Objective: Find all complex zeros of a polynomial function.

## <u>Concept</u>

<u>Fundamental Theorem of Algebra</u>: Every polynomial equation of degree greater than zero has at least one root in the set of complex numbers. Also, the number of complex roots, including those that repeat, is equal to the degree.

8x + 5 = 0

Degree = 1 Number of complex roots = 1

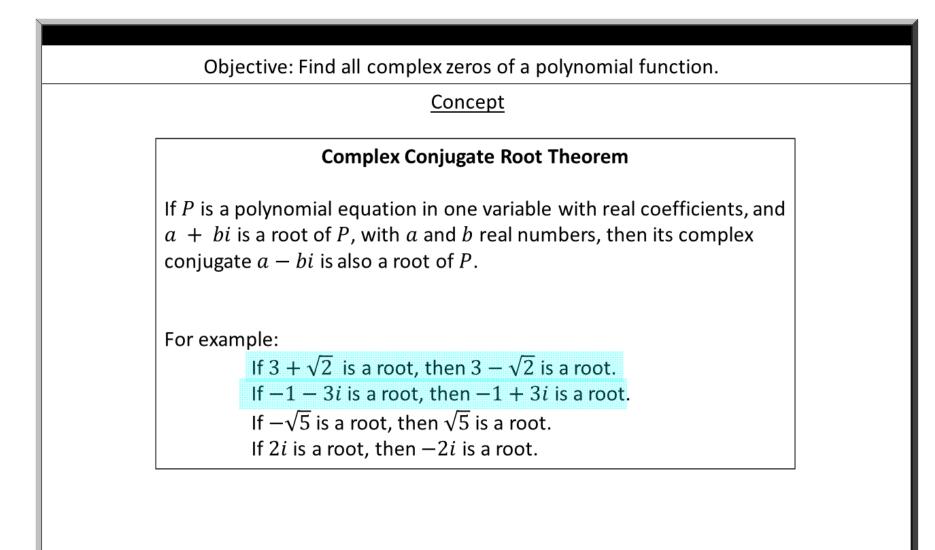
$$8x^2 + 5 = 0$$

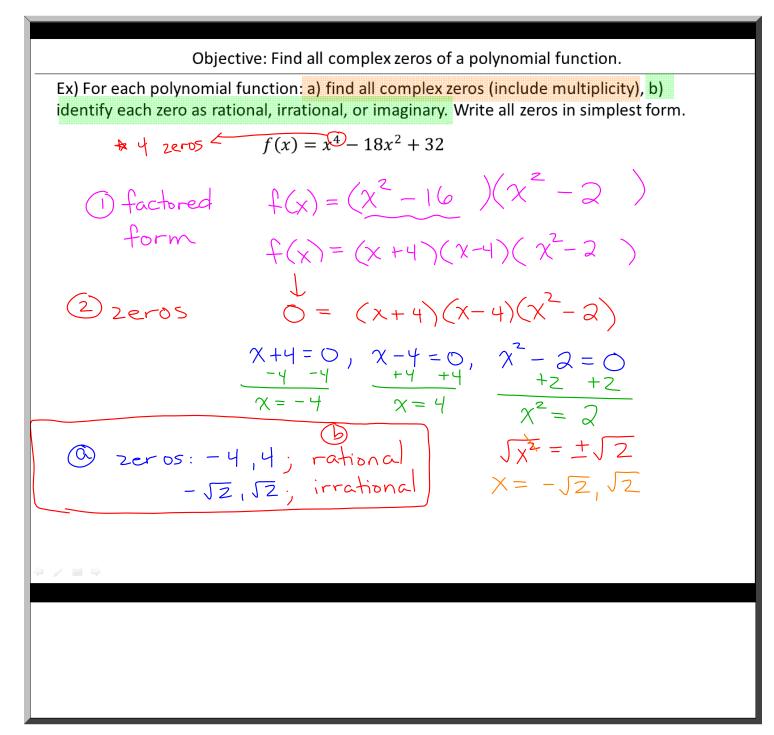
Degree = 2 Number of complex roots = 2

