Which function has the greatest *y*-intercept?
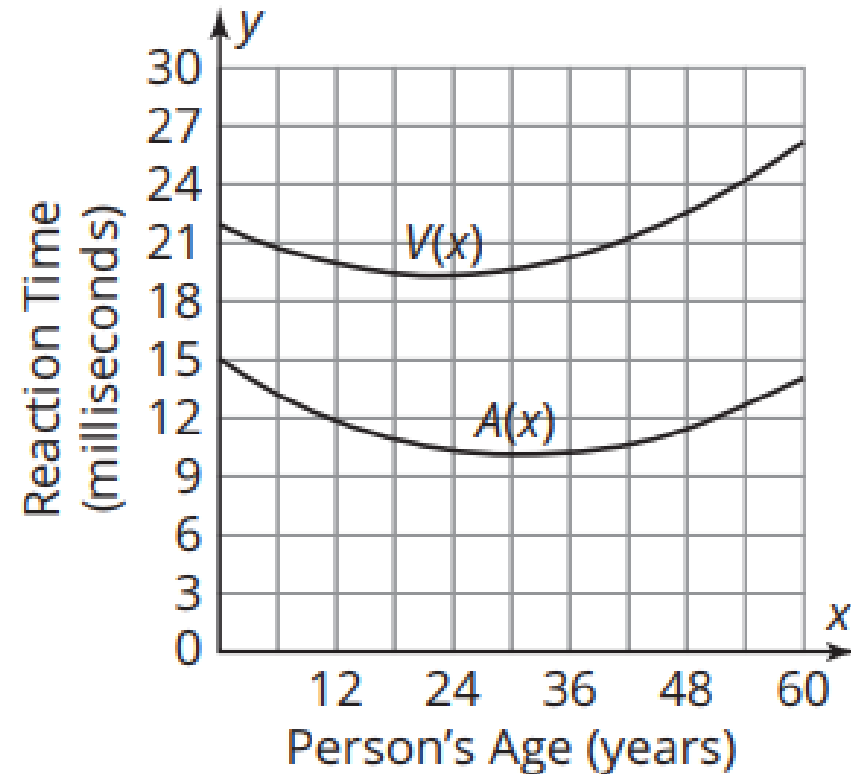
$$f(x) = x^2 - 10x + 16$$

$$g(x) = (x-5)^2 - 2$$

$$h(x) = -(x-5)(x+3)$$

The graphs of functions $V(x)$ and $A(x)$ are shown. The function $V(x)$ models people's reaction times to visual stimuli in milliseconds, based upon the age of a person in years. The function $A(x)$ models people's reaction times to audio stimuli in milliseconds based on the age of a person in years.

1. **Interpret the graphs of the functions.**

   a. **Describe the functions $V(x)$ and $A(x)$.**

   b. **Write a summary to describe people's reaction times to visual stimuli and audio stimuli.**

   c. **Do you think a person would react faster to a car horn or a flashing light? Explain your reasoning.**

2. Estimate the age that a person has the quickest reaction time to each stimuli. Explain how you determined each answer.

   a. visual stimuli   **b. audio stimuli**

Many times, auto insurance companies use test results similar to the ones shown to create insurance policies for different drivers.

3. How do you think the information provided in the graphic representation may be used by an auto insurance company?

4. Consider a new function $h(x)$, where $h(x) = V(x) - A(x)$. What does $h(x)$ mean in terms of the problem situation?

You are playing a new virtual reality game called "Species." You are an environmental scientist who is responsible for tracking two species of endangered parrots, the orange-bellied parrot and the yellow-headed parrot. Suppose the orange-bellied parrots' population can be modeled by the function $B(x)$, where x represents the number of years since the current year. Suppose that the population of the yellow-headed parrot can be modeled by the function $H(x)$.

