Relations and Functions:

A Relation is a set of ordered pairs of numbers.

Examples:

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

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

Domain of a Relation:

The set of first numbers

Domain of *R*?

Domain of *S*?

Range of a Relation:

The set of second numbers

Range of *R*?

Range of *S*?

Function:

A function is a relation in which each number in the domain is associated with exactly one number in the range.

Is *R* a function?

Is *S* a function?

Relations and Functions from equations:

Sometimes relations are represented by an equation. The *x*-values correspond to domain values, and the *y*-values correspond to range values. If for each domain value x, it's possible to uniquely solve for the corresponding range value, y, then the relation represented by the equation is a function.

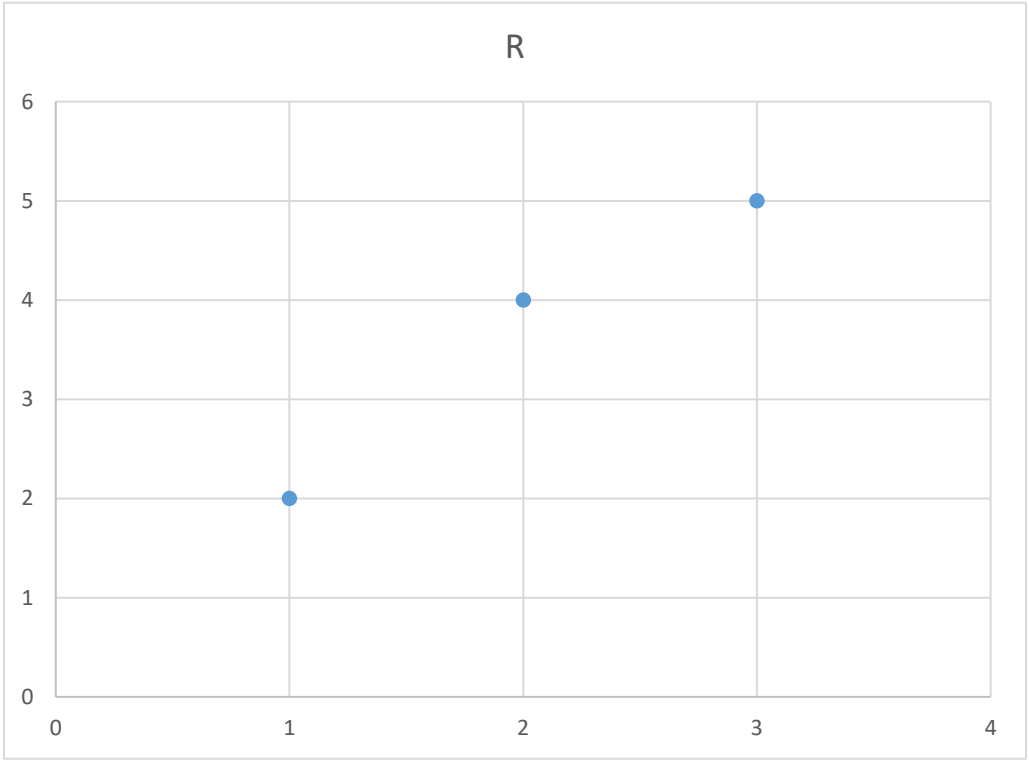
Determine if the following relations are functions:

$$x + y = 6$$

$$x = y^2$$

Relations and Functions from graphs:

Sometimes relations are represented as graphs. The *x*-coordinates are the domain values, and the *y*-coordinates are the range values.