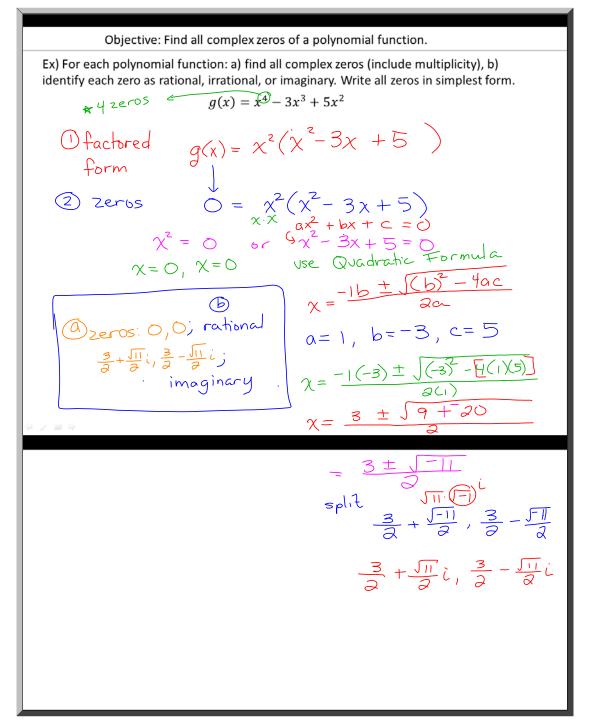
 $x^3 - 8x^2 + 5 = 0$ 

 $x^4 - 8x^2 + 5 = 0$ 

Degree = 3 Number of complex roots = 3 Degree = 4 Number of complex roots = 4

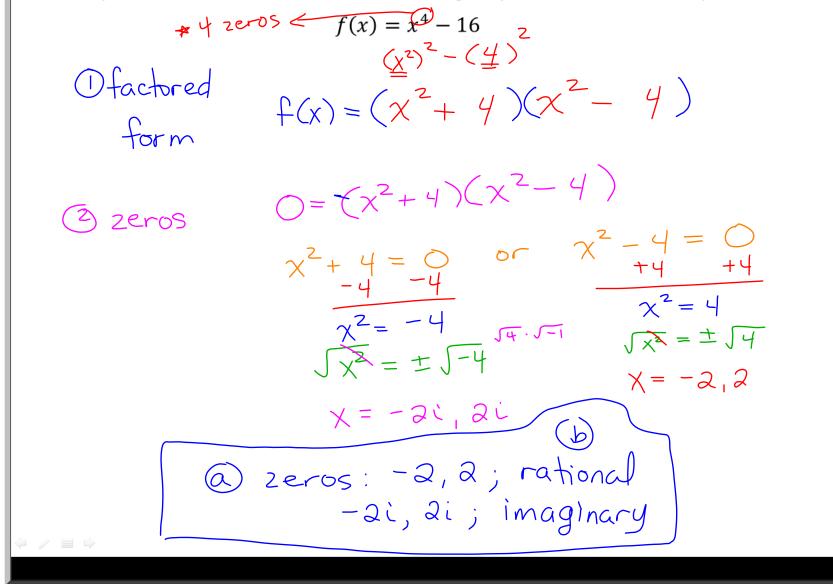




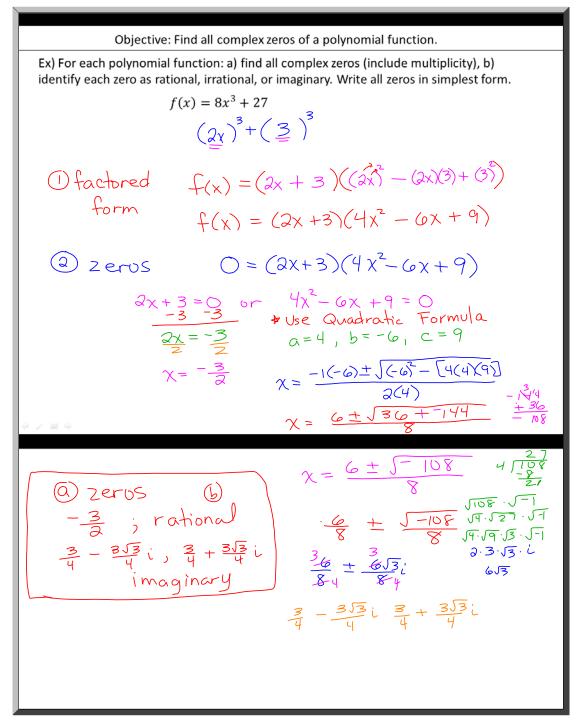


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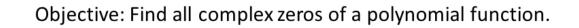
Ex) For each polynomial function: a) find all complex zeros (include multiplicity), b) identify each zero as rational, irrational, or imaginary. Write all zeros in simplest form.



