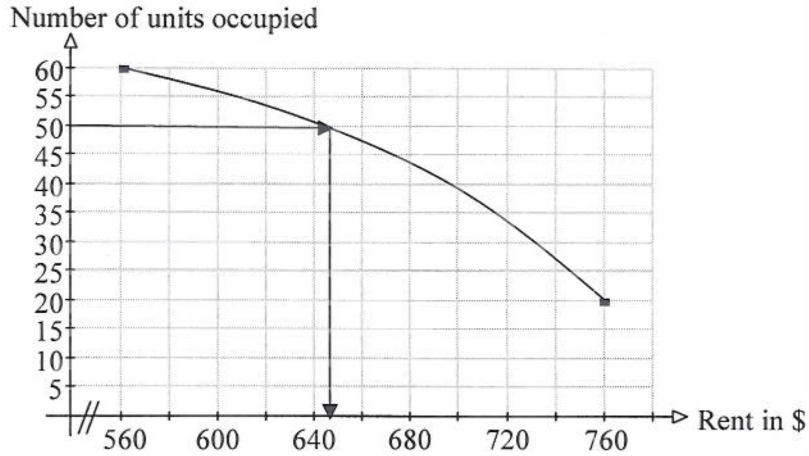
Completed

MAT 012 Review/Lec. Notes Ch 3.6 & 7.1 (1st & 2nd 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

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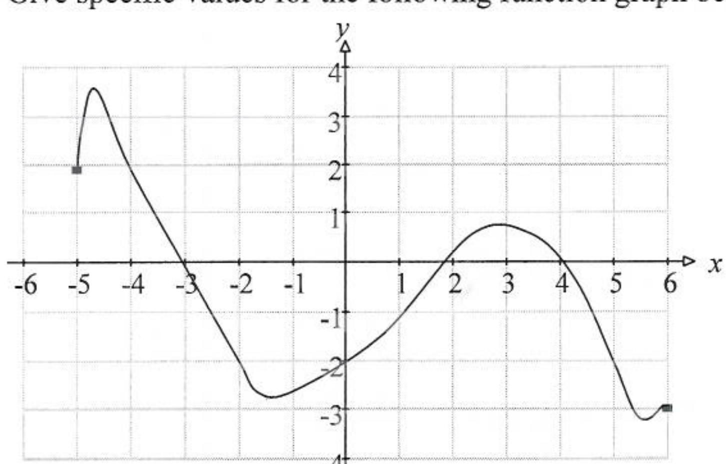
Function: Relationship of two variables. For every value of the first variable there is only one corresponding value of the second variable.

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

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

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

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

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

$f(-3)$ is undefined

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

Domain and Range

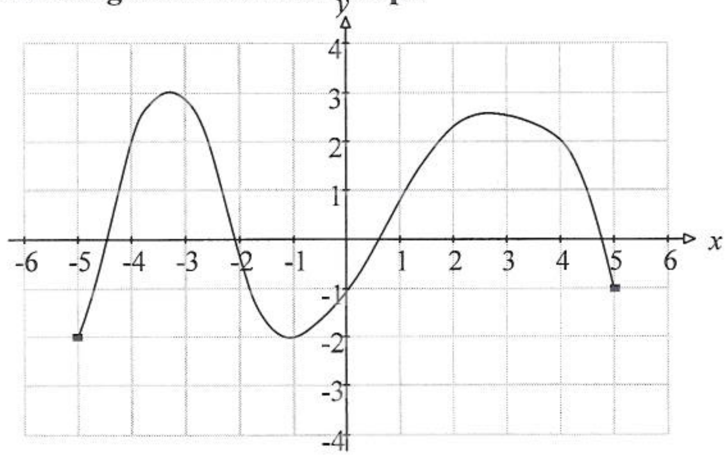
Domain: The domain of a function is the set of values for which the independent variable x is defined. (In some applied problems the domain may have to be restricted to a smaller interval.)

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: $\{x \mid -5 \le x \le 5\}$ same as $-5 \le x \le 5$

same as $[-5, 5]$

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

same as $[-2, 3]$

. also o.k not to not include 3 : $-2 \le y < 3$

also o.k. $[-2, 3)$

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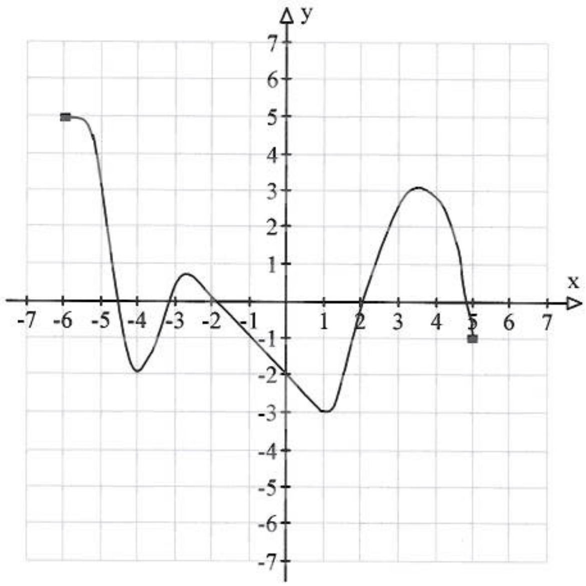
Example:



