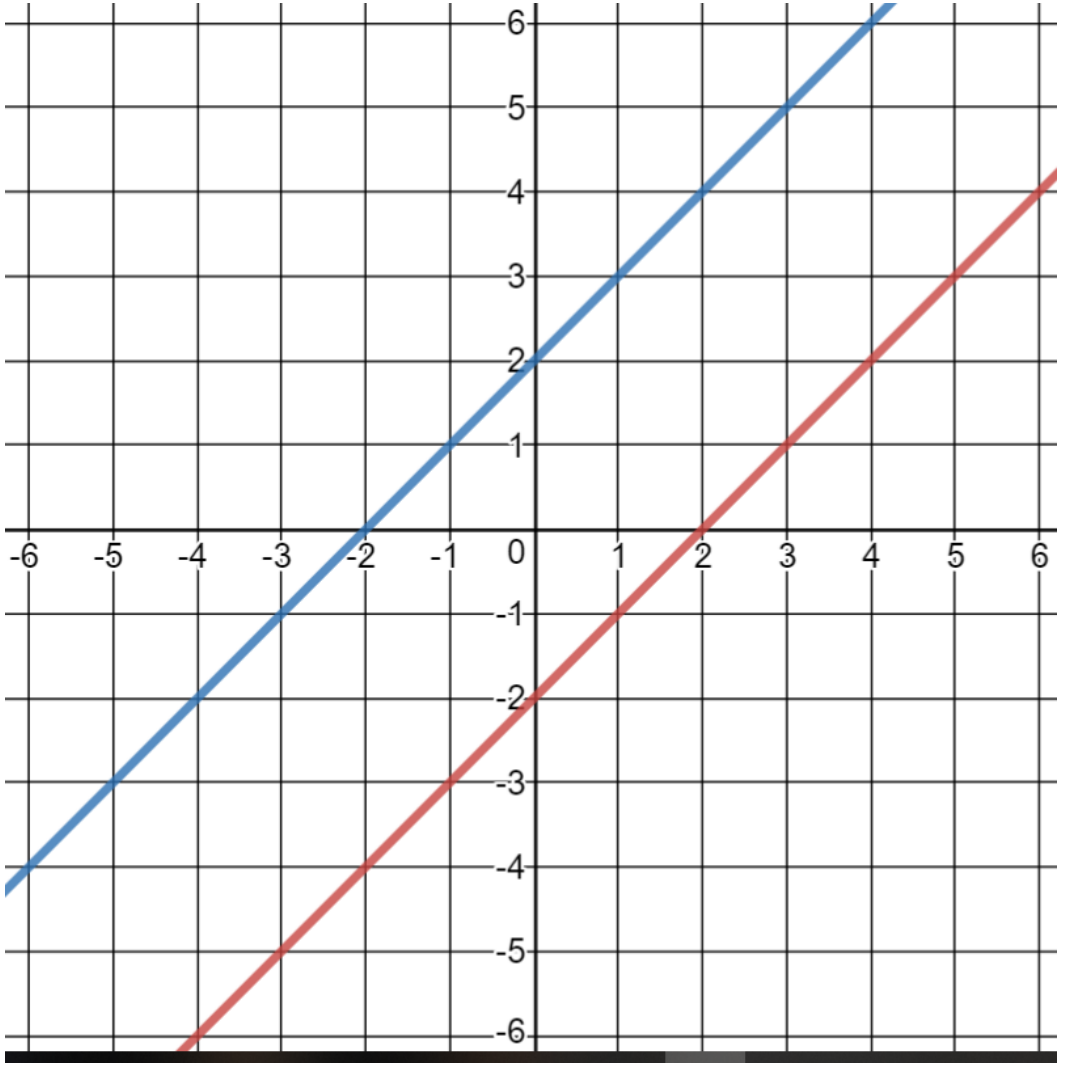
Warm-up

Use the two graphs to create a graph of the product, $h(x) = f(x) \cdot g(x)$

$f(x) = x - 2$

$g(x) = x + 2$



Decomposing Cubic Functions

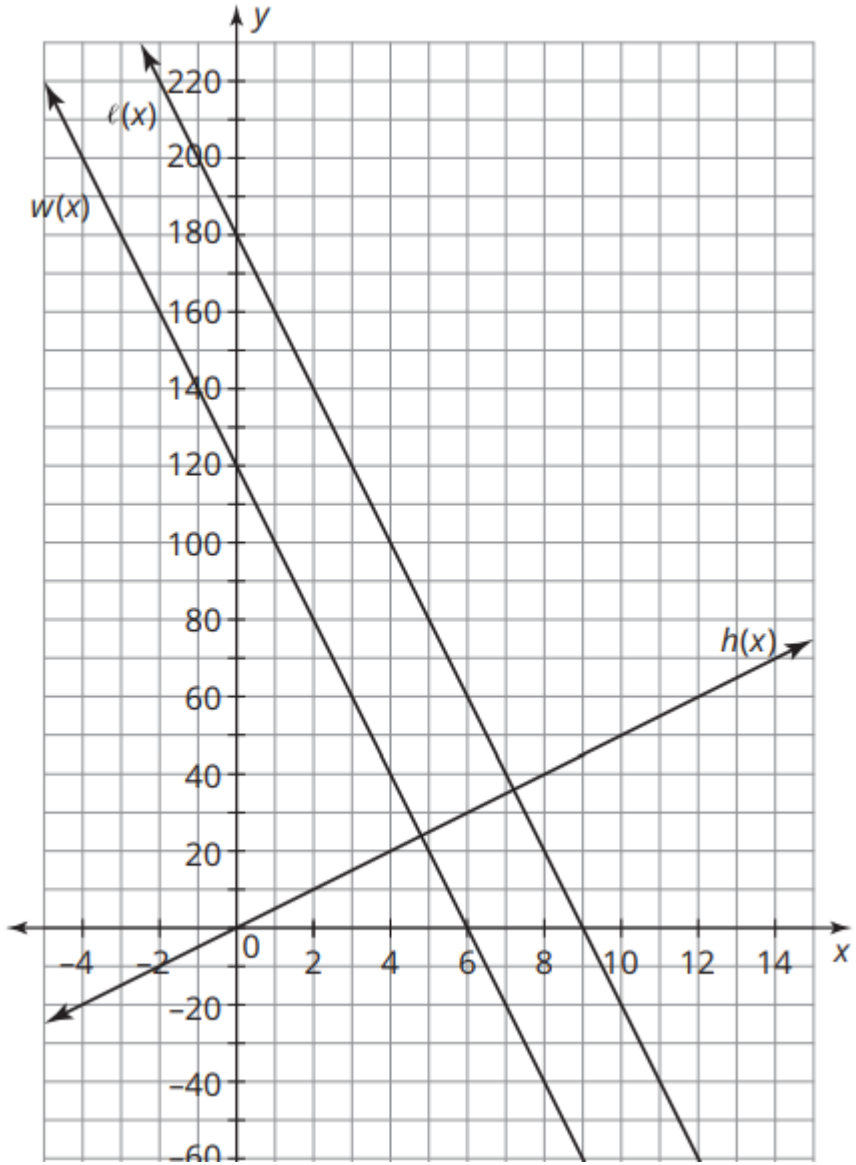
Let's now use three linear functions to sketch their cubic function product.

Recall that the volume function $V(x) = x(18 - 2x)(12 - 2x)$ for the planter boxes in a previous lesson was built by multiplying three linear functions representing length, width, and height.

You can sketch the graph of this cubic function without technology using the three linear functions. The linear functions that represent the length, width, and height of the planter boxes from Plant-A-Seed are shown on the graph.

Think about:

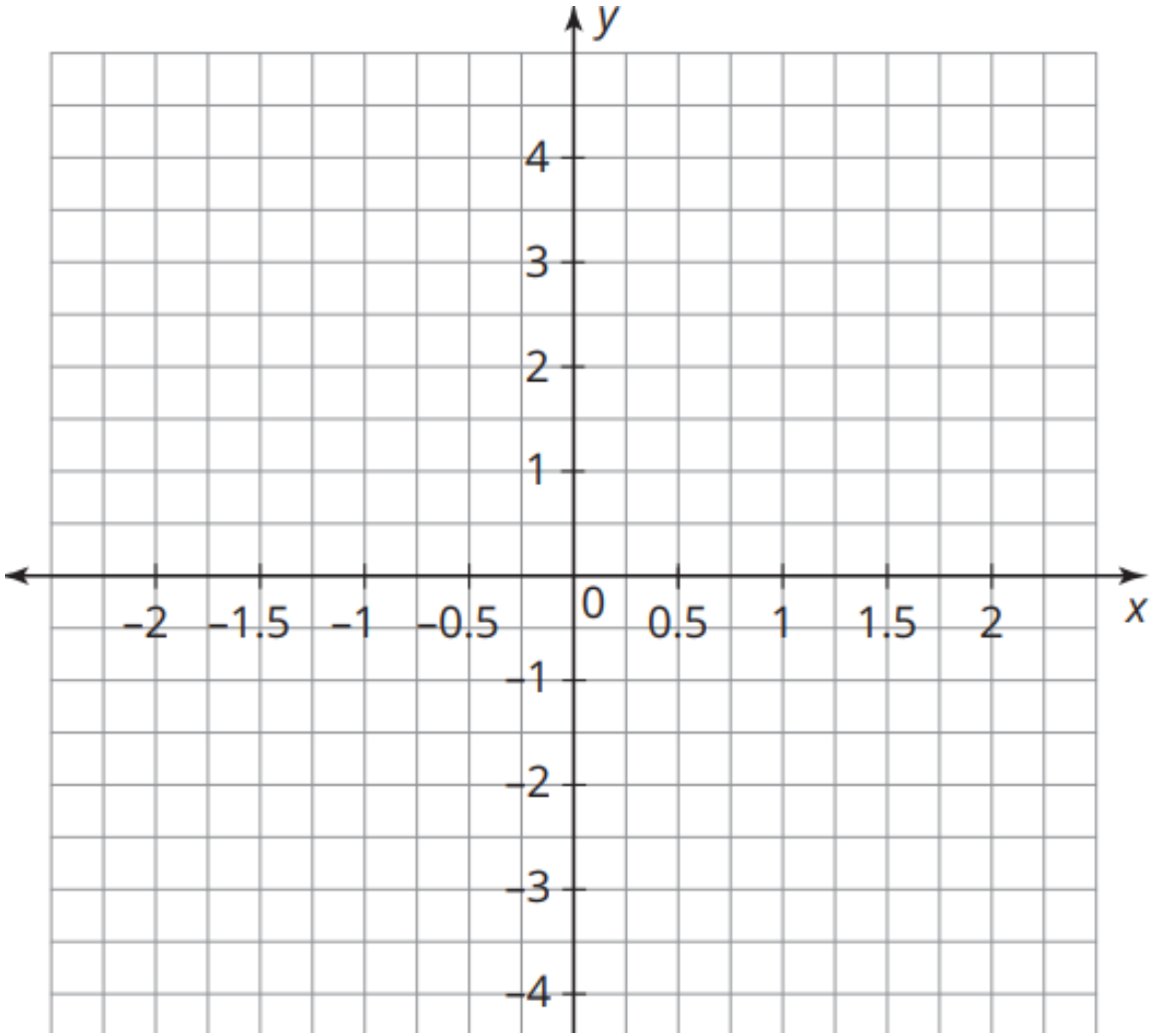
How do the zeros help you construct a sketch of the function defined by the factors of the polynomial?



$V(x) = x(18 - 2x)(12 - 2x)$

Recall that the volume function for the cylindrical planter in a previous lesson was built from a quadratic function, $A(x) = \pi x^2$, representing the area of the base and a linear function, $h(x) = 2x$, representing the height.

2. **Sketch the graph of the cubic volume function that is the product of the quadratic and linear functions. Show all your work and explain your reasoning.**



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n, $h(x) = 2x$, representi

Explain how the two cubic functions presented in this activity demonstrate the Fundamental Theorem of Algebra.

The Fundamental Theorem of Algebra states that a degree n polynomial has, counted with multiplicity, exactly n zeros.

Multiplying to Create Polynomials

You can multiply to determine whether a product written in factored form is equivalent to a quadratic or cubic function written in general form.

Consider, for example, the cubic function $f(x) = 3x^3 + 16x^2 + 12x - 16$. Is the function equivalent to $g(x) = (x + 2)(3x - 2)(x + 4)$?

Worked Example

You can determine the product of the linear factors $(x + 2)(3x - 2)(x + 4)$ using multiplication tables.

Step 1:

Choose 2 of the binomials, multiply, and then combine like terms.

·	x	2
$3x$	$3x^2$	$6x$
-2	$-2x$	-4

Step 2:

Multiply the product from step 1 with the remaining binomial. Then combine like terms.

·	x	4
$3x^2$	$3x^3$	$12x^2$
$4x$	$4x^2$	$16x$
-4	$-4x$	-16

$$(x + 2)(3x - 2)(x + 4) = 3x^3 + 16x^2 + 12x - 16$$

2. **Determine each product algebraically. Show all your work and then use technology to verify your product is correct. Finally, sketch the graph and explain how the function demonstrates the Fundamental Theorem of Algebra.**

Ask yourself:

How do the factors of the given expression relate to the zeros of the graph?

a. $(x + 2)(-3x + 2)(2x + 1)$