$$B(x) = -18x + 120$$

$$H(x) = 4x^2 - 5x + 25$$

Time Since Present (years)
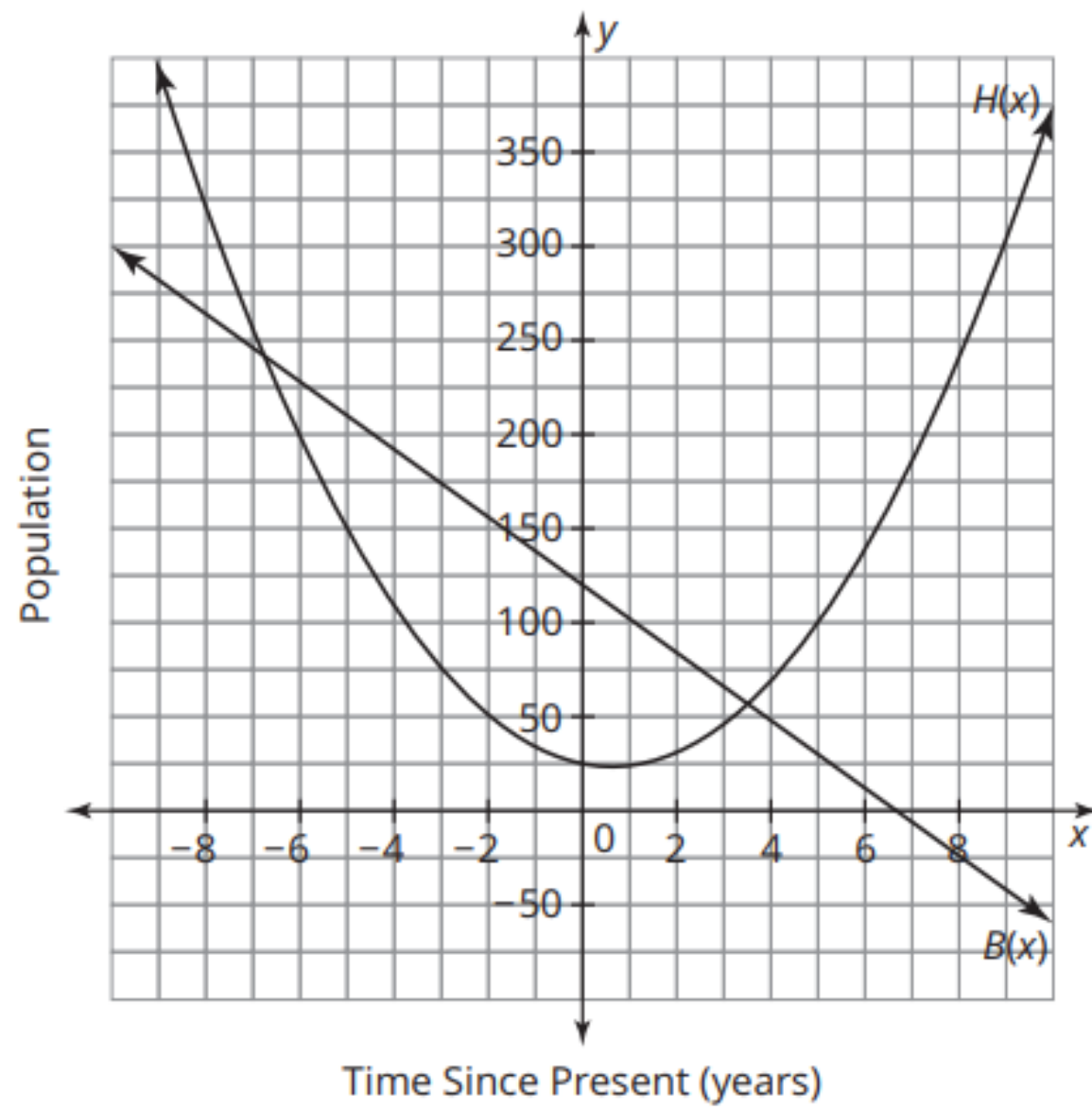
Your new task in this game is to determine the total number of these endangered parrots each year over a six-year span. You can calculate the total population of parrots using the two graphed functions.

1. **Use the graphs of B(x) and H(x) to determine the function, T(x), to represent the total population of parrots.**

   a. **Write T(x) in terms of B(x) and H(x).**

You can write a function, $T(x)$, in terms of x to calculate the total number of parrots at any time.

Worked Example

$T(x) = B(x) + H(x)$	Write $T(x)$ in terms of two known functions.
$T(x) = (-18x + 120) + (4x^2 - 5x + 25)$	Substitute the functions in terms of x.
$T(x) = 4x^2 + (-18x + (-5x)) + (120 + 25)$	Use the Commutative Property to reorder and the Associative Property to group like terms.
$T(x) = 4x^2 - 23x + 145$	Combine like terms.

1. **Analyze each student's work. Determine the error and make the necessary corrections.**

Marco 👎

$3x^2 + 5x^2 = 8x^4$

Kamiah 👎

$2x - (4x + 5)$

$2x - 4x + 5$

$-2x + 5$

Alexis 👎

$(4x^2 - 2x - 5) + (3x^2 + 7)$

$(4x^2 + 3x^2) - (2x) - (5 + 7)$

$7x^2 - 2x - 12$

2. Determine each function. Write your answers in general form.

a. $J(x) = A(x) + C(x)$

b. $K(x) = D(x) - B(x)$

c. $L(x) = C(x) + D(x)$

d. $M(x) = B(x) - A(x)$

e. $N(x) = A(x) - C(x) - D(x)$

3. **Are the functions $J(x)$, $K(x)$, $L(x)$, $M(x)$ and $N(x)$ polynomial functions? Explain why or why not.**

When an operation is performed on any of the numbers in a set and the result is a number that is also in the same set, the set is said to be **closed**, or have **closure**, under that operation.

For example, the set of integers is closed under addition and subtraction. That means whenever two integers are added or subtracted, the result is also an integer.

The definition of closure can also be applied to polynomials.

4. Based on the definition of closure, determine whether polynomials are closed under addition and subtraction. Justify your answer.