1-3 Graphs of Functions

What will you learn?

- To find the Domain and Range of functions
- To use Vertical Line Test for function
- To determine intervals on which functions are
  - incresing
  - decreasing
  - constant
- To determine relative maximum and relative minimum values of functions
- To identify and graph step functions and other piecewise-defined functions
- To identify even and odd functions

The graph of a function *f* is the collection of ordered pairs

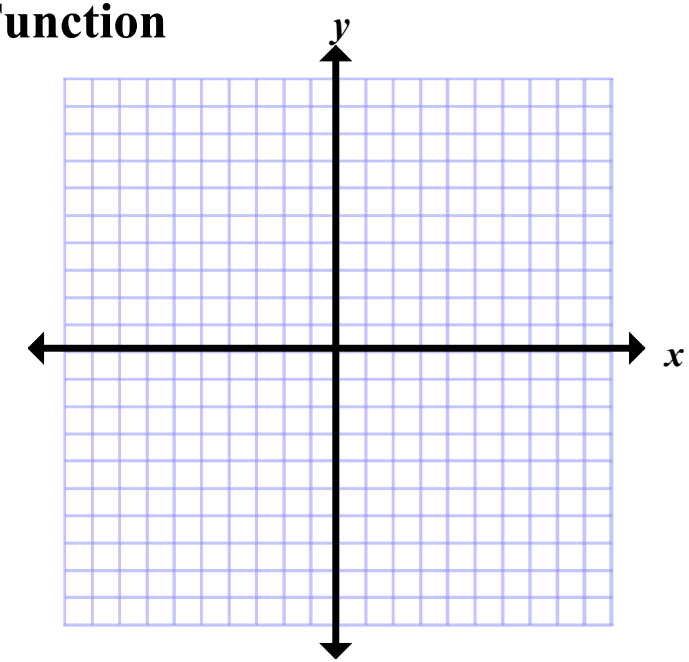
(*x*, *f(x)*)

