Applications of Transformations Worksheet
ANSWER KEY

Task 1.

A small missile is shot from a helicopter. The missile's height follows the equation

$$h = -16t^2 + 192t + 5824$$

a. Graph the equation on the axes provided below, then answer the questions listed below on the next page. Be sure to show all your work.
b. How high was the missile when it was fired?
   Answer: 5824 feet (this is the constant in the initial equation)
c. What was the missile's peak height? When did this occur?
   Answers: 6400 feet, 6 seconds after the missile was fired (this is the vertex)
d. How long did it take the missile to hit the ground?
   Answer: 26 seconds (this is the value of t when h = 0)

b.

c.

d.

Task 2.

A logistic function has the following form, where e is a special constant approximately equal to 2.718.

$$f(x) = \frac{1}{1 + e^{-x}}$$

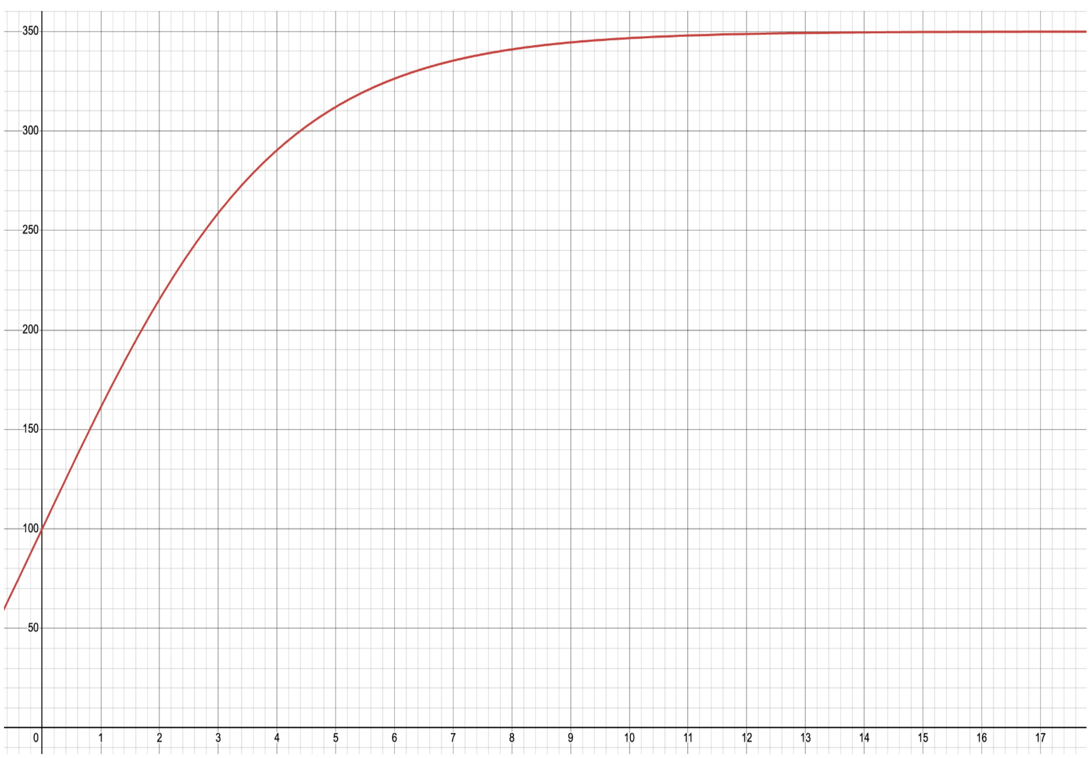
Transformations work with logistic functions just like they do with polynomial functions. The graph below shows the number of fish in a pond. At time zero, there were 100 fish and then the population levels off to about 350 after about 12 or 13 weeks due to the limited space in the pond.

Use Desmos and what you know about transformation to find the values for $\boldsymbol{a}$, $\boldsymbol{b}$, and $\boldsymbol{c}$ in the following equation to come up with an equation that models the fish in the pond.

$$P(t) = \frac{a}{1 + e^{-bt}} + c$$

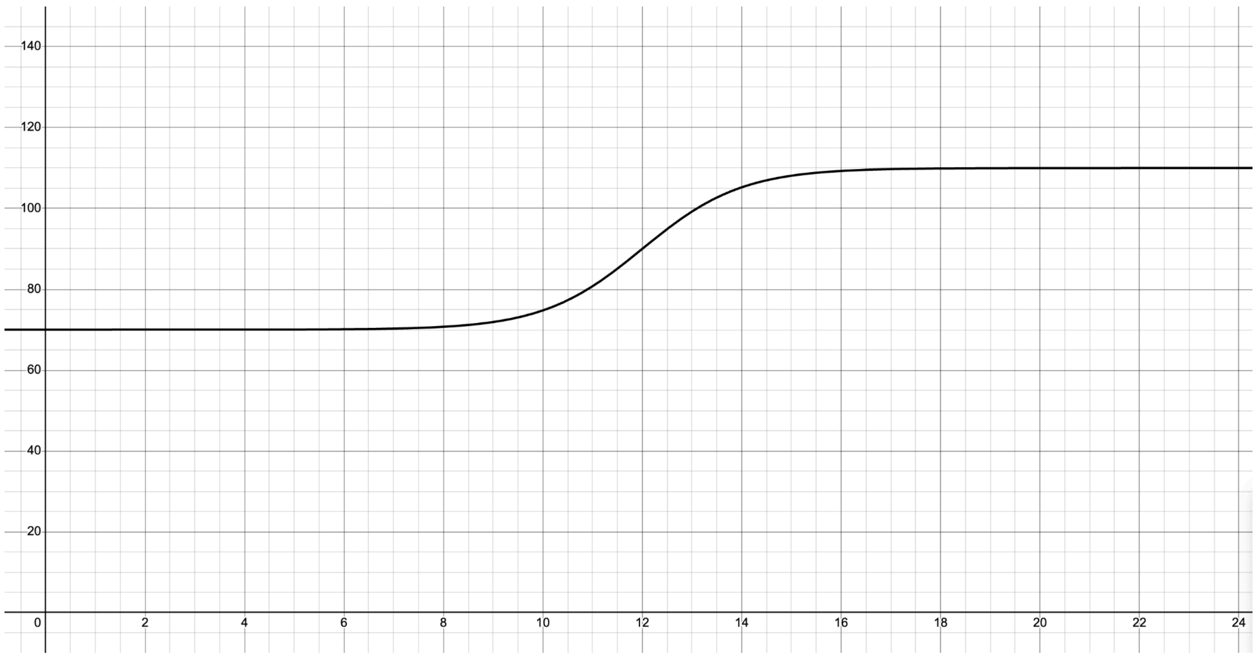
Answer

$$P(t) = \frac{500}{1 + e^{-.5t}} - 150$$



Task 2b.

The population of toads in the same pond also follows a logistic function starting with 70 toads then level off at 110 toads, since it seems that the toads are eating some of the baby fish, that starts around week 10 as shown in the graph below. Use transformations and Demos to find an equation that fits the graph. Note that you are not limited to the transformations that were used in Task 2.



Answer:

$$P(t) = \frac{40}{1 + e^{-(x-12)}} + 70$$