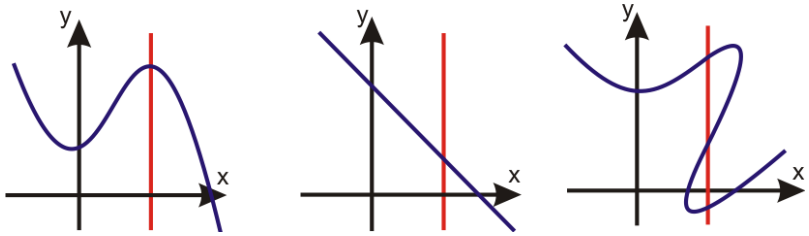


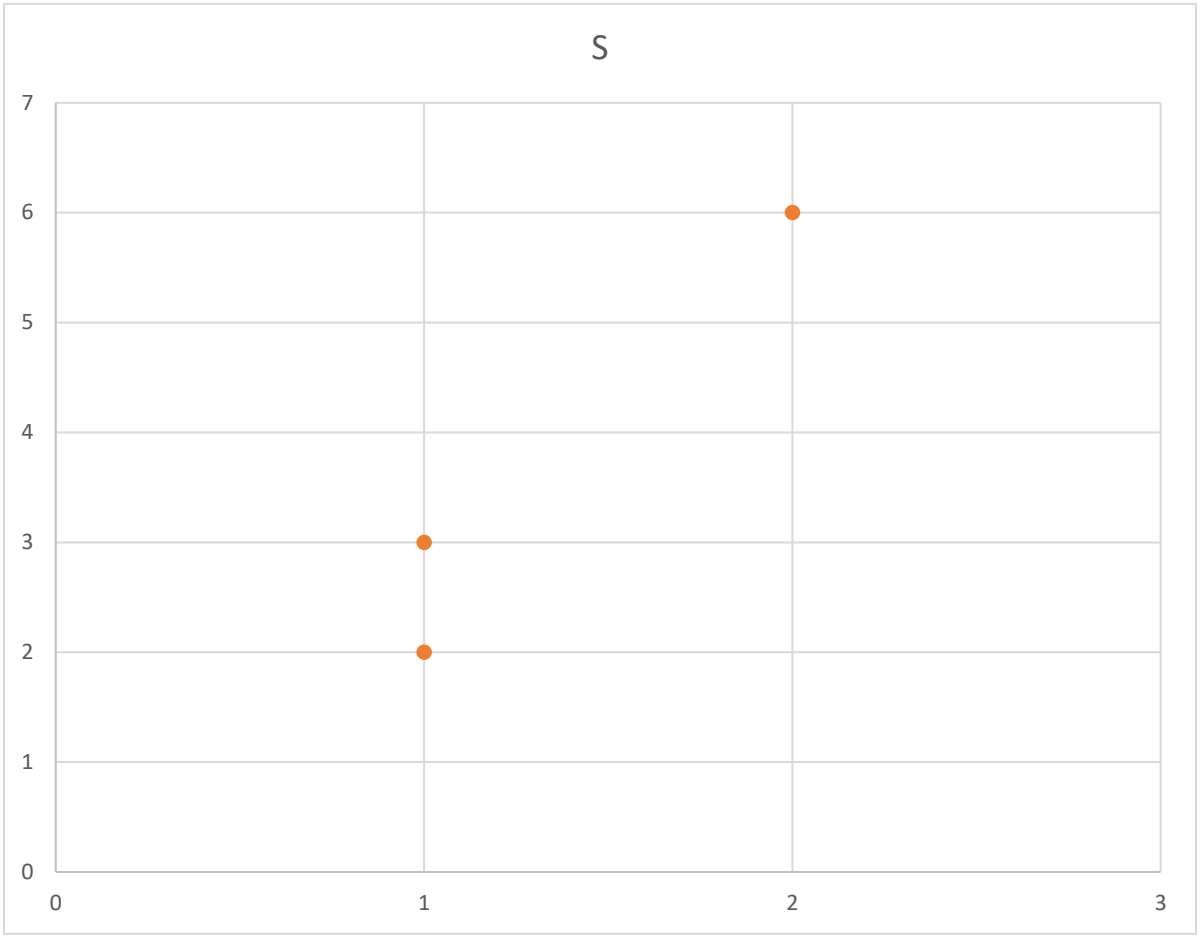
Domain?

Range?

Function?

Vertical Line Test?

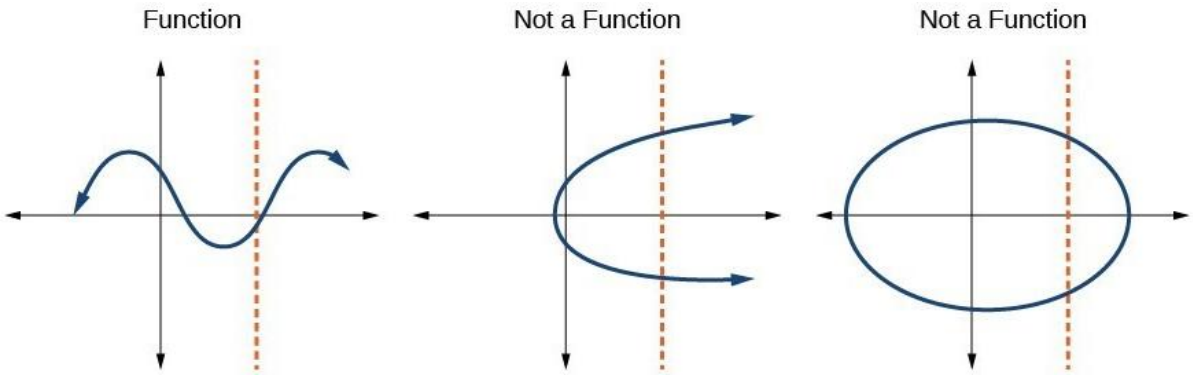




Domain?

Range?

Function?