such that *x* is the domain of *f*

***x* = distance from the *y*-axis**

***f(x)* = distance from the *x*-axis**

Example 1 - Finding the Domain and Range of a Function



a.) find the Domain of *f*

b.) find *f (- 1)* and *f (2)*

c.) find the Range of *f*

See p. 38; exercise 3

Example 2 - Finding the the Domain and Range of a Function

Find the domain and range of

$$f(x) = \sqrt{x - 4}$$

Algebraic

Graphical

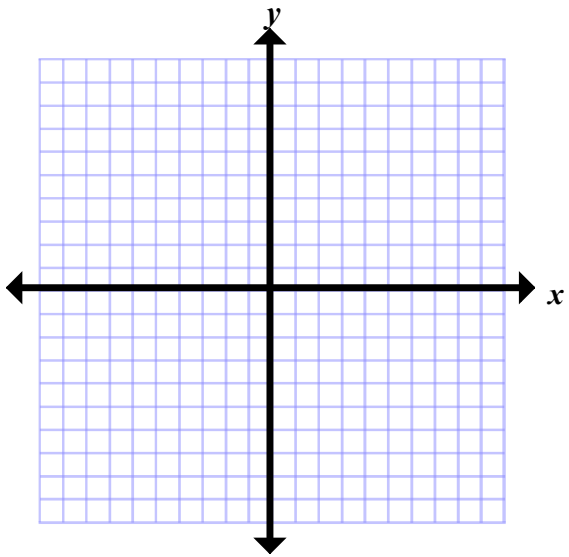
See p. 38; exercise 7

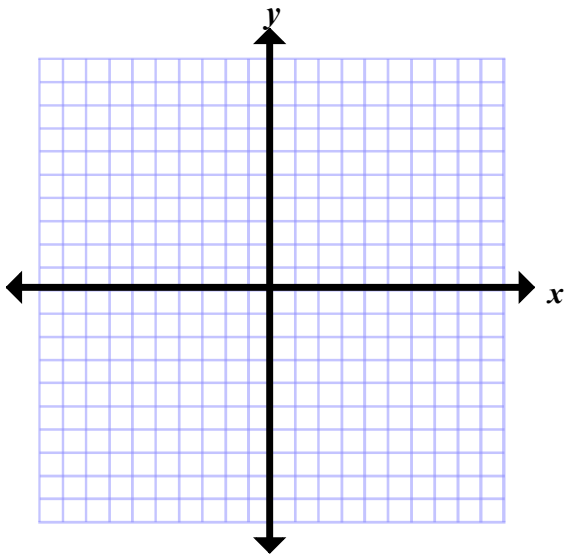
Vertical Line Test

A set of points in a coordinate plane is the graph of *y* as a function of *x* if and oly if no vertical ine intersects the graph at more than one point.

Example 3 - Vertical Line Test for Functions

Use the verical line test to decide whether the graphs represent *y* as a function of *x*





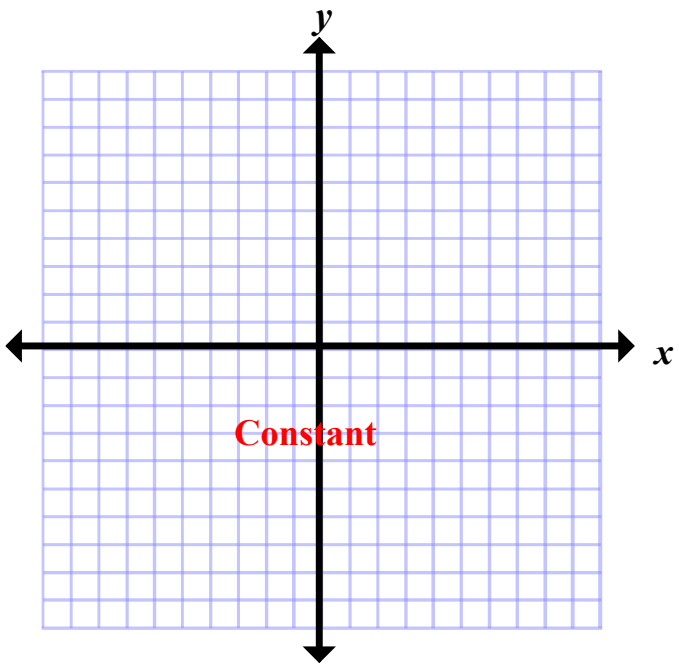
See. p. 38; exercise 13

Increasing and Decreasing Functions

- **Increasing** :

- **Decreasing** :

- **Constant** :

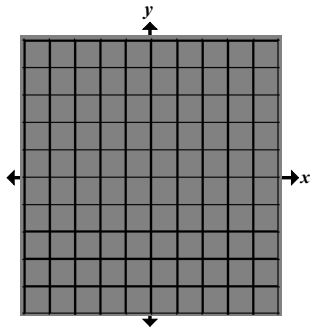


Decreasing

Example 4 - Increasing and Decreasing Functions

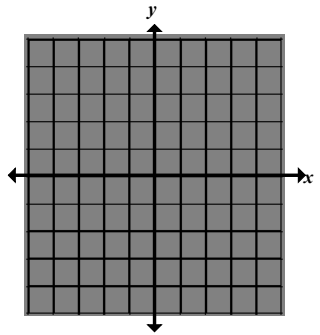
Determine the open intervals on which each function is increasing, decreasing or constant

a.) $f(x) = x3$



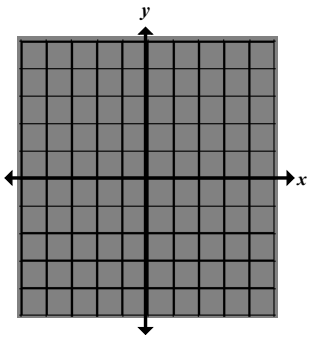
---

b.) $f(x) = x3 - 3x$



---

c.) $f(x) = \begin{cases} x + 1, & x < 0 \\ 1, & 0 \le x \le 2 \\ -x + 3, & x > 2 \end{cases}$