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

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

same as $[-6, 5]$

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

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

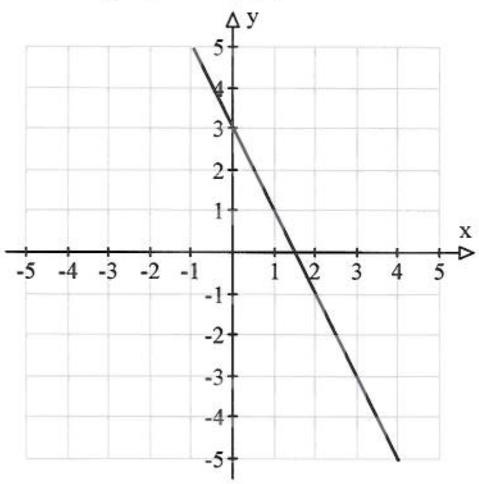
same as $[-3, 5]$

Also o.k. to not include -3

$-3 < y \le 5$

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 $f(x) = \dfrac{x-1}{x+3}$. Give the domain

Domain: All real numbers except -3

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

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

$$\begin{aligned} 3x - 7 &\ne 0 \\ +7 \quad & \quad +7 \\ \hline \frac{3x}{3} &\ne \frac{7}{3} \\ x &\ne \frac{7}{3} \end{aligned}$$

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

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

Completed

Example: Let $f(x)=\dfrac{x-6}{x^2+5x}$. 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 $x \neq -5,\ x \neq 0$

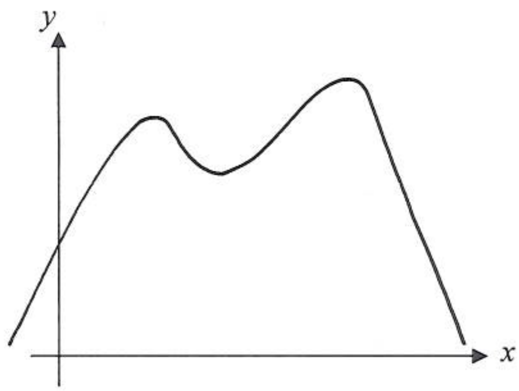
Vertical line test

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.

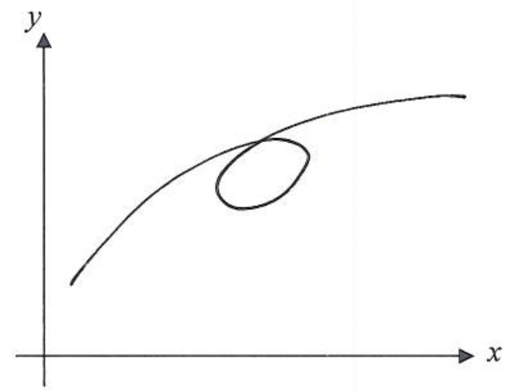
In other words:

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

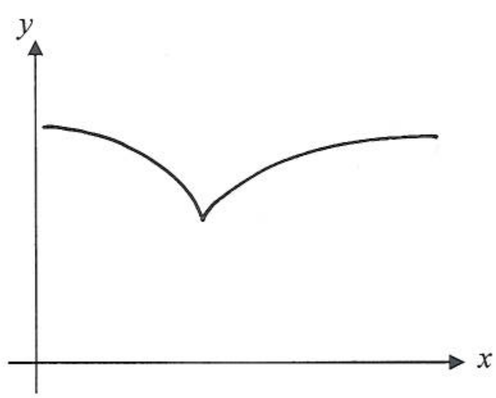
Examples:
Determine whether this graph is the graph of a function. Use the vertical line test.



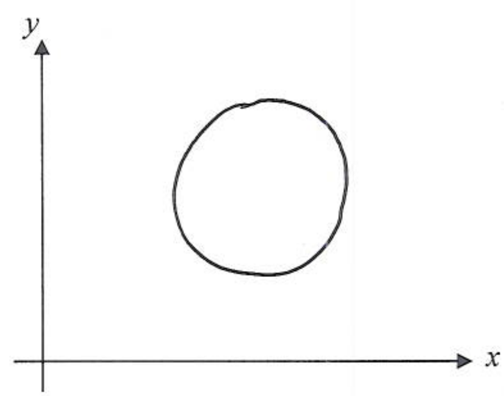
This graph passes the vertical line test. It is a function



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



yes, this is a function



No, not a function