Sec 2.2 Domain and Range

If $Q = f(t)$, then

- the **domain** of f is the set of input values, t, which yield an output value.
- the **range** of f is the corresponding set of output values, Q.

Ex. What are the domain and range of the following?

A.
- Katy → June 20
- Jake → April 10
- Cedric → Feb. 13
- Henry → Feb. 13

Domain = {Katy, Jake, Cedric, Henry}
Range = {June 20, April 10, Feb 13}

B.
- Dave → 555-0273
- Don → 382-9382
- April → 382-8291
- Sarah → 829-5692
- Sarah → 918-8165

Domain = {Dave, Don, April, Sarah}
Range = {555-0273, 382-9382, 382-8291, 829-5692, 918-8165}

C. {(1, 4) (2, 4) (3, 5) (6, 10)}

Domain = {1, 2, 3, 6}
Range = {4, 5, 10}

D. {(-3, 9) (-2, 4) (0, 0) (1, 1) (-3, 8)}

Domain = {-3, -2, 0, 1}
Range = {0, 1, 4, 8, 9}

E. {(1, 4) (2, 5) (3, 6) (4, 7)}

Domain = {1, 2, 3, 4}
Range = {4, 5, 6, 7}

Ex. Find the domain of:

a. $f(x) = x^2 + 5x$

All real numbers

b. $g(x) = \dfrac{3x}{x^2 - 4}$

$x^2 - 4 \neq 0$
$x^2 \neq 4$
$x \neq 2,\ x \neq -2$

c. $h(s) = \sqrt{4 - 3x}$

$4 - 3x \geq 0$
$-3x \geq -4$
$x \leq \frac{4}{3}$

Ex. Given: $f(x) = \dfrac{x}{x-3}$.

Find:

A. Is the point (1, .5) on the graph?

$.5 = \dfrac{1}{1-3}$

$.5 \neq \dfrac{1}{-2}$ NO

B. If x = -1, what is f(x)? What point is on the graph of f?

B.) $f(-1) = \dfrac{-1}{-1-3} = \dfrac{-1}{-4} = \dfrac{1}{4}$ $\left(-1, \frac{1}{4}\right)$

C. If f(x) = 2, what is x? What point is on the graph of f?

C.) $\dfrac{2}{1} = \dfrac{x}{x-3}$

$2(x-3) = x$
$2x - 6 = x$
$x = 6$

$(6, 2)$

D. What is the domain of this function? All reals $x \neq 3$

E. What is the range of this function? All reals $y \neq 1$

Choosing Realistic Domains and Ranges

Ex. Algebraically speaking, the formula T = ¼ R + 40 can be used for all values of R.

However, if we use this formula to represent the temperature, T, as a function of a cricket's chirp rate, R, as we did in Chapter 1, some values of R cannot be used. For example, it does not make sense to talk about a negative chirp rate. Also, there is some maximum chirp rate R_{max} that no cricket can physically exceed.

The domain is $0 \le R \le R_{max}$

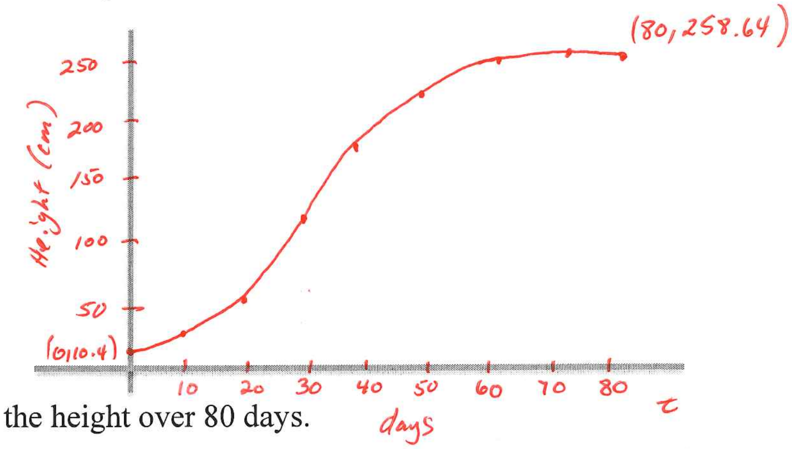
The range of the cricket function is also restricted. Since the chirp rate is nonnegative, the smallest value of T occurs when R = 0. This happens at T = 40. On the other hand, if the temperature gets too hot, the cricket will not be able to keep chirping faster, $T_{max} = ¼\, R_{max} + 40$. The range is $40 \le T \le T_{max}$

Using a Graph to Find Domain and Range of a Function

A good way to estimate the domain and range of a function is to examine its graph.

- The domain is the set of input values on the horizontal axis which give rise to a point on the graph;
- The range is the corresponding set of output values on the vertical axis.

Ex. **Analysis of Graph for Example 3**
A sunflower plant is measured every day *t*, for $t \ge 0$. The height, $h(t)$ in cm, of the plant can be modeled by using the *logistic function* $h(t) = \dfrac{260}{1+24(0.9)^t}$.



a. Using a graphing calculator, graph the height over 80 days.

b. What is the domain of this function? What is the range? What does this tell you about the height of the sunflower?

Domain: $0 \le t \le 80$
Range: $10.4 \le y \le 258.64$

10.4 is the height when first measured. The range approaches but will not reach 260, which is the average height attained by a sunflower.

Using a Formula to Find the Domain and Range of a Function

Ex. State the domain and range of *g*, where $g(x) = 1/x$.

Domain: all reals $x \neq 0$
Range: all reals $g(x) \neq 0$

$\frac{1}{x}$ will approach but never reach 0

HW: pg 77-79, #1-4, 6-14 (evens), 15, 16, 21-36 (m3)