

## Algebra 2 Honors

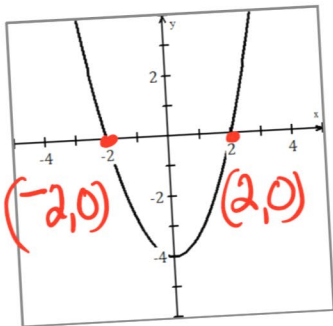
# The Fundamental Theorem of Algebra



### Lesson 6: The Fundamental Theorem of Algebra

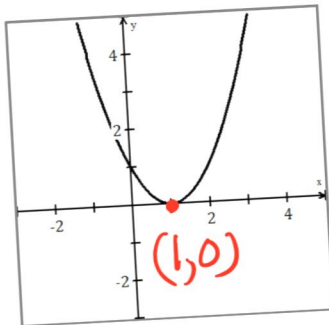
**Fundamental Theorem of Algebra** – If  $P(x)$  is a polynomial of degree  $n \geq 1$  with complex coefficients, then  $P(x) = 0$  has at least one complex root.

**Example:**  $P(x) = 3x^3 - 2x + 3$  is a polynomial of degree 3, so  $P(x) = 0$  has at least one complex root.



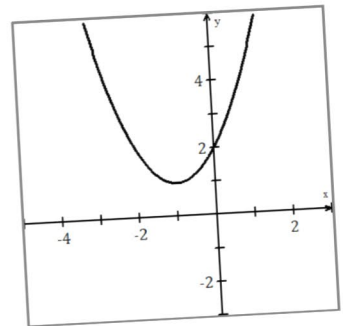
$$y = x^2 - 4$$

two real zeros



$$y = x^2 - 2x + 1$$

one real zero



$$y = x^2 + 2x + 2$$

no real zeros

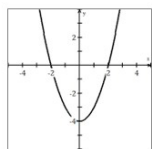
# Completely Editable

# 5.6

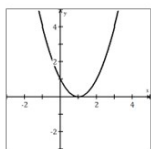
## Lesson 5.6: The Fundamental Theorem of Algebra

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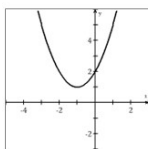
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$$y = x^2 - 4$$



$$y = x^2 - 2x + 1$$



$$y = x^2 + 2x + 2$$

### Using the Fundamental Theorem

1. Write polynomial in standard form.
2. Find the list of possible rational roots.
3. Use synthetic division to find roots.
4. Continue to factor until you have linear factors.
5. Use Fundamental Theorem to find remaining roots.

**EX #1:** What are the roots of the equation  $x^4 + 2x^3 = 13x^2 - 10x$ ?

**EX #2:** What are all the zeros of the function  $g(x) = 2x^4 - 3x^3 - x - 6$ ?

### Linear Factors

**EX #3:** Find all the zeros of the function by factoring completely, into a product of linear factors.  $f(x) = x^4 - 2x^3 - x^2 + 2x$

### Finding Zeros of Polynomials

**EX #4:** Without using a calculator, find all the roots of the equation.  
 $x^4 + 4x^3 + 7x^2 + 16x + 12 = 0$

### Using Descartes' Rule of Signs

**EX #5:** State the number of complex roots, the possible number of real roots, and the possible rational roots. Then find all the roots of the polynomial  
 $f(x) = x^4 - x^3 - 7x^2 + 5x + 10$ .

### Putting It All Together

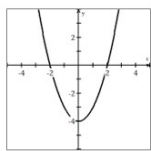
**EX #6:** Find all rational roots for  $P(x) = 2x^3 - 3x^2 - 18x - 8$

# NOTES

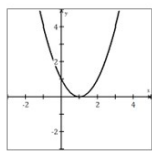
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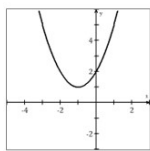
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### Putting It All Together

**EX #6:** Find all rational roots for  $P(x) = 2x^3 - 3x^2 - 18x - 8$

# Practice Sets

# Lesson Warm-Ups

1. Use Descartes' Rule of Signs to state the number of complex roots, the possible number of real roots and the possible rational roots.

2. Then, find the roots of the polynomial.

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

## Lesson 5.6: The Fundamental Theorem of Algebra

## Warm-Up #2

**Questions 1 - 2:** Given the polynomial equation  $x^4 + x^3 - 5x^2 + x - 6 = 0$

1. Use Descartes' Rule of Signs to state the number of complex roots, and the possible rational roots.

2. Then, find the roots of the polynomial.

### 5.6 The Fundamental Theorem of Algebra Form A

Name \_\_\_\_\_

Date \_\_\_\_\_ Period \_\_\_\_\_

1. Find all the roots of the equation.  
 $x^3 - 4x^2 - 7x + 10 = 0$

2. Find the rational roots of the function.  
 $x^3 + 3x^2 - 2x - 6 = 0$

### 5.6 The Fundamental Theorem of Algebra Form B

Name \_\_\_\_\_

Date \_\_\_\_\_ Period \_\_\_\_\_

1. Find all the roots of the equation.  
 $x^3 - 2x^2 - 11x + 12 = 0$

2. Find the rational roots of the function.  
 $x^3 + 2x^2 - 3x - 6 = 0$

Grade: \_\_\_\_\_

Grade: \_\_\_\_\_

# Daily Lesson Quiz