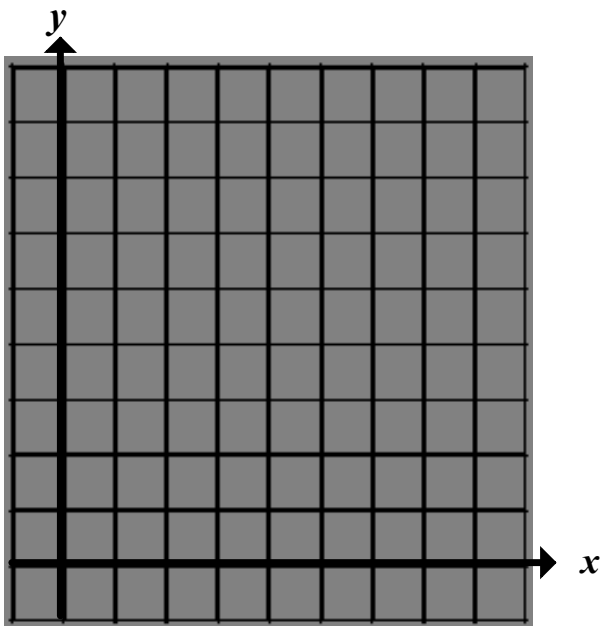
See p. 39; exercise 19

Relative Minimum and Maximum Values

The points at which a function changes its increasing, decreasing of constant behavior are helpful in determining relative maximum orrelative minimum values

- **A function value $f(a)$ is a Relaive Minimum of f if**

- **A function value $f(a)$ is a Relaive Maximum of f if**

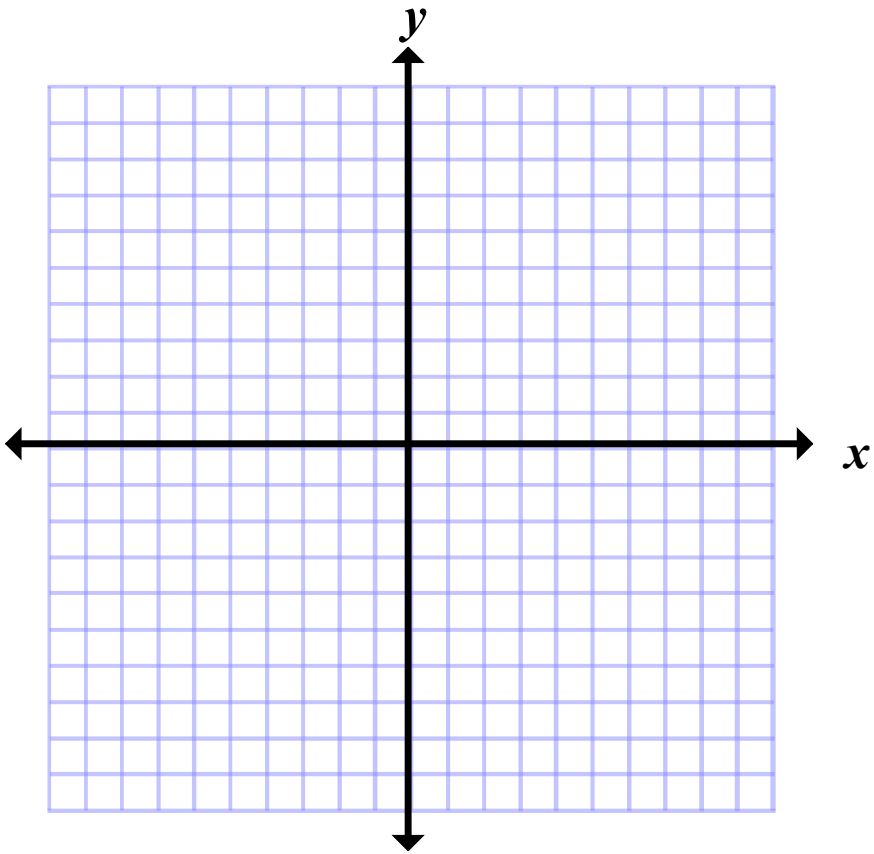


Example 5 - Approximating a Relative Minimum

Use a graphing utility to approximate the relative minimum of the function :

$$f(x) = 3x2 - 4x - 2$$

(Use zoom and trace features)