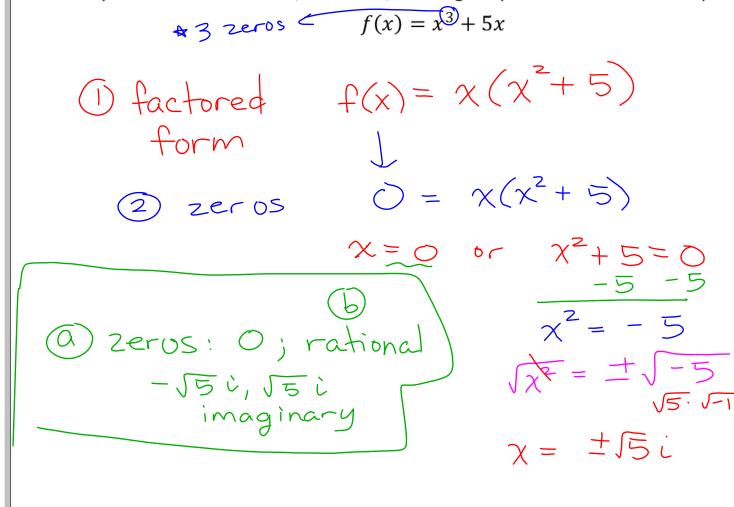
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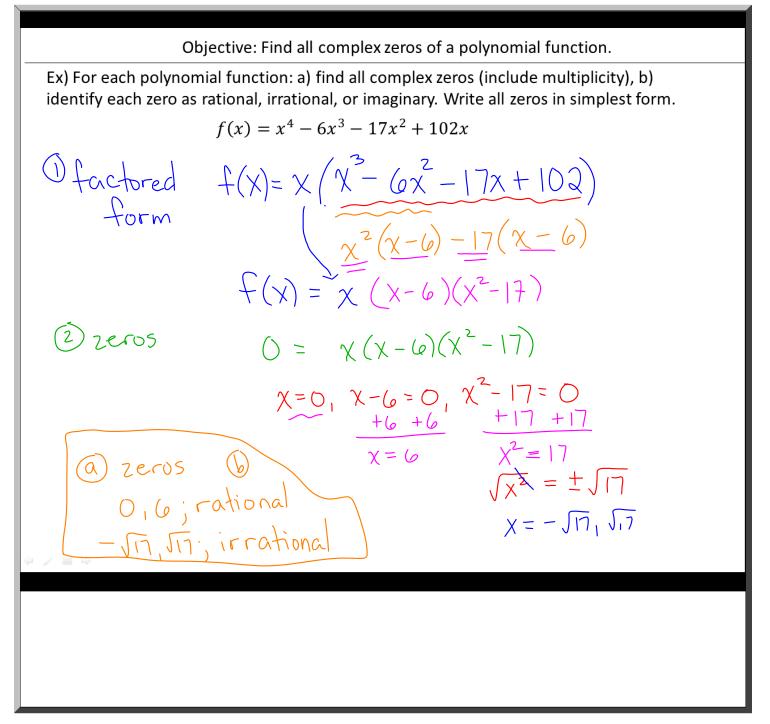


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Ex) For each polynomial function: a) find all complex zeros (include multiplicity), b) identify each zero as rational, irrational, or imaginary. Write all zeros in simplest form.





Objective: Find all complex zeros of a polynomial function.

## <u>Closure</u>

Irene found the zeros of the polynomial function below. Her work is shown. What is Irene's error? How would you correct the error and what is the correct answer?

$$f(x) = x^4 + 5x^2 - 36$$

$$0 = x^{4} + 5x^{2} - 36$$
  

$$(x^{2} - 4)(x^{2} + 9) = 0$$
  

$$(x + 2)(x - 2)(x^{2} + 9) = 0$$
  

$$x + 2 = 0 \quad x - 2 = 0 \quad x^{2} + 9 = 0$$
  

$$x = -2 \quad x = 2 \quad x^{2} = 9$$
  

$$x = \pm \sqrt{9}$$
  

$$x = \pm 3$$
  
[zeros: -2, 2, -3, 3]

Irene's error is that she didn't subtract the 9. I would correct the error by writing  $x = \pm \sqrt{-9}$  which gives  $x = \pm 3i$ . The zeros are -2,2,-3i and 3i.