

# Roots

*Drawing Mathematics with Desmos | Justin Skycak*

**Setup.** Navigate to <https://www.desmos.com/calculator>. Be sure to sign in so that you can save your graph.

**Demonstration - Root Graph.** Observe the graph as you type each of the following inputs. In general, the graph  $y = m\sqrt{x - a}$  makes an “r” shape that is shifted right  $a$  units and stretched vertically by a factor of  $m$ .

$$y = \sqrt{x}$$

$$y = 5\sqrt{x}$$

$$y = 0.2\sqrt{x}$$

$$y = \sqrt{x - 2}$$

$$y = \sqrt{x + 3}$$

**Demonstration - Reflections.** Observe the graph as you type each of the following inputs. In general, the graph  $y = \sqrt{-(x - a)}$  is the graph of  $y = \sqrt{x - a}$  reflected over the y-axis, and the graph of  $y = -\sqrt{x - a}$  is the graph of  $y = \sqrt{x - a}$  reflected over the x-axis.

$$y = \sqrt{-x}$$

$$y = \sqrt{-(x - 2)}$$

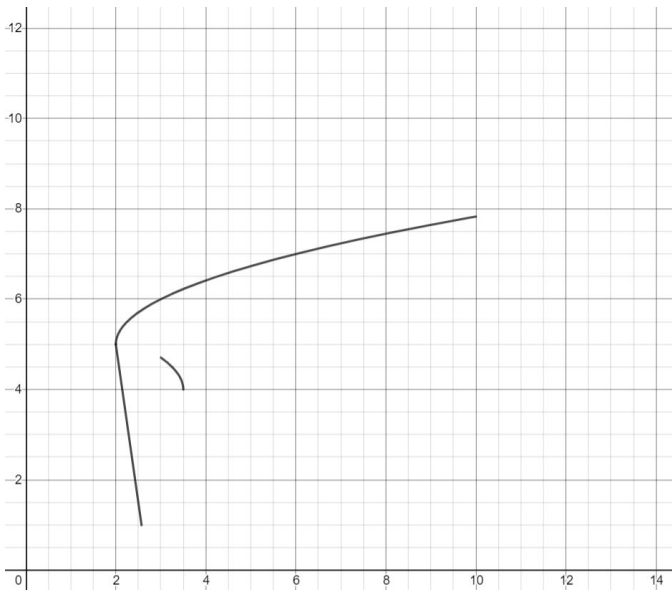
$$y = -\sqrt{x - 5}$$

$$y = -\sqrt{-(x - 5)}$$

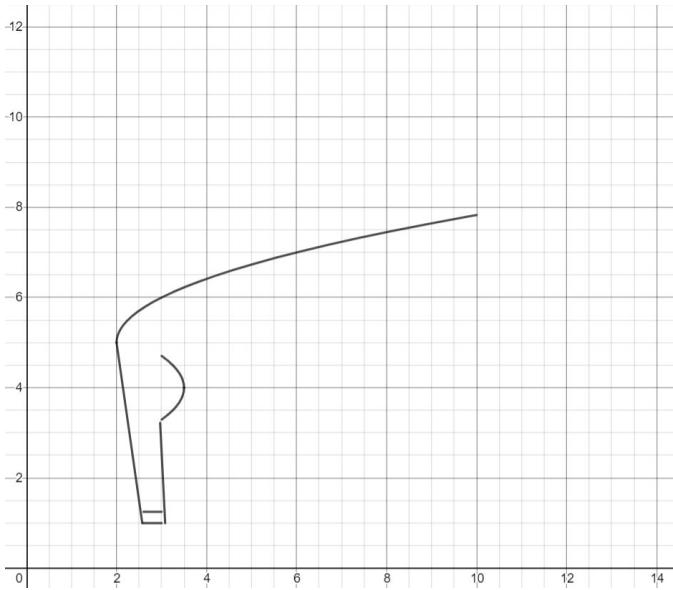
**Exercise.** Reproduce the graph shown below using a square root function of the form  $y = m\sqrt{x - a} + b$ . This will form the back of a “root deer”.



