

Name: _____

Date: _____ # _____

Section 5-2 Polynomials, Linear Factors, and Zeros

Learning Goal: To understand how to analyze the factored form of a polynomial; to understand how to write a polynomial function from its zeros.

Essential Questions: What does the degree of a polynomial tell you about its related polynomial function?

For a polynomial function, how are factors, zeros, and x-intercepts related?

For a polynomial equation, how are factors and roots related?

Warm Up:

Factor:

1. $x^2 + 7x + 12$

2. $x^2 + 8x - 20$

3. $x^2 - 14x + 24$

4. $3x^2 - 9x + 6$

5. $36x^2 - 84x + 49$

6. $121x^2 - 400$

7. $x^3 - 2x^2 - 15x$

8. $x^3 - x^2 - 12x$

Vocabulary:

Roots, Zeros, x-intercepts, and solution to the equation - all mean the same thing.

Example: Let $P(x) = -x^3 + 2x + 4$, and let $x = 2$.

$$\text{Then } P(2) = -(2)^3 + 2(2) + 4 = 0$$

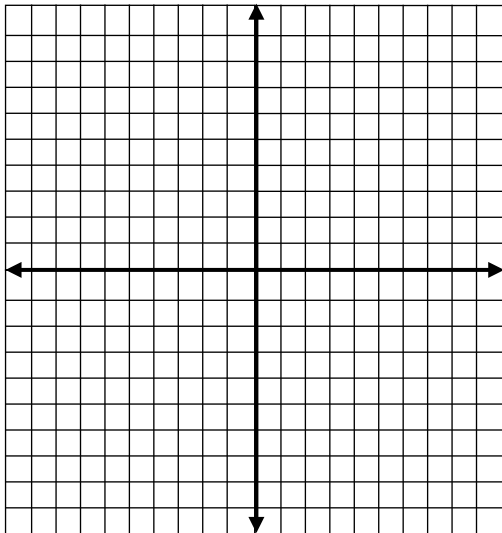
Therefore,

- $x - 2$ is a factor of $-x^3 + 2x + 4$
- 2 is a zero for the polynomial function $P(x)$
- 2 is a solution to the equation
- The point $(2, 0)$ is an x-intercept of the graph of $P(x) = -x^3 + 2x + 4$

Finding the Zeros of a Polynomial Function

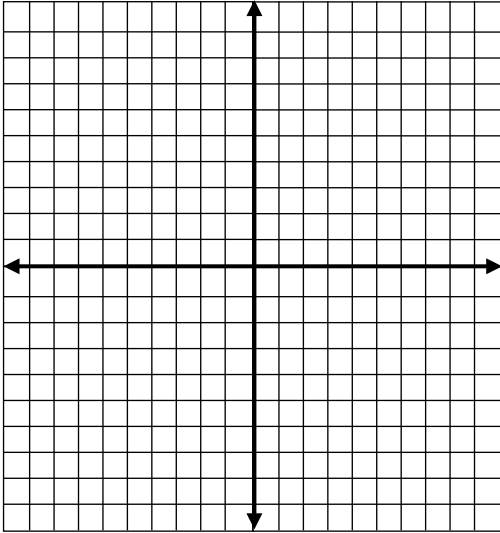
1. Factor the polynomial.
2. Use the zero-product property to find the zeros.
3. Find the point for the x-values between the zeros.
4. Using your x-values solve for y, to create an order pair.
5. Determine the end behavior.
6. Use the zeros and the additional points and the end behavior to sketch the graph .

Example: What are the zeros of $y = (x + 2)(x - 1)(x - 3)$? Graph the function.

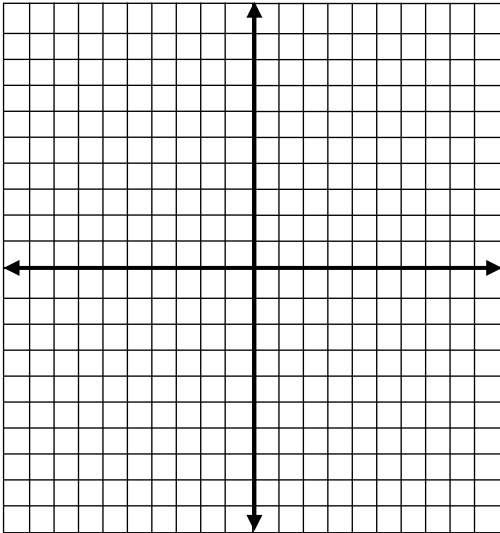


You Try:

1. What are the zeros of $y = x(x - 3)(x + 5)$? Graph the function.



2. What are the zeros of $y = -(x - 3)(x + 4)(x - 1)$? Graph the function.



Factor Theorem - The expression $x - a$ is a factor of a polynomial if and only if the value a is a zero of the related polynomial function.

1. Identify the zeros
2. Write a linear factor for each zero
3. Multiply 2 of the binomials together
4. Multiply the 3rd binomial to the product of the two
5. Keep multiplying until all the factors are gone and you are left with a standard form polynomial.
6. Simplify your expression
7. Write as $f(x) =$

Example: What is the cubic polynomial function in standard form with zeros -2, 2, and 3?

You Try:

3. What is the cubic polynomial function in standard form with zeros 1, -1, and 4?

4. What is the quartic polynomial function in standard form with zeros -2, -2, 2 and 3?

Multiple Zeros- a repeated linear factor

Multiplicity – is the number of times the related linear factor is repeated in the factored form of the polynomial. (note: a graph bounces at a multiplicity point)

How Multiple Zeros Affect a Graph

Example: What are the zeros of $f(x) = x^4 - 2x^3 - 8x^2$. How does the graph behave at these zeros?

You Try:

5. What are the zeros of $f(x) = x^3 - 5x^2 + 3x + 9$? What are the multiplicities? How does the graph behave at these zeros?

The graph of a polynomial function can have several turning points, the function can have a relative maximum and a relative minimum.

Relative Maximum – is the value of the function at an up to down turning point

Relative Minimum – is the value of the function at a down to up turning point

6. What are the relative maximum and minimum of $f(x) = x^3 - 9x$?

Closure: What do the zeros of a polynomial function tell you about the function's graph?

Assignment: section 5.2 # 7,10,11,12,14,15,16,20,21,27,29,31,32,35,44 (15 problems)