the function equation. The **range** is best found looking at the graph. The intervals for domain and range must span the values that are used in the graph. Never make a domain or a range smaller than the given values.

### Domain and Range from a Given Graph

Example:



Domain:  $\{x \mid -5 \leq x \leq 5\}$  same as  $-5 \leq x \leq 5$

same as  $[-5, 5]$

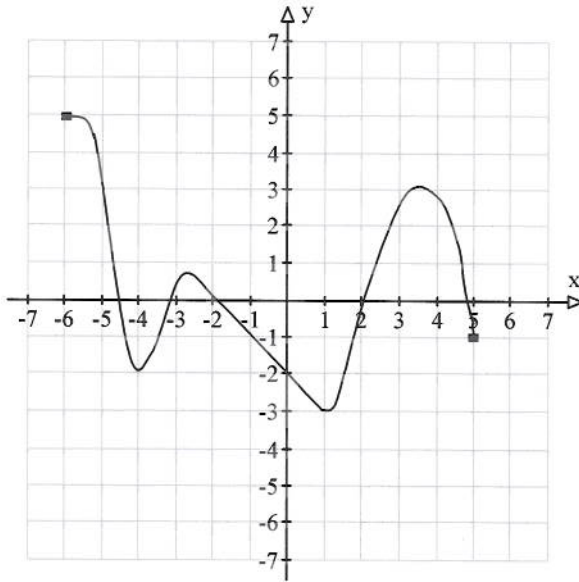
Range:  $\{y \mid -2 \leq y \leq 3\}$  same as  $-2 \leq y \leq 3$

same as  $[-2, 3]$

also o.k. not to not include 3:  $-2 \leq y < 3$   
also o.k.  $[-2, 3)$

# MAT 012 Review/Lec. Notes Ch 3.6 & 7.1 (1<sup>st</sup> & 2<sup>nd</sup> page): Introduction to Functions

Example:



Domain:  $\{x \mid -6 \leq x \leq 5\}$

same as  $-6 \leq x \leq 5$

same as  $[-6, 5]$

Range:  $\{y \mid -3 \leq y \leq 5\}$

same as  $-3 \leq y \leq 5$

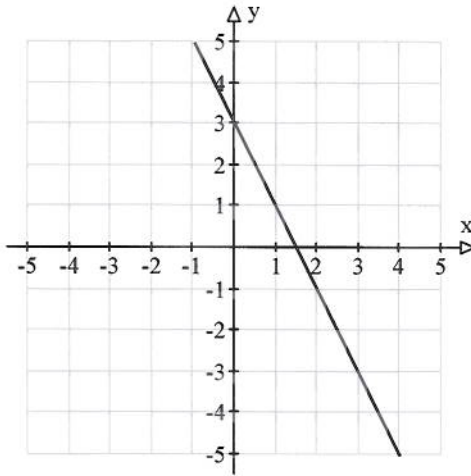
same as  $[-3, 5]$

Also o.k. to not include -3

$-3 < y \leq 5$

same as  $(-3, 5]$

Example: For the graph of  $g(x) = -2x + 3$  shown below, give the domain and range.



Domain:  $\mathbb{R}$

same as: All real numbers

same as:  $(-\infty, \infty)$

Range:  $\mathbb{R}$

same as: All real numbers

same as  $(-\infty, \infty)$

## Exclude values from the domain for which the function is undefined

The **domain** of a function can also be found by examining the equation and excluding all  $x$  values for which  $f(x)$  would be undefined.

Example: Let  $f(x) = \frac{x-1}{x+3}$ . Give the domain

Domain: All real numbers except -3

better:  $\mathbb{R}$  but  $x \neq -3$

Example: Let  $h(x) = \frac{5-x}{3x-7}$ . Give the domain.

$$\begin{array}{r} 3x - 7 \neq 0 \\ +7 \quad +7 \\ \hline 3x \neq 7 \\ \frac{3x}{3} \neq \frac{7}{3} \end{array}$$

$x \neq \frac{7}{3}$

Domain: All real numbers except  $\frac{7}{3}$

better:  $\mathbb{R}$  but  $x \neq \frac{7}{3}$



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Example: Let  $f(x) = \frac{x-6}{x^2+5x}$ . Give the domain.

$$f(x) = \frac{x-6}{x^2+5x} = \frac{x-6}{x(x+5)}$$

$$x \neq 0, x \neq -5$$

Domain: All real numbers except -5 and 0  
 better:  $\mathbb{R}$  but  $x \neq -5, x \neq 0$

## Vertical line test

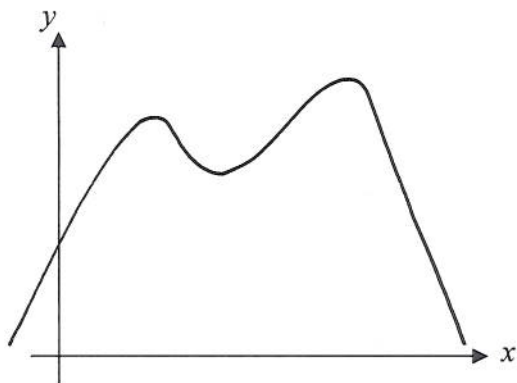
If it is possible for a vertical line to cross the graph more than once, then the graph is **not** the graph of a function.

In other words:

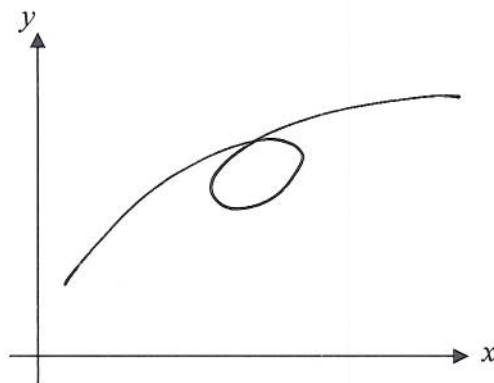
If all possible vertical lines only intersect the graph at most once, then the graph represents a function.

Examples:

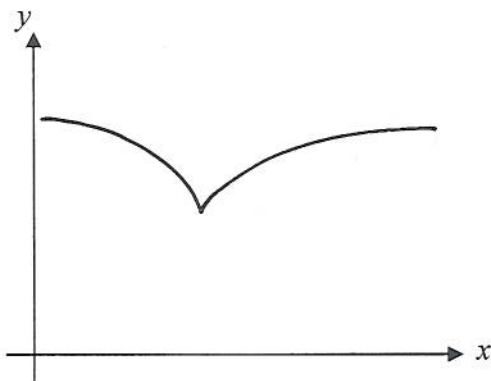
Determine whether this graph is the graph of a function. Use the vertical line test.



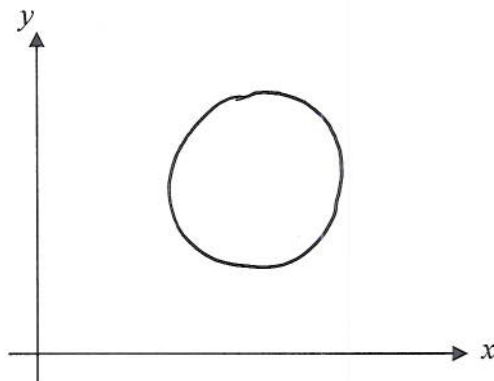
This graph passes the vertical line test. It is a function



This graph does NOT pass the vertical line test. It is not a function



yes, this is a function



No, not a function