Warm Up:

Check your hw answers with your neighbor and decide who's right on answers that differ.

Oct 23-9:19 AM

4-1 HW Answer Key

1. $\sqrt{-1}$
2. -1
3. $i\sqrt{r}$
4. 7i
5. -9i
6. $2i\sqrt{6}$
7. $6i\sqrt{5}$
8. -12
9. $2i\sqrt{15}$
10. $-3i\sqrt{5}$
11. -11
12. 50i
13. 2i
14. $-4i\sqrt{2}$
15. 12i
16. $x = \pm i\sqrt{5}$
17. $x = \pm 6i$
18. There is no real number that you can multiply by itself and get a negative number. For example, 2•2 = 4; -2•-2 = 4.

Sep 1-1:38 PM

Name Key

Alg 2 Homework 4-1

1. $i = \sqrt{-1}$
2. $i^2 = -1$
3. $\sqrt{-r} = i\sqrt{r}$

Simplify:

4. $\sqrt{-49} = 7i$
5. $-\sqrt{-81} = -9i$
6. $\sqrt{-24} = i\sqrt{4}\sqrt{6} = 2i\sqrt{6}$
7. $2\sqrt{-45} = 2i\sqrt{9}\sqrt{5} = 6i\sqrt{5}$
8. $\sqrt{-4} \bullet \sqrt{-36} = 2i(6i) = 12i^2 = 12(-1) = -12$
9. $\sqrt{6} \bullet \sqrt{-10} = \sqrt{6} \cdot i\sqrt{10} = i\sqrt{60} = i\sqrt{4}\sqrt{15} = 2i\sqrt{15}$
10. $-\sqrt{-3} \bullet \sqrt{15} = -i\sqrt{3}\sqrt{15} = -i\sqrt{45} = -i\sqrt{9}\sqrt{5} = -3i\sqrt{5}$
11. $(\sqrt{-11})^2 = -11$
12. $5\sqrt{-100} = 5i\sqrt{100} = 5i(10) = 50i$
13. $\frac{1}{2}\sqrt{-16} = \frac{1}{2} i\sqrt{16} = \frac{1}{2}(4)i = 2i$
14. $-\sqrt{-32} = -i\sqrt{16}\sqrt{2} = -4i\sqrt{2}$
15. $\sqrt{-144} = 12i$

Aug 12-3:48 PM

Solve for x and put answer in i form.

16. $x^2 + 5 = 0$

$x^2 = -5$

$x = \pm i\sqrt{5}$

17. $x^2 + 36 = 0$

$x^2 = -36$

$x = \pm 6i$

18. Explain why there is no real number that is the square root of a negative number. For example, think about the $\sqrt{-4}$.

There's no real # that you can multiply by itself and get a negative #.

EX. $2(2) = 4$

$-2(-2) = 4$

Aug 12-3:49 PM

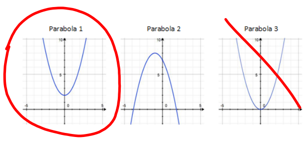
Complex numbers

Algebra 2 Unit 4 Day 2

Yesterday we learned about a new number i. Today we are going to take it a step further and learn about complex numbers.

Which of these three parabolas are represented by a quadratic equation $y = ax^2+bx+c$ that has no real solution to $ax^2 + bx + c = 0$? Explain.

Does not cross the x-axis



Using the quadratic formula, $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$, try solving $x^2 + 2x + 5 = 0$.

a : 1 b : 2 c : 5

$b^2 - 4ac : (2)^2 - 4(1)(5)$

$: 4 - 20 : -16$

$x = \frac{-2 \pm \sqrt{-16}}{2}$

$x = \frac{-2 \pm 4i}{2}$

$: \frac{-2}{2} \pm \frac{4}{2} i$

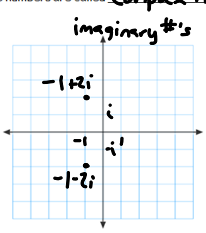
$: -1 \pm 2i$ a+bi form

real part

pure imaginary

Sep 1-1:55 PM

These numbers are called complex numbers, which we can locate in the complex plane.



$-1 \pm 2i$

$-1 + 2i$ $-1 - 2i$

(-1, 2) (-1, -2)

Sep 1-1:56 PM

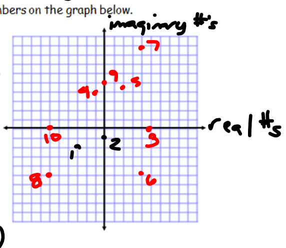
In fact, all complex numbers can be written in the form a + bi, where a and b are real numbers. Just as we can represent real numbers on the number line, we can represent complex numbers in the complex plane. Each complex number a+bi can be located in the complex plane in the same way we locate the point (a, b) in the Cartesian plane. From the origin, translