

Review of Relations and Functions:

$$R = \{(1, 2), (2, 4), (3, 5)\}$$

$$S = \{(1, 2), (1, 3), (2, 6)\}$$



Domain of R ?

Domain of S ?

Range of R ?

Range of S ?

Is R a function? Explain.

Is S a function? Explain.

Relations and Functions from equations: *The equation defines y as a function of x if when each domain value is substituted in for x , there is a unique value for y that makes the equation true.*

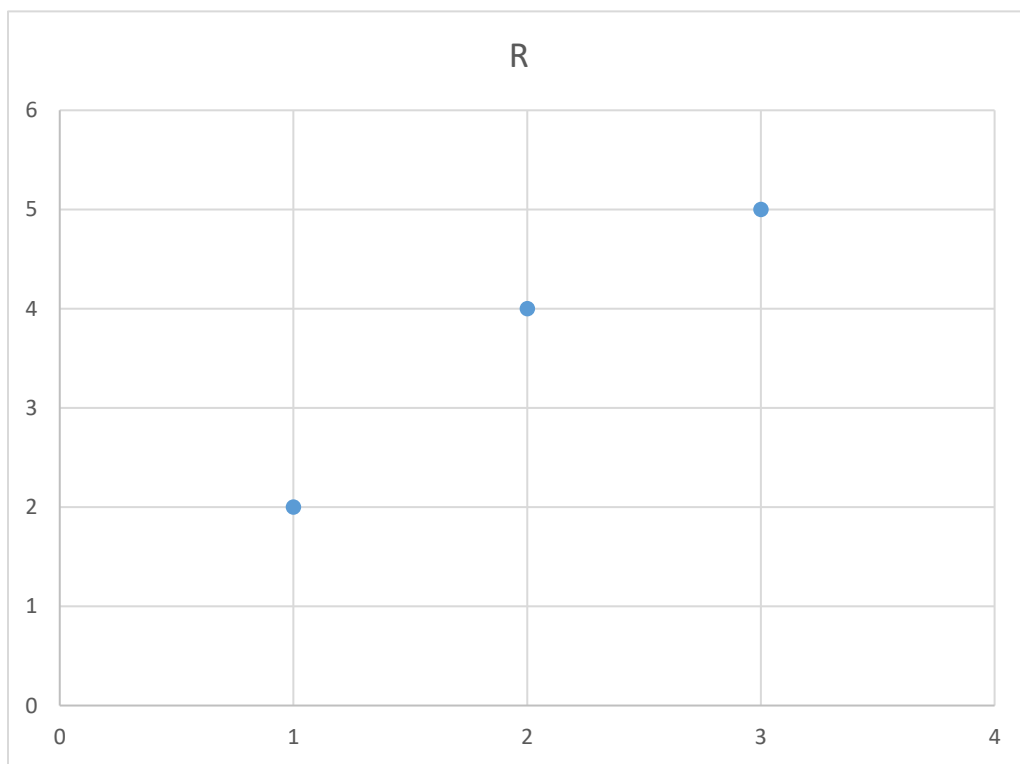
$$x + y = 6$$

$$x = y^2$$

$$2x^2 + 3y^2 = 0$$

$$|y| = x$$

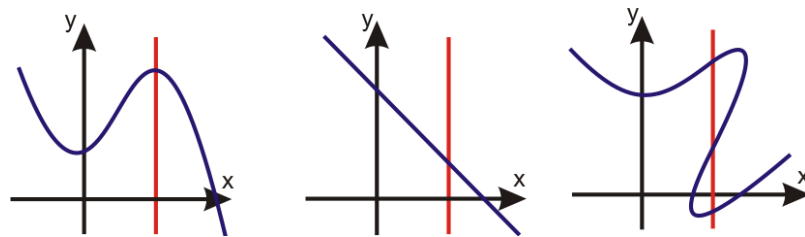
Relations and Functions from graphs:

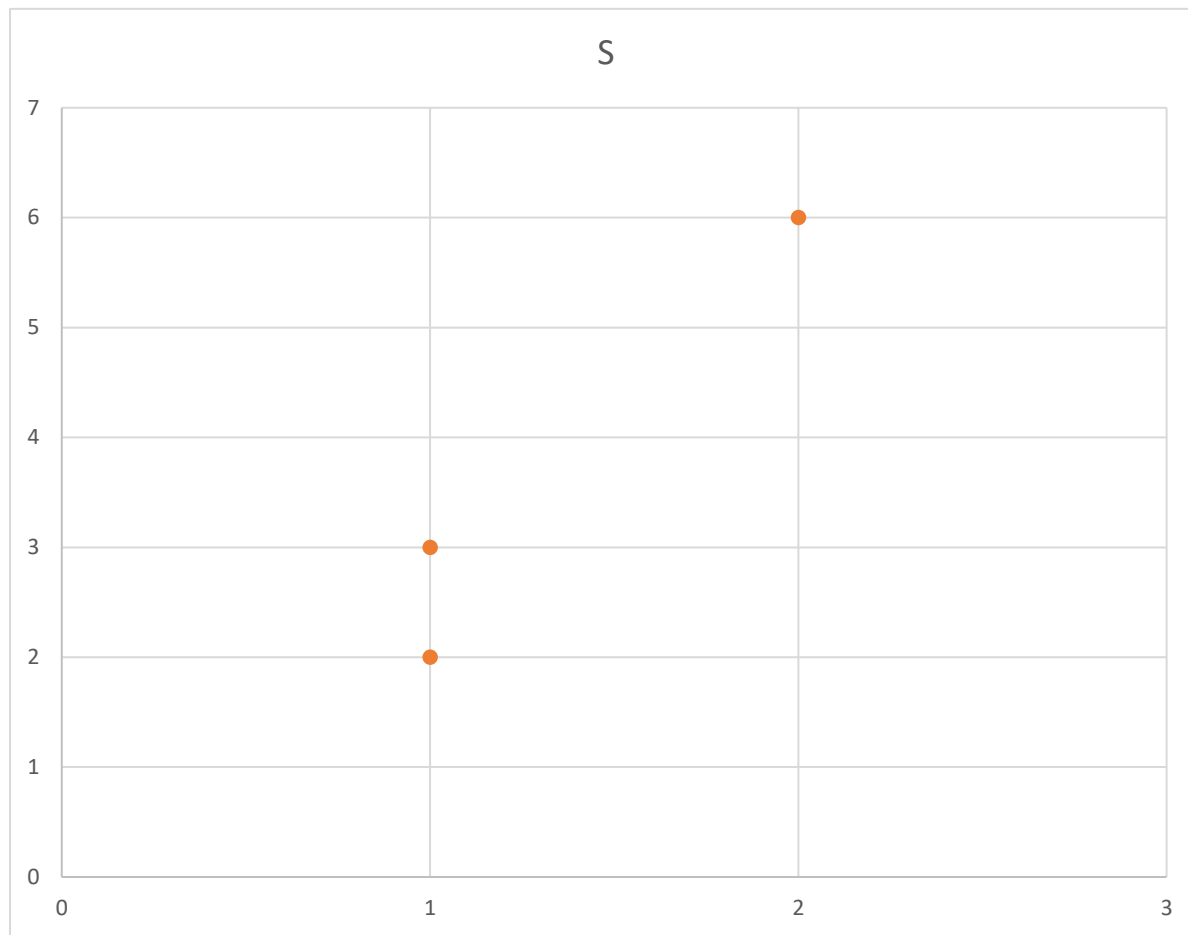


Domain? (*x-coordinates*)

Range? (*y-coordinates*)

Function? (*vertical line test*)



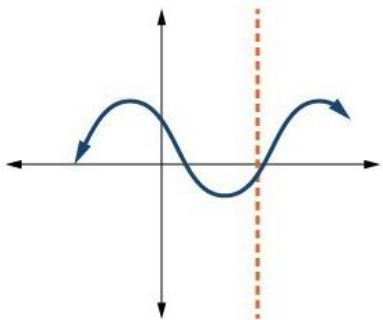


Domain?

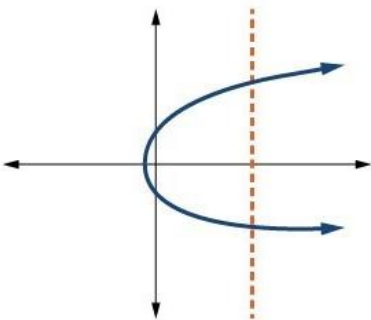
Range?

Function?

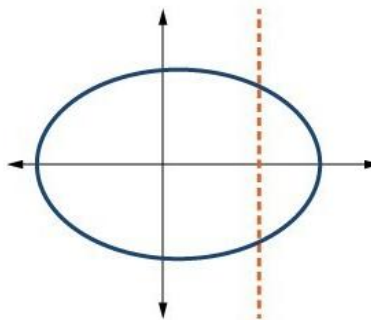
Function

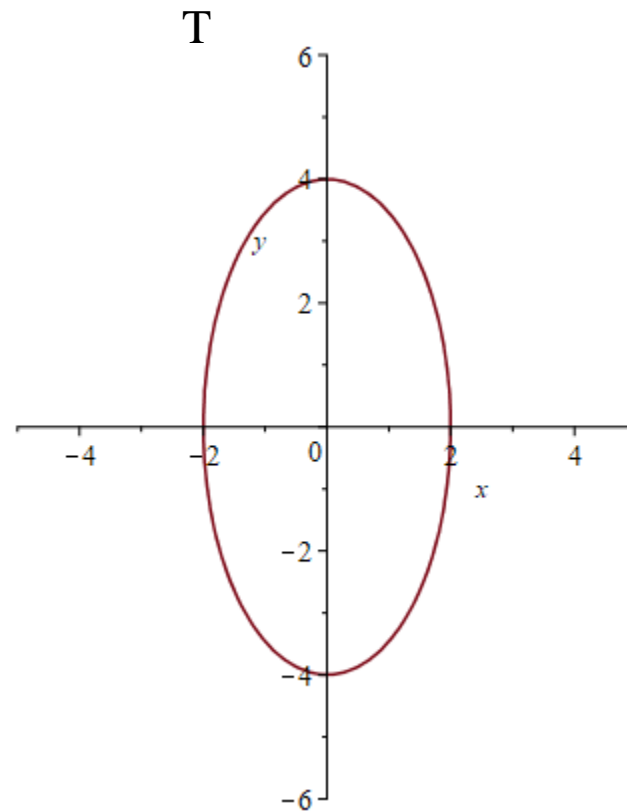


Not a Function



Not a Function

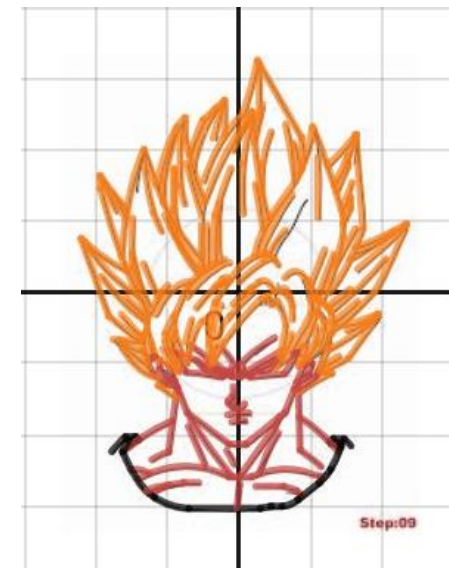


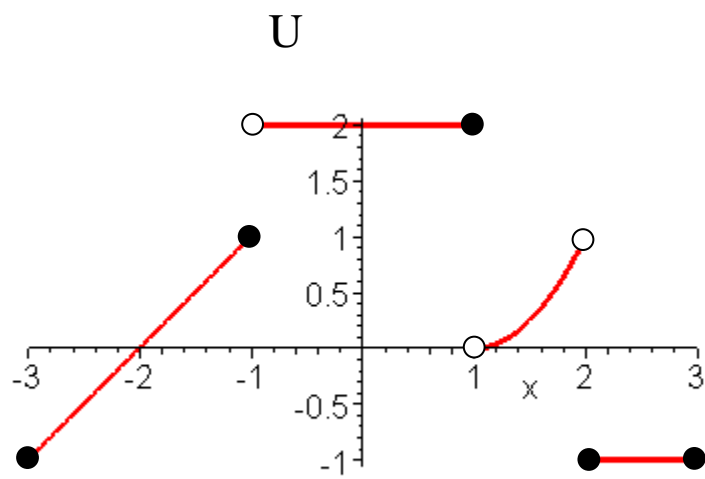


Domain?*(left to right)*

Range?*(bottom to top)*

Function?*(vertical line test)*





Domain?

Range?

Function?

Function Notation and Function Evaluation:

$$f(x) = x^2 - 1$$

$$f(-1)$$

$$f(-1) = (-1)^2 - 1 =$$

$$f(2)$$

Function Notation

$$f(x) = 2x$$

f is the name
of the function

This tells you
that x is the
input

Tells you what the
function does
(this function multiplies
the input values by 2)

$$f(0)$$

$$f\left(\frac{1}{2}\right)$$

$$f(x) = 5x + 6$$

input

output

$$g(x) = \begin{cases} x & ; x \leq -1 \\ 2x + 1 & ; x > -1 \end{cases}$$

$$g(-2)$$

Which formula?

Is $-2 \leq -1$, or is $-2 > -1$?

$$g(-2) = -2$$

$$g(1)$$

Which formula?

Is $1 \leq -1$, or is $1 > -1$?

**EVALUATING ~
Piecewise function**

$$f(x) = \begin{cases} \frac{1}{2}x + 4 & x < 2 \\ x^2 - 1 & -2 \leq x \leq 2 \\ -1 & x > 2 \end{cases}$$

$f(-4) = 2$
 $f(2) = 3$
 $f(3) = -1$

$$g(-1)$$

Which formula?

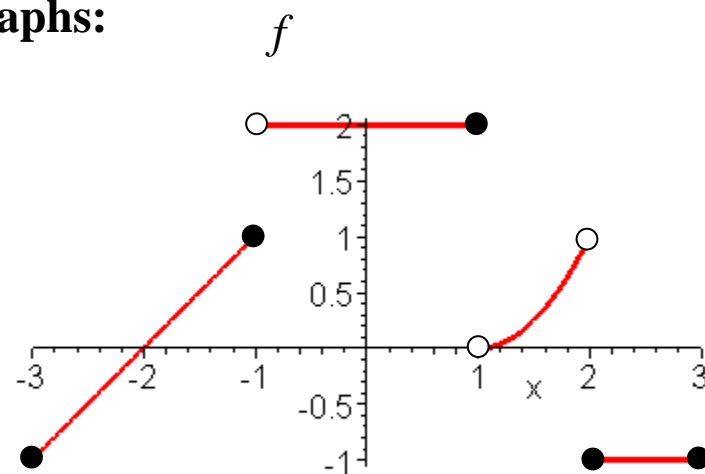
Is $-1 \leq -1$, or is $-1 > -1$?

$$g\left(\frac{1}{2}\right)$$

Which formula?

Is $\frac{1}{2} \leq -1$, or is $\frac{1}{2} > -1$?

Function values from graphs:



$$f(-3)$$

What is the y-coordinate of the
point on the graph with x -coordinate -3 ?

$$f(-2)$$

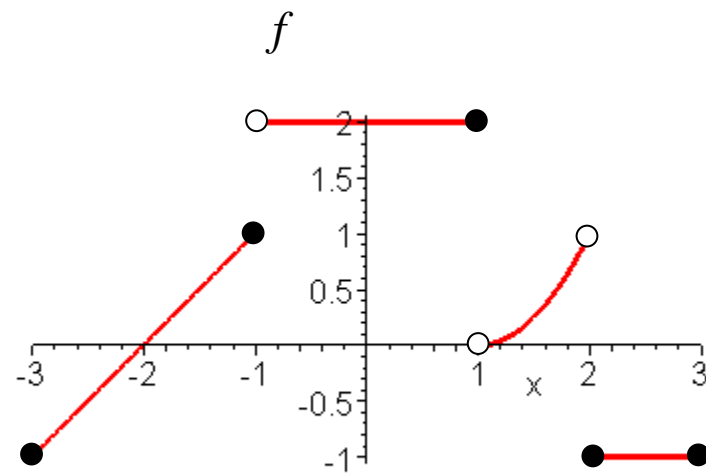
$$f(-1)$$

$$f(0)$$

$$f(1)$$

$$f\left(\frac{5}{2}\right)$$

$$f(-4)$$



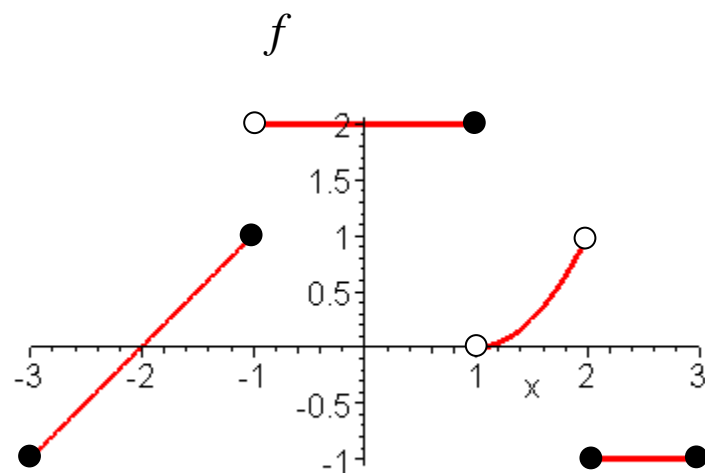
Solve the equations:

$$f(x) = 1$$

$$f(x) = 2$$

Find the x -coordinates of all the points on the graph with y -coordinate 1.

$$f(x) = \frac{3}{2}$$



Solve the inequalities:

$$f(x) > 1$$

$$0 \leq f(x) < 1$$

Find the x -coordinates of all the points on the graph with y -coordinates larger than 1.

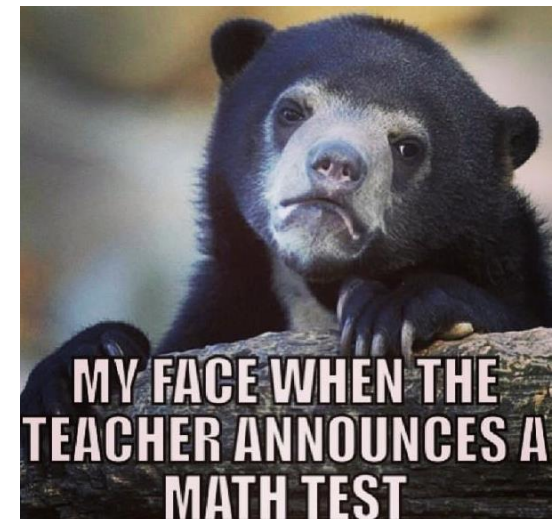
$$f(x) \leq -1$$

Domains from function formulas:*(Avoid division by zero and even roots of negative numbers.)*

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

$$g(x) = \sqrt{1 - 2x}$$

$$h(x) = \frac{\sqrt{x - 2}}{x - 3}$$



Combinations of functions:

$$f + g, f - g, fg, \frac{f}{g}, f \circ g$$

Combining Functions

$$(f + g)(x) = f(x) + g(x)$$

$$(f - g)(x) = f(x) - g(x)$$

$$(fg)(x) = f(x)g(x)$$

$$\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)}$$

$$(f \circ g)(x) = f(g(x))$$

$$f(x) = \text{cookie} \quad g(x) = \text{cream}$$

$$(f \circ g)(x) = \text{cookie with cream}$$

$$(g \circ f)(x) = \text{cream sandwich}$$

$$f(x) = x^2 - 2, \quad g(x) = \sqrt{x+1}$$

$$(f + g)(0)$$

$$(f + g)(-1)$$

$$(g \circ f)(0)$$

$$(f - g)(3)$$

$$(f - g)(-2)$$

$$(f \circ f)(3)$$

$$(fg)(3)$$

$$\left(\frac{f}{g}\right)(-1)$$

$$\left(\frac{f}{g}\right)(3)$$

$$\left(\frac{f}{g}\right)(-2)$$

$$(g \circ g)(3)$$

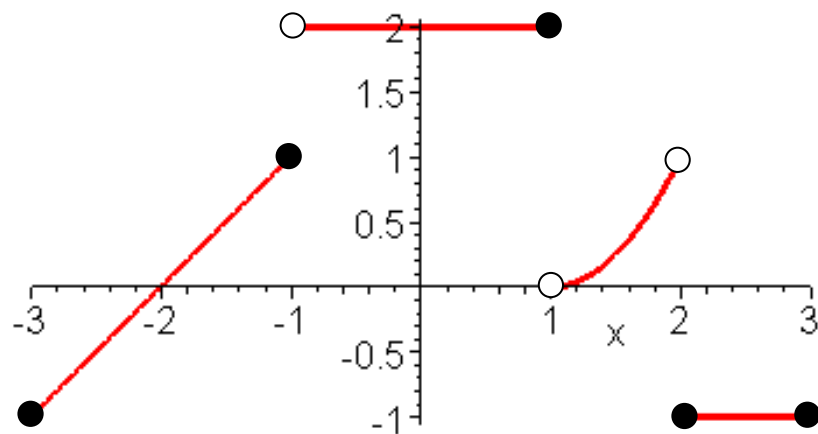
$$(f \circ g)(3)$$

$$(g \circ f)(3)$$

$$(f \circ g \circ f)(\sqrt{5})$$

Combinations from graphs:

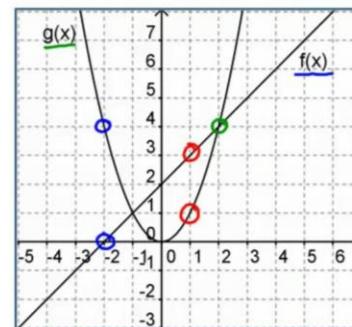
Graph of f



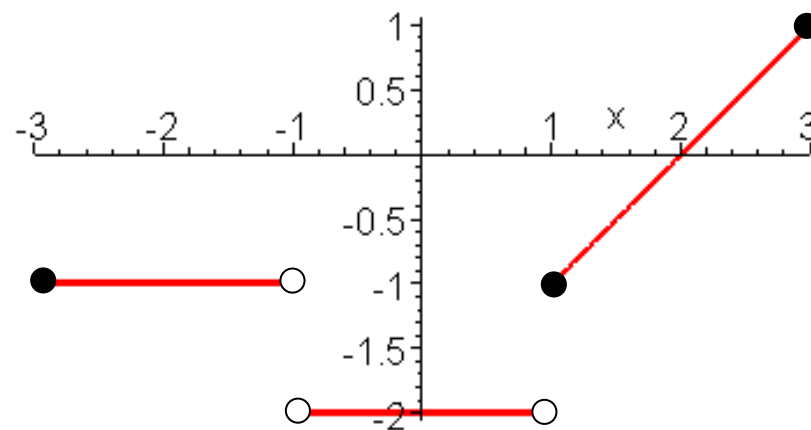
$$(f + g)(0) \quad \left(\frac{f}{g}\right)(1)$$

$$(g \circ f)(2)$$

$$(g \circ g)(0)$$



Graph of g



$$(fg)(-3)$$

$$(f \circ g)(2)$$

$$(f \circ f)(-1)$$

$$(f \circ g \circ f)(1)$$

$$\begin{aligned} (f + g)(1) &= f(1) + g(1) = 3 + 1 = 4 \\ (f - g)(-2) &= f(-2) - g(-2) = 0 - 4 = -4 \\ (fg)(2) &= f(2) \cdot g(2) = 4 \cdot 4 = 16 \\ (f/g)(-2) &= \end{aligned}$$