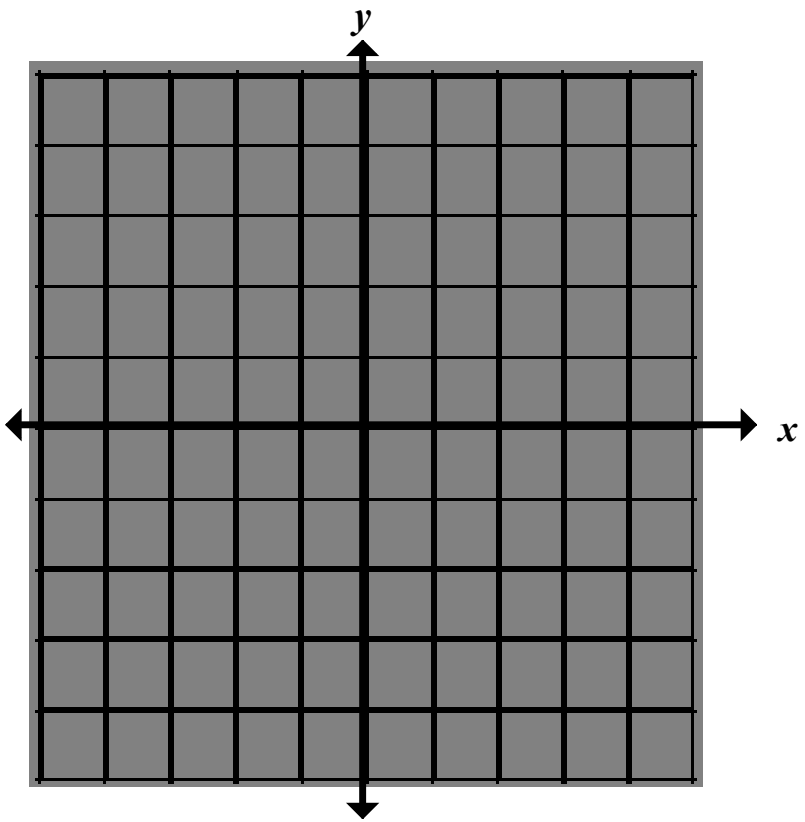
See p. 39; exercise 29

Example 6 - Approximating Relative Maxima and Minima

Use a graphing utility to approximate the relative minimum and relative maximum of the function:

$$f(x) = -x3 + x$$

Use zoom and trace features
or
minimum and maximum features



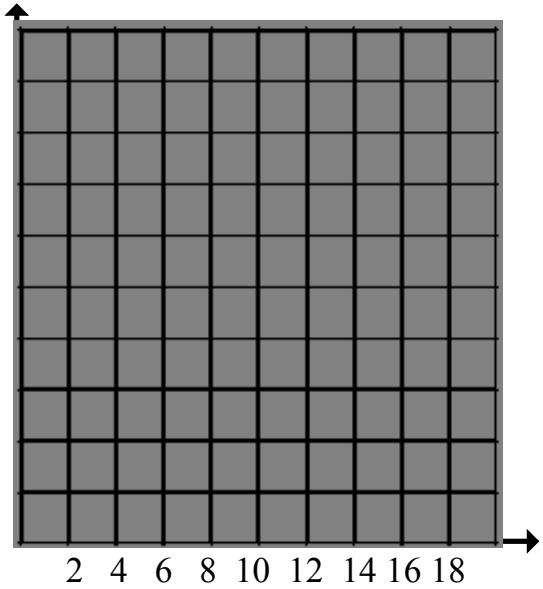
See p. 39; exercise 31

Example 7 - Temperature

During a 24-hour period, the temperature y (in degrees Fahrenheit) of a certain city can be approximated by the model

$$y = 0.026x^3 - 1.03x^2 + 10.2x + 34$$

where x represents the time of day, with $x = 0$ corresponding to 6:00 a.m. Approximate the maximum and minimum temperatures during the 24-hour period.



Use zoom and trace
or
maximum and minimum features

See p. 40; exercise 87

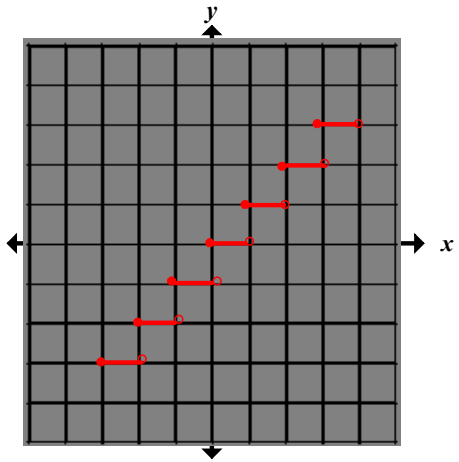
Graphing Step Functions & Peicewise-Defined Functions

Step Function : Greatest Integer Function

$[\![x]\!]$ →

Use *dot mode* on graphing calc.

$f(x) = [\![x]\!]$



Domain:

Range :

x - intercepts:

y - intercept:

Behavior :

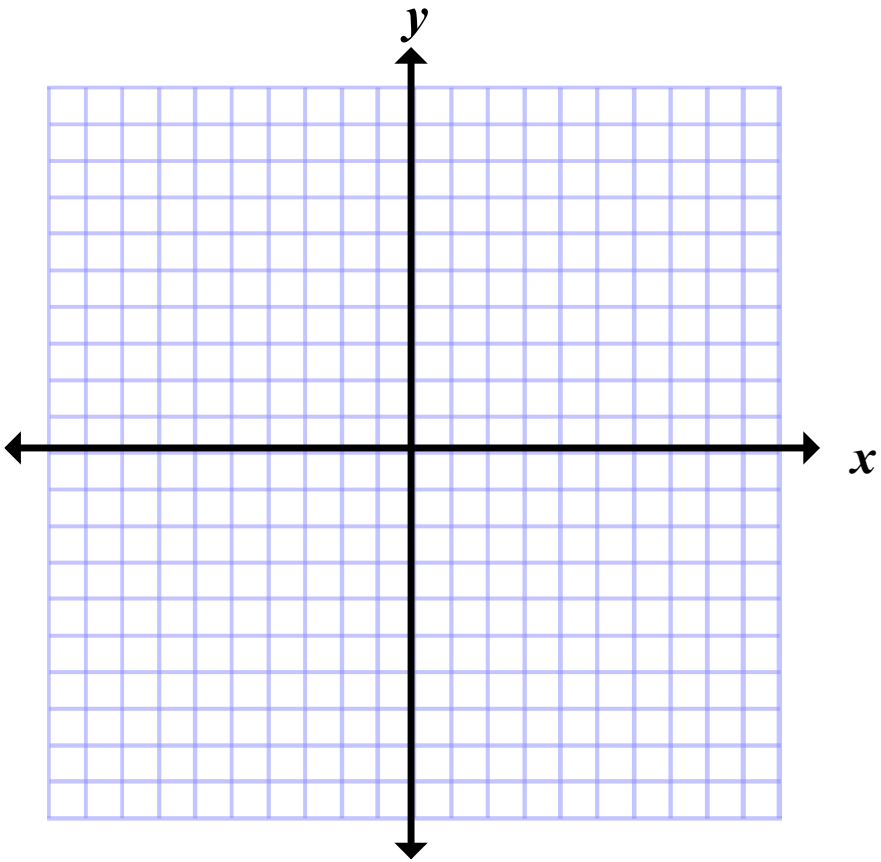
$[\![-1]\!]$

$[\![\frac{1}{10}]\!]$

$[\![1.5]\!]$

Example 8 - Graphing a Piecewise-Defined Function

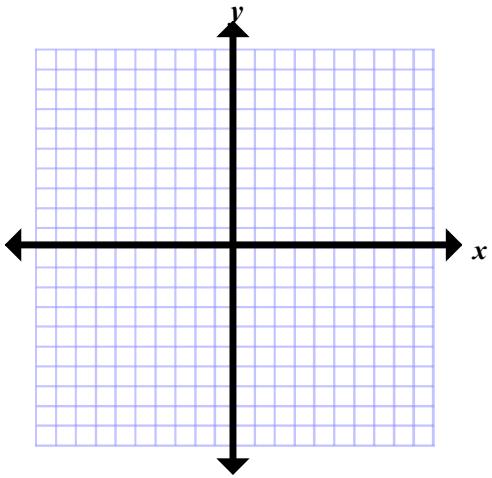
Sketch the graph of $f(x) = \begin{cases} 2x + 3, & x \leq 1 \\ -x + 4, & x > 1 \end{cases}$



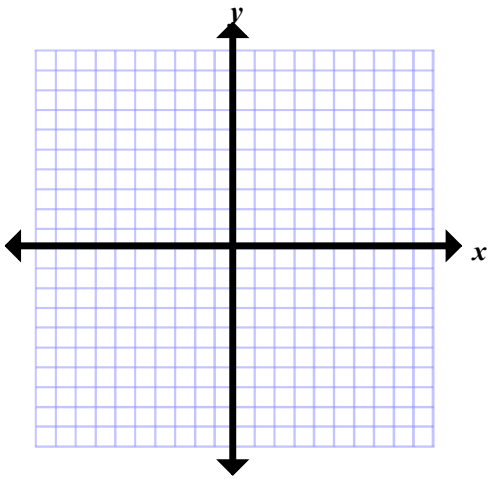
What is $f(1)$ **?**

See p. 39; exercise 41

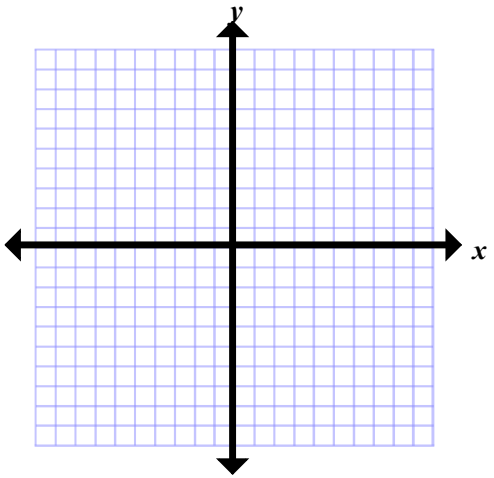
Even & Odd Functions



