LESSON 3.2c

Complex Solutions and Zeros

Where are we? What are we doing? Where are we going?

Learning how to "***solve***" quadratic functions/equations

… find the "***roots***" of the function/equation … which are the same as the *x*-intercepts.

1. Solve by ***graphing*** the equation on your graphing calculator (yesterday)

2. Solve ***Algebraically***
   - using square roots (L3.1 yesterday)
   - **by factoring / "finding the zeros" of the function (L3.1 today)**
     - **when the quadratic has *COMPLEX SOLUTIONS***
   - completing the square (L3.3)
   - using the quadratic function (L3.4)

Today you will:

- Solve quadratic functions with complex solutions
- Practice using English to describe math processes and equations

So far…

- We've said when asked to solve something like the following the answer is ***no solution***:
  - $x^2 = -4$
- Actually the correct answer is:
  - No solution ***IN THE REAL NUMBER SYSTEM***
- But what if we considered the ***complex number system***? Would we be able to get an answer then?

Solve (a) $x^2 + 4 = 0$ and (b) $2x^2 - 11 = -47$.

SOLUTION

a. $x^2 + 4 = 0$ Write original equation.

$x^2 = -4$ Subtract 4 from each side.

$x = \pm\sqrt{-4}$ Take square root of each side.

$x = \pm 2i$ Write in terms of i.

▶ The solutions are $2i$ and $-2i$.

LOOKING FOR STRUCTURE

Notice that you can use the solutions in Example 6(a) to factor $x^2 + 4$ as $(x + 2i)(x - 2i)$.

b. $2x^2 - 11 = -47$ Write original equation.

$2x^2 = -36$ Add 11 to each side.

$x^2 = -18$ Divide each side by 2.

$x = \pm\sqrt{-18}$ Take square root of each side.

$x = \pm i\sqrt{18}$ Write in terms of i.

$x = \pm 3i\sqrt{2}$ Simplify radical.

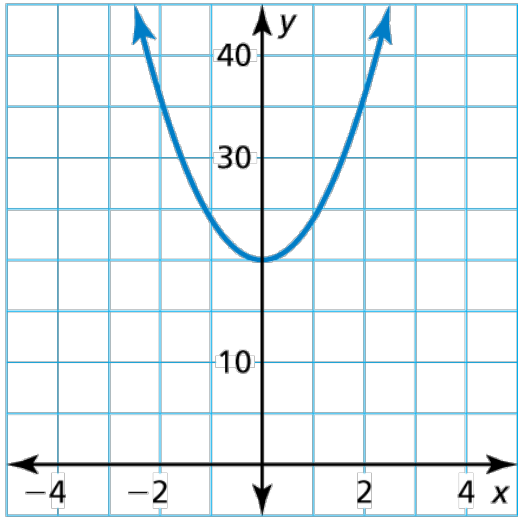
▶ The solutions are $3i\sqrt{2}$ and $-3i\sqrt{2}$.

Work on #49-50 page 109 in your text.

You have 10 minutes.

FINDING AN ENTRY POINT

The graph of f does not intersect the x-axis, which means f has no real zeros. So, f must have complex zeros, which you can find algebraically.



Find the zeros of $f(x) = 4x^2 + 20$.

SOLUTION

$4x^2 + 20 = 0$	Set $f(x)$ equal to 0.
$4x^2 = -20$	Subtract 20 from each side.
$x^2 = -5$	Divide each side by 4.
$x = \pm\sqrt{-5}$	Take square root of each side.
$x = \pm i\sqrt{5}$	Write in terms of i.

So, the zeros of f are $i\sqrt{5}$ and $-i\sqrt{5}$.

Check

$f(i\sqrt{5}) = 4(i\sqrt{5})^2 + 20 = 4 \cdot 5i^2 + 20 = 4(-5) + 20 = 0$ ✓

$f(-i\sqrt{5}) = 4(-i\sqrt{5})^2 + 20 = 4 \cdot 5i^2 + 20 = 4(-5) + 20 = 0$ ✓

Work on #55-62 page 109 in your text.

You have 10 minutes.

Homework

Pg 109, # 49-61, 63-65, 67-68, 71-74