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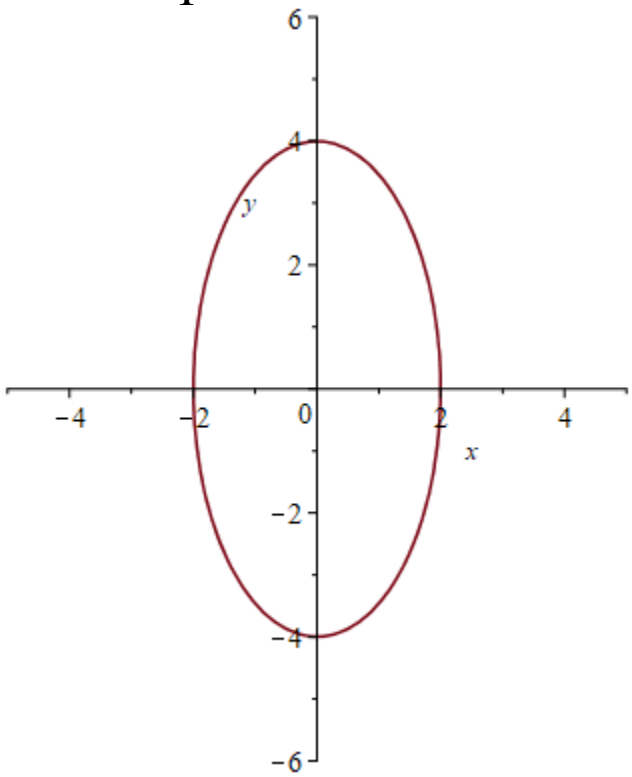
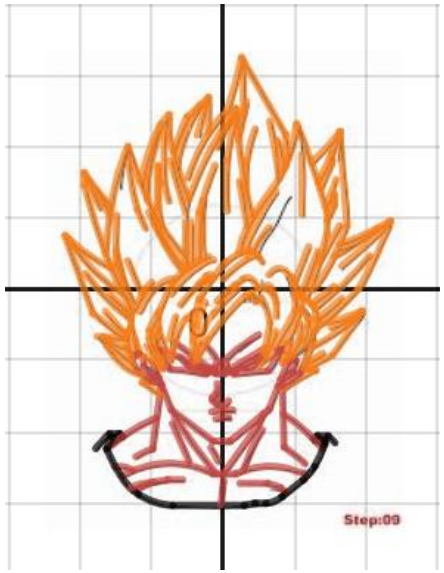
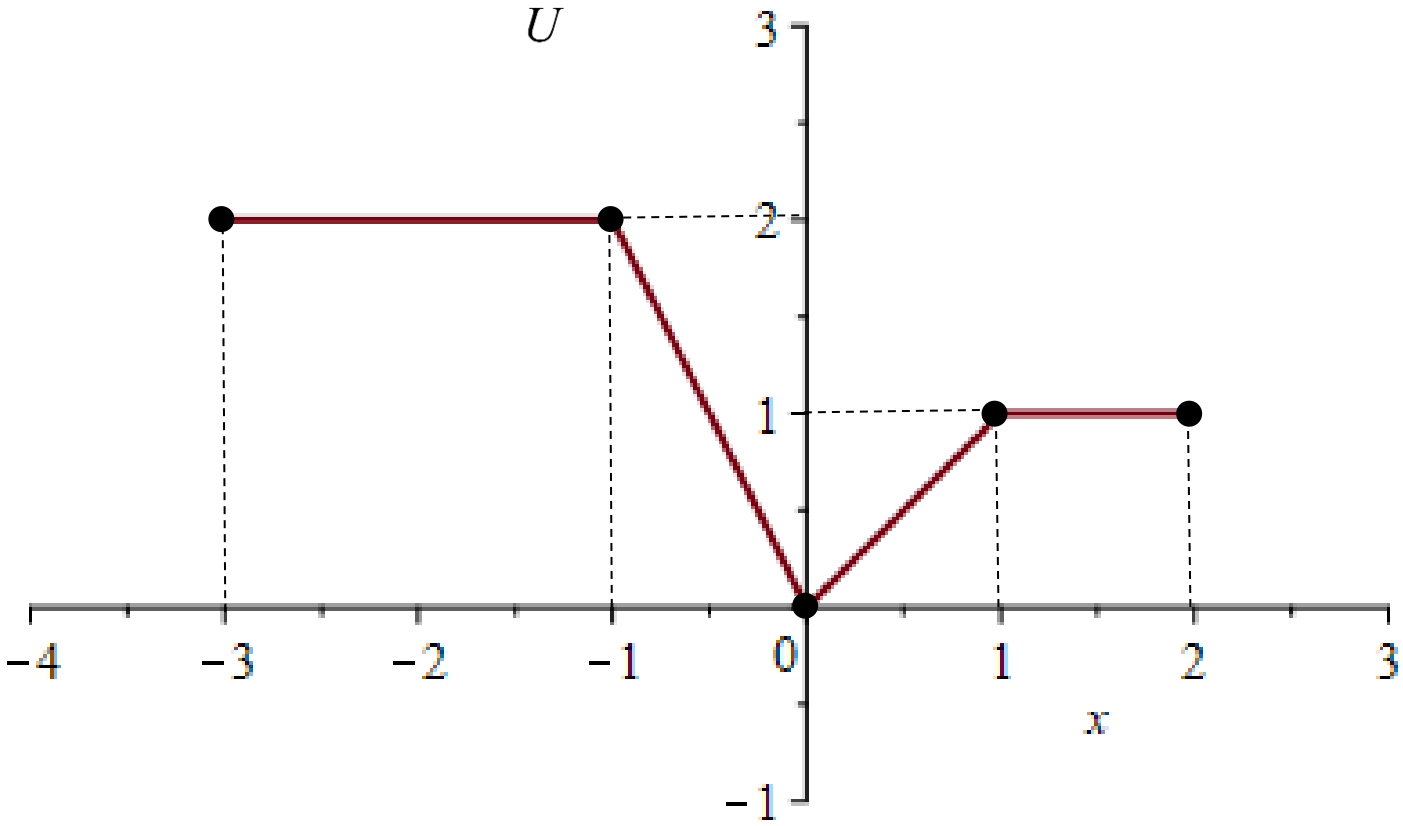


Domain?

Range?

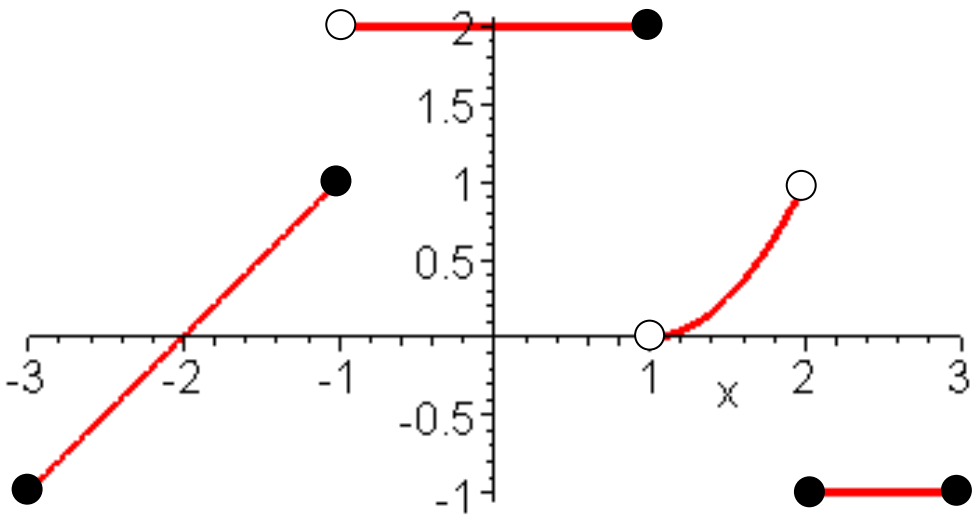
Function?