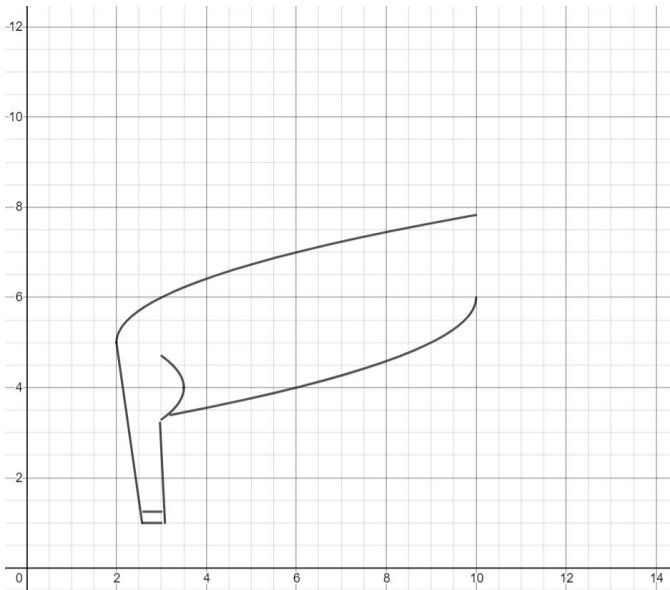
**Exercise.** Draw the back hip of the deer using a root function, and the back leg of the deer using a line.



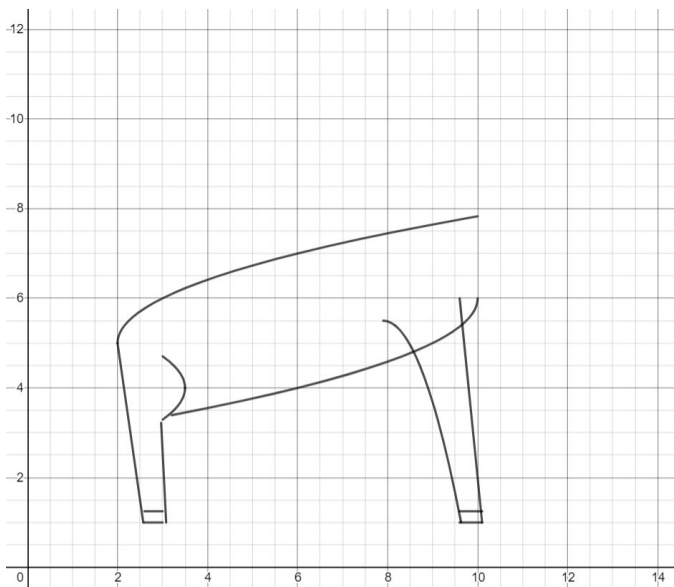
**Exercise.** Complete the back leg of the deer.



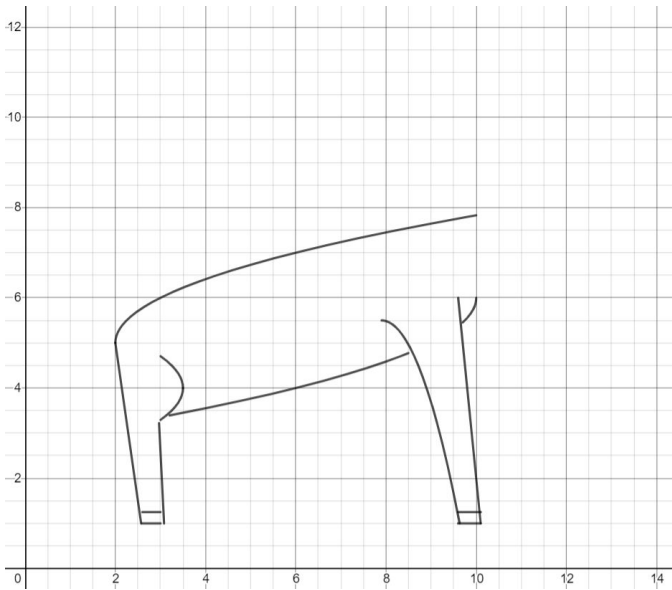
**Exercise.** Use another root function to draw the belly of the deer.



**Exercise.** Use lines and a parabola to draw the front leg of the deer.

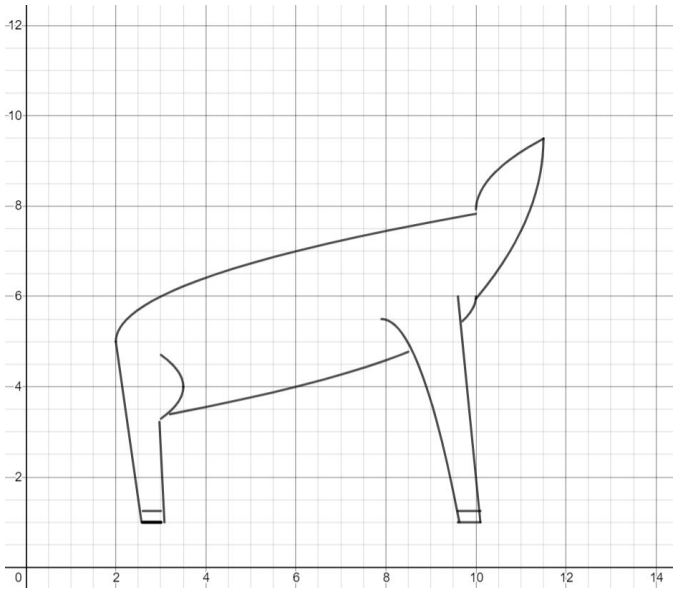


**Exercise.** Break the belly of the deer into two separate functions so that it does not cross over the deer's front leg.

