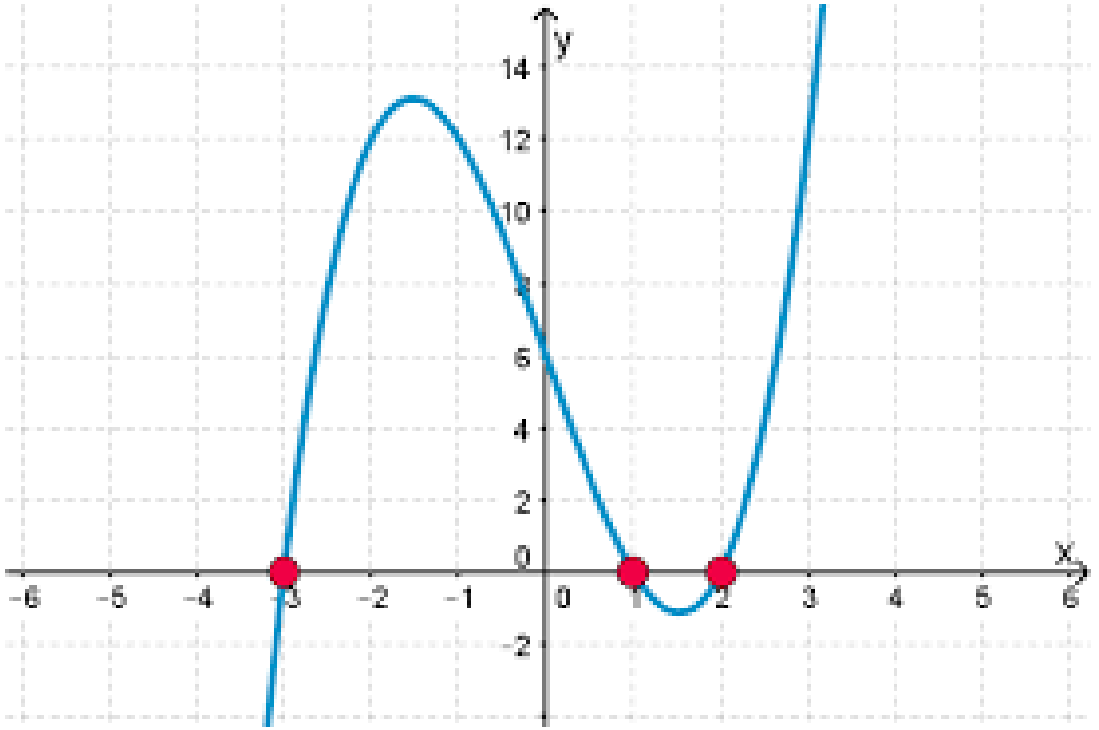
Warm-up

Copy the graph and identify
ALL information that you know.