Domain? **Range?** **Function?**

V



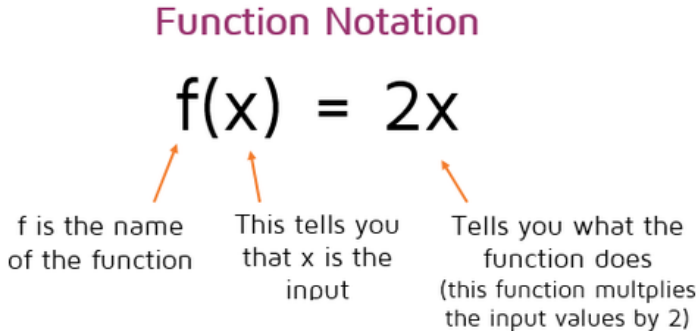
Domain?

Range?

Function?

Function Notation:

When a relation is a function, there is a special notation for connecting domain values and range values called function notation: $f(x)$. It's frequently used to define a function in terms of a formula.

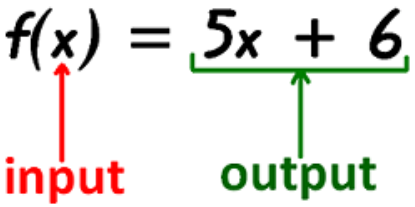


$$f(x)=x^2-1$$

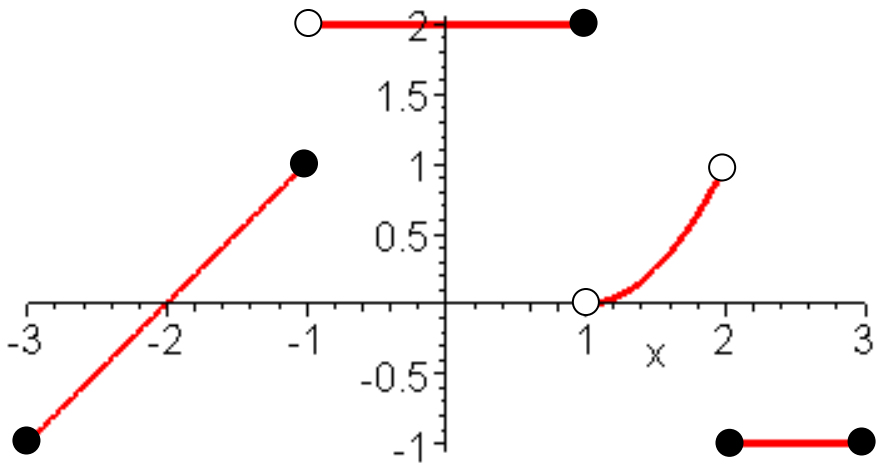
$$f(-1), f(0), f(2), f\left(\tfrac{1}{2}\right), f(a)$$

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

$$g(-2), g(-1), g(1), g\left(\tfrac{1}{2}\right), g(x-1)$$



Function values from graphs: f



$f(-4), f(-3), f(-2), f(-1), f(0), f(1), f\left(\frac{5}{2}\right)$

***x*-intercepts:** ***y*-intercept:**

Solve the equations: $f(x)=1,\ f(x)=\frac{3}{2},\ f(x)=2$

Solve the inequalities: $f(x)>1,\ 0\le f(x)<1$

Domains from function formulas:

When functions are defined using function notation and a formula, the domain is assumed to be all real values of *x* so that the formula produces a real number. The things to avoid are division by zero or an even root of a negative number.

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

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

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