What is a Function?

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function/mapping: a mapping (also called a function) is a rule that assigns to every element x of a set X a single element of a set Y. It is written as:

$$f : X \to Y$$

where the arrow indicates mapping, and the letter *f* symbolically specifies a rule of mapping. When we write:

$$y = f(x)$$

we are mapping from argument *x* in domain *X* to value *y* in co-domain Y.

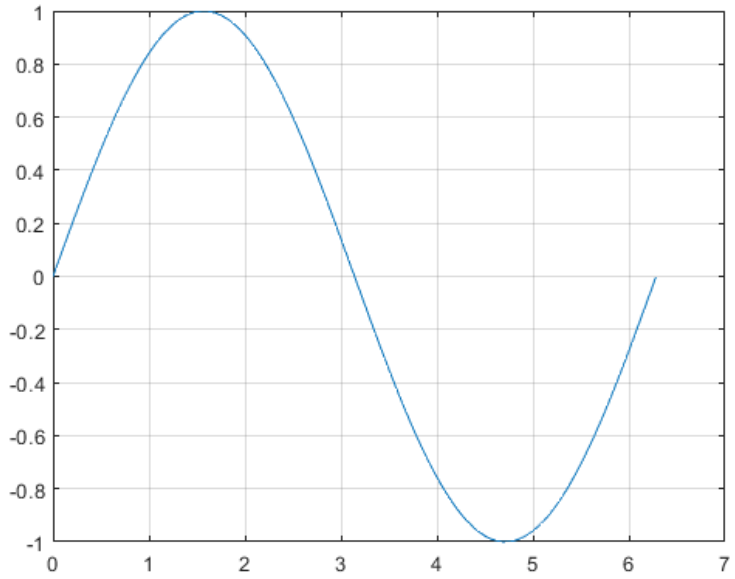
Definitions:

- **domain**: big *X* is the domain of *f*
- **argument**: little *x* is an element in big *X*, an argument of the function *f*.
- **co-domain**: big *Y* is the co-domain of *f*.
- **image/value**: when $y = f(x)$, we refer to *y* as the image or value of *x* under *f*.
- **range**: $f(X) = \{y \in Y : y = f(x) \text{ for some } x \in X\}$

In some textbooks, *x* is called independent or exogenous variables, and *y* is called dependent or endogenous variables. We will avoid using those words to avoid confusion.

This is a function:

```
figure();
x = 0:pi/100:2*pi;
y = sin(x);
plot(x,y);
grid on;
```



This is NOT a function:

```
figure();
x = 1; y=1; r=1;
th = 0:pi/50:2*pi;
xunit = r * cos(th) + x;
yunit = r * sin(th) + y;
h = plot(xunit, yunit);
grid on;
```