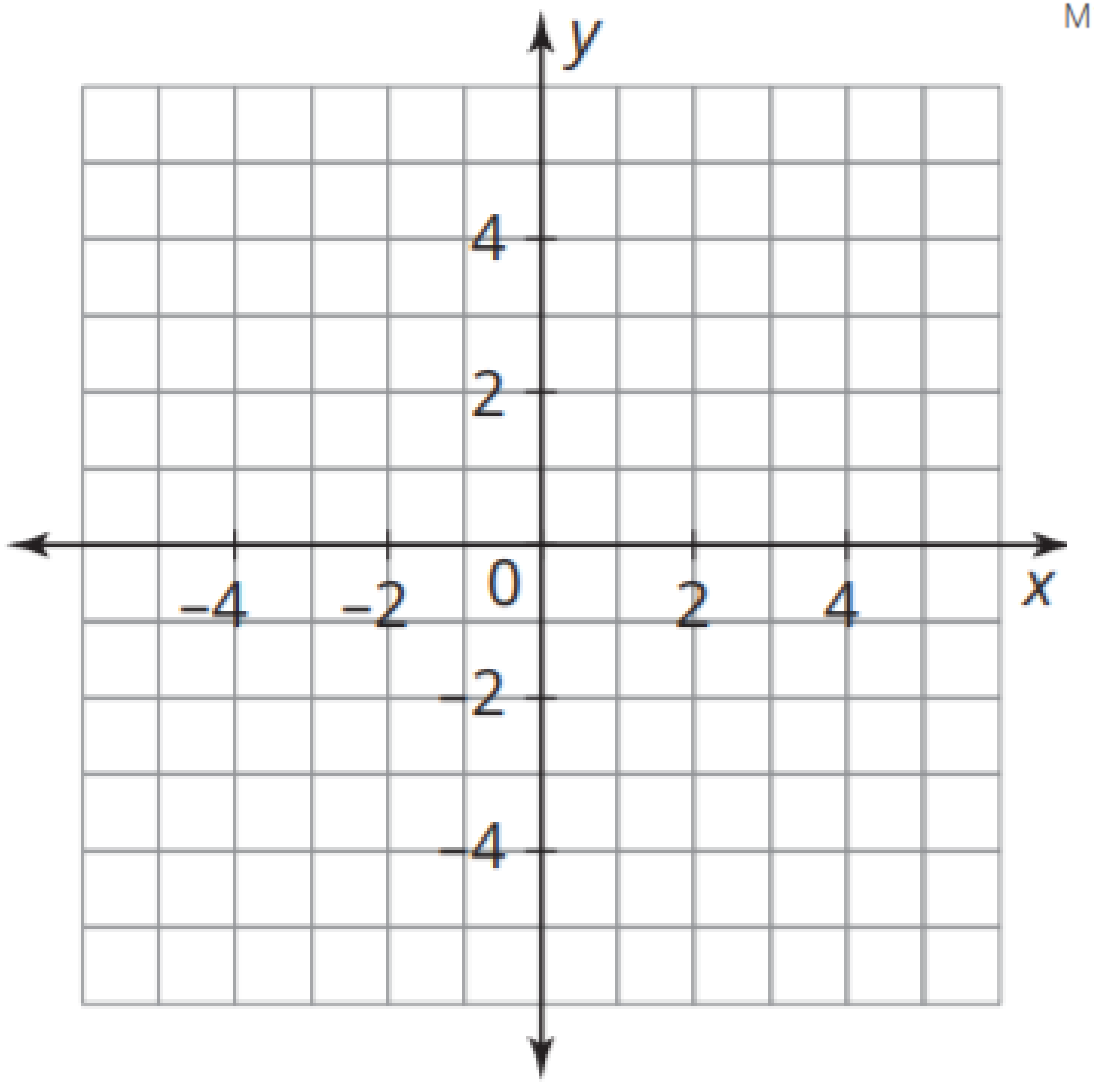
$f(x) = x$	$g(x) = x + 1$	$h(x) = x - 1$	$j(x) = -x + 1$
$m(x) = x^2$	$p(x) = x^2 + 1$	$r(x) = (x - 1)^2$	$w(x) = -(x - 1)(x + 1)$

Choose a set of functions from the functions provided whose product builds a cubic function with the given characteristics. Explain your reasoning. Then list similarities and differences between your graphs and your classmates' graphs.

c. zero: $x = 1$ (multiplicity 3)

Explanation:

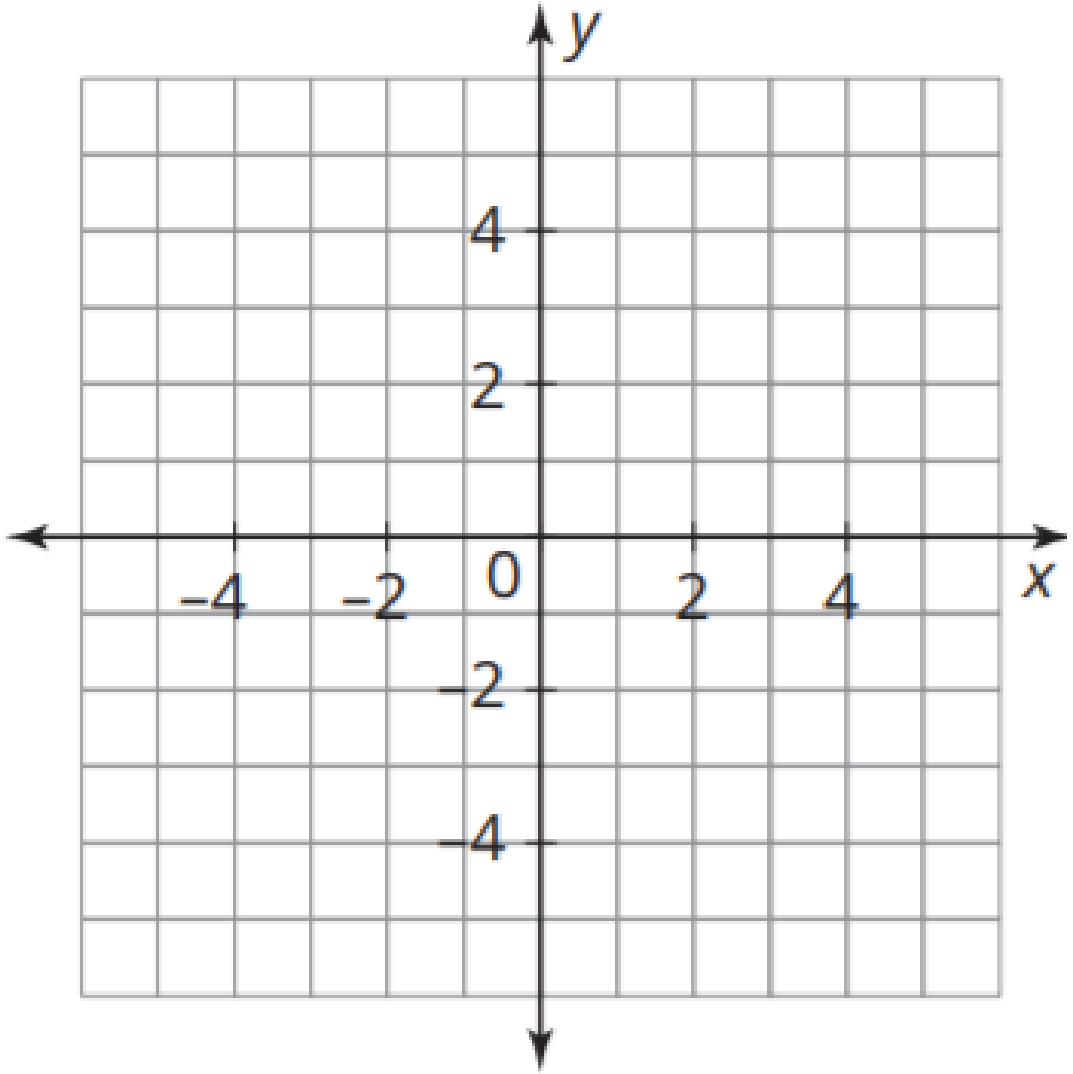
Similarities/Differences:



d. three distinct real zeros

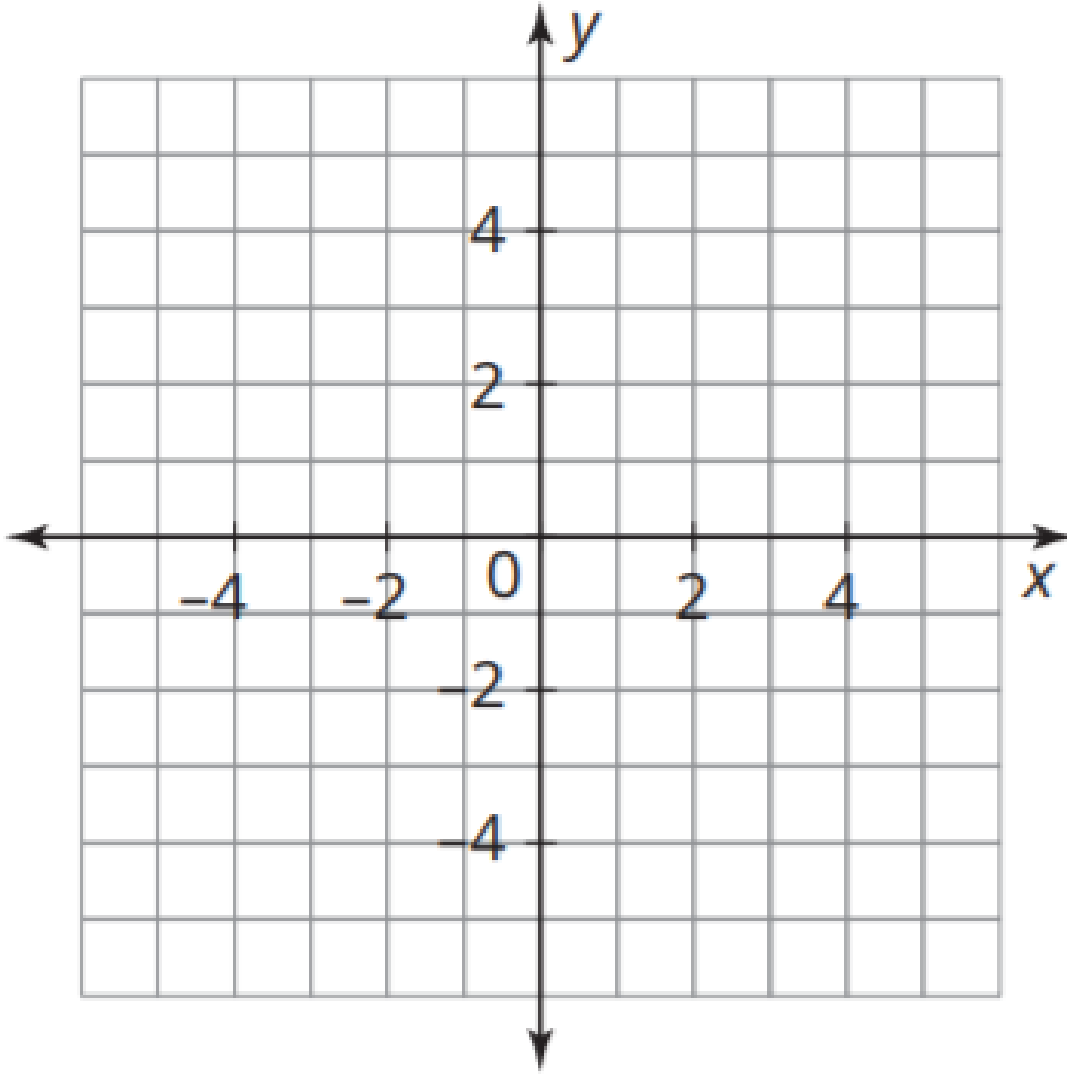
Explanation:

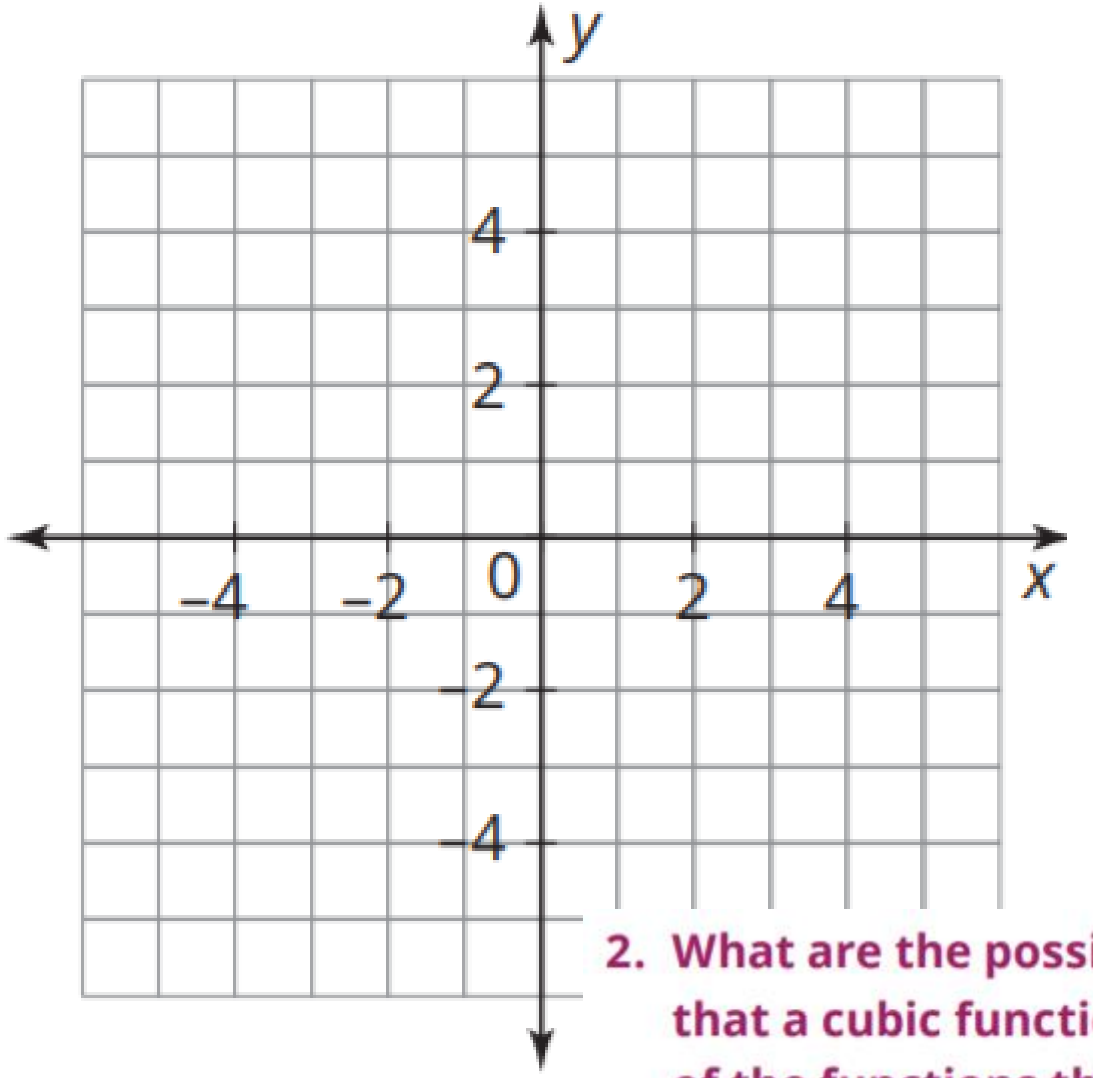
Similarities/Differences:



e. located in Quadrants I and III only
Explanation:

Similarities/Differences:





f. 3 imaginary zeros
Explanation:

Similarities/Differences:

2. What are the possible combinations of real and imaginary zeros that a cubic function can have? Explain your reasoning in terms of the functions that can build a cubic function.

3. **Emily makes an observation about the number of imaginary zeros a cubic function may have.**

Emily

A cubic function must have three zeros. I know this from the Fundamental Theorem of Algebra. However, the number of real and imaginary zeros can vary. The function may have 0, 1, 2, or 3 imaginary zeros.

Explain the error in Emily's reasoning.

4. **Augie, Kathryn, and Chili each wrote a cubic function with zeros at $x = 3$, $x = 1$, and $x = -4$.**

Augie

The cubic function $f(x) = (x - 3)(x - 1)(x + 4)$ has the three zeros given. I can verify this by solving the equations $x - 3 = 0$, $x - 1 = 0$, and $x + 4 = 0$.

Kathryn

The cubic function $g(x) = 5(x - 3)(x - 1)(x + 4)$ has the three zeros given.

Chili

The cubic function $j(x) = (2x - 6)(3x - 3)(x + 4)$ has the three zeros given.

5. **Write two different cubic functions with the given characteristics.**

   a. **zeros: $x = 2$, $x = 0$, and $x = -4$**

   b. **zeros: $x = 0$, $x = 2i$, $x = -2i$**

   c. **zeros: $x = 6$ (multiplicity 2) and $x = -5$**

   d. **zeros: $x = 2$, $x = 3$, $x = 1$ and a y-intercept $(0, -24)$**