Symmetric to *y* - axis
Even Function



Symmetric to Origin
Odd Function



Symmetric to x -axis
NOT a Function

Test for Even & Odd Functions

- A function *f* is **EVEN** if

- A function *f* is **ODD** if

Even $f(-x) = f(x)$

Odd $f(-x) = -f(x)$

Example 9 - Testing for Evenness & Oddness

Is the function $f(x) = |x|$ **odd, even or neither?**

Algebraic

Graphical

See p. 39; exercise 49

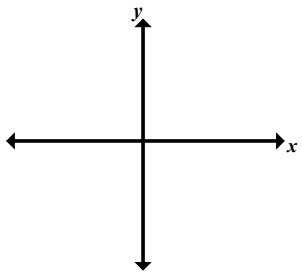
Example 10 - Even & Odd Functions

Determine whether each fnction is even, odd or neither.

a.) $g(x) = x3 - x$

Algebraic

Graphical

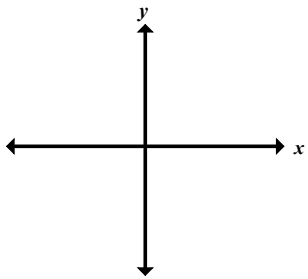


---

b.) $h(x) = x2 + 1$

Algebraic

Graphical

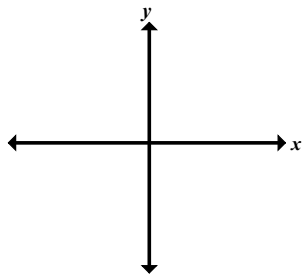


---

c.) $f(x) = x3 - 1$

Algebraic

Graphical



See p. 39; exercise 51