

# Assignment

## Write

Explain how you can determine the combination of the three zeros of a cubic function from a graph of the function.

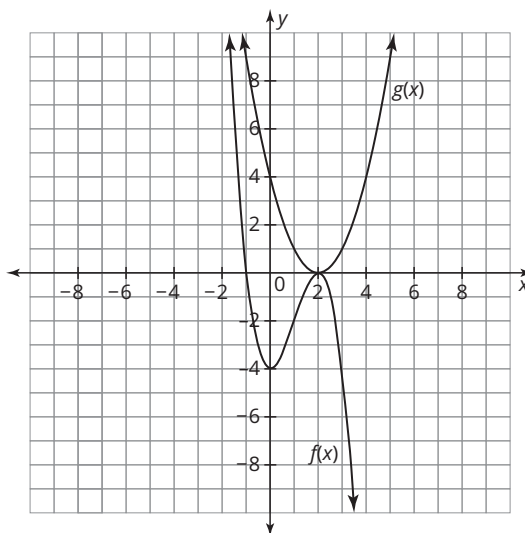
## Remember

The characteristics of a polynomial function are formed by the characteristics of the functions that are its factors.

A polynomial function may have a combination of real and imaginary zeros, as long as the imaginary zeros are in pairs.

## Practice

1. Consider the functions  $k(x) = x - 1$ ,  $m(x) = x + 2$ ,  $n(x) = x - 3$ , and  $f(x) = k(x) \cdot m(x) \cdot n(x)$ .
  - a. Graph  $k(x)$ ,  $m(x)$ , and  $n(x)$ .
  - b. Determine the degree of the function  $f(x)$ . Explain your reasoning.
  - c. Determine the zeros of  $f(x)$ . Explain your reasoning.
  - d. Determine the  $y$ -intercept of  $f(x)$ . Explain your reasoning.
2. Consider the graphs of the quadratic function  $g(x) = (x - 2)^2$  and the cubic function  $f(x) = g(x) \cdot h(x)$ .



- a. Determine the degree of the function  $h(x)$ . Explain your reasoning.
  - b. Determine the  $x$ -intercept(s) of  $h(x)$ . Explain your reasoning.
  - c. Determine the  $y$ -intercept of  $h(x)$ . Explain your reasoning.
  - d. Determine the equation of the function  $h(x)$ .
3. Determine 2 linear functions and 1 quadratic function such that the product of the 3 functions will build a quartic function with a double zero at  $-1$  and a  $y$ -intercept at  $(0, -3)$ . Write the equation of the quartic function. Explain your reasoning.
  4. Determine 2 quadratic functions such that the product of the 2 functions will build a quartic function with only 2  $x$ -intercepts at  $(-2, 0)$  and  $(1, 0)$  and a  $y$ -intercept at  $(0, -8)$ . Write the equation of the quartic function. Explain your reasoning.

## Stretch

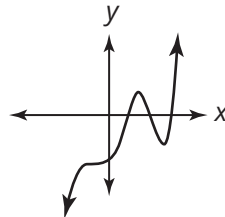
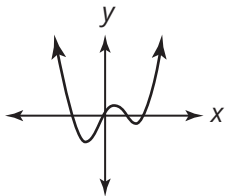
- Determine 2 quadratic functions and a linear function such that the product of the 3 functions will build a quintic function with 3  $x$ -intercepts at  $(-1, 0)$ ,  $(2, 0)$  and  $(3, 0)$  and a  $y$ -intercept at  $(0, 12)$ . Write the equation of the quintic function. Explain your reasoning.
- Consider the function  $f(x) = x^4 - 4x^3 - 2x^2 + 12x - 3$ .
  - Graph the function.
  - Complete the table of values for the function.

$x_1$	$x_2$	$f(x_1)$	$f(x_2)$	$f(x_2) - f(x_1)$	$x_2 - x_1$	$\frac{f(x_2) - f(x_1)}{x_2 - x_1}$
-2	-1					
3	4					

- Compare the last column of the table to the graph between the values  $x_1$  and  $x_2$ . What do you notice?

## Review

- Describe the combination of real and imaginary zeros for each graphed function. Include the multiplicity of each real zero.
  - Quartic
  - Quintic



- An open topped bin is to be made from a piece of metal by cutting equal squares from the corners and turning up the sides. The piece of metal is 5 meters by 8 meters. The function  $V(x) = x(5 - 2x)(8 - 2x)$  represents the volume of a bin in terms of the side length,  $x$ , of the removed squares.
  - Determine the maximum volume of a bin. What are the dimensions of a bin with the maximum volume?
  - Determine any relative maximums or relative minimums of  $V(x)$ . Then, determine the intervals over which the function is increasing and decreasing.
- Perform each operation.
  - $(25 + 17i) - (-24 + 18i)$
  - $(12 + 2i)(12 - 2i)$