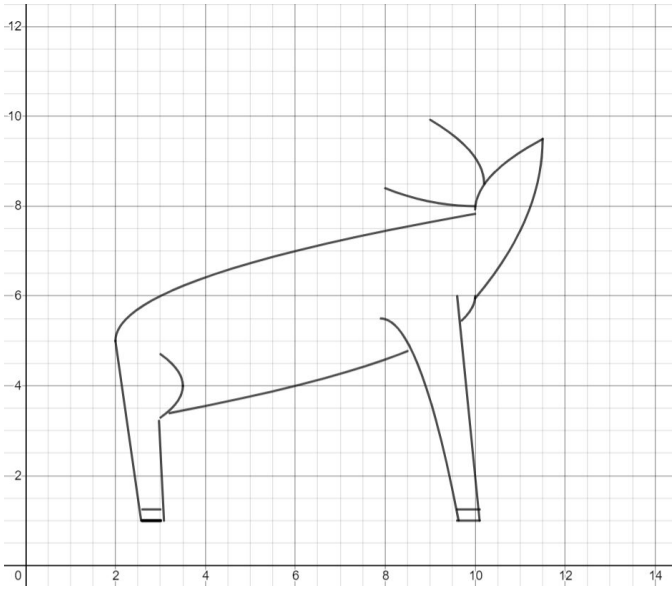




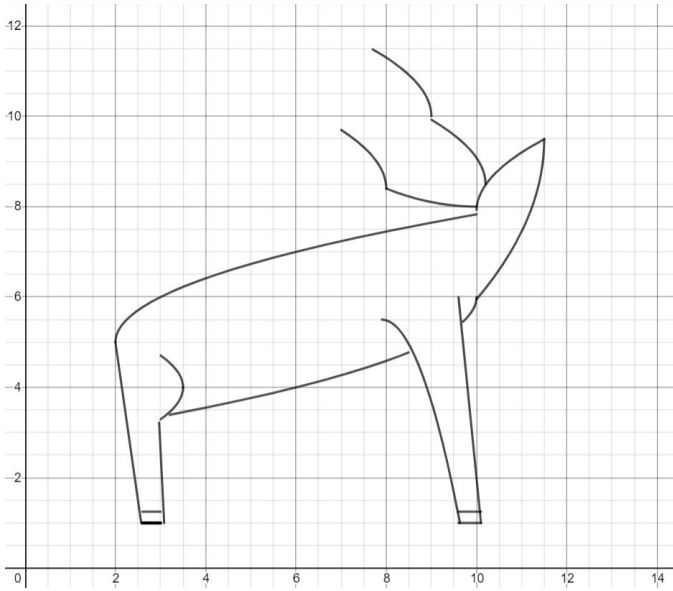
**Exercise.** Draw the head of the deer using two root functions.



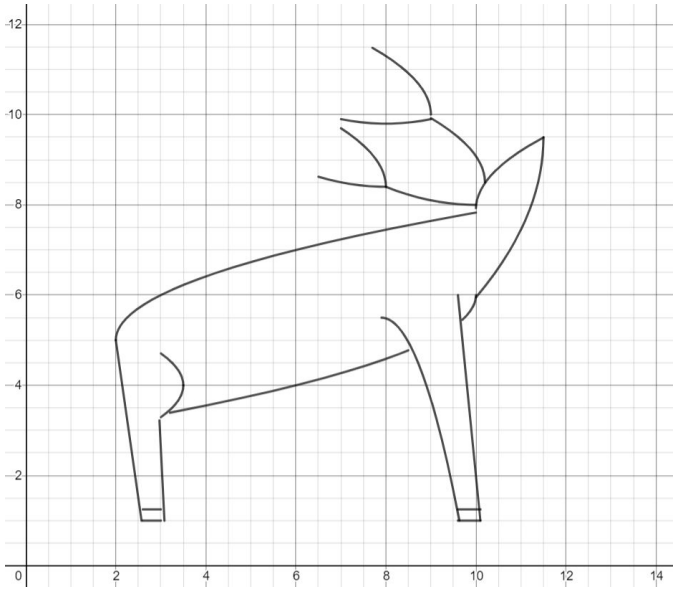
**Exercise.** Draw antlers on the deer. You can use a root function for the upper antler, and a parabola for the lower antler.



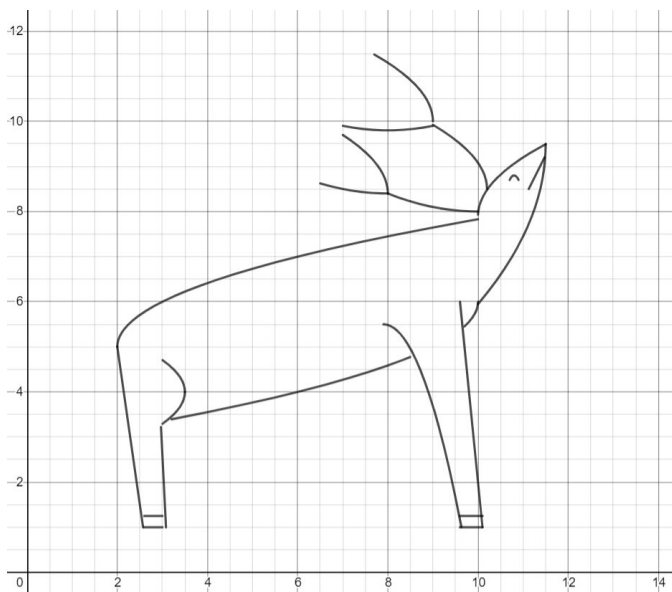
**Exercise.** Use a root function to draw an upper branch of antlers on each of the antlers previously drawn.



**Exercise.** Use a parabola to draw a lower branch of antlers below each of the antlers previously drawn.



**Exercise.** Use lines and a parabola to complete the face of the deer.



**Challenge.** Draw another woodland creature, such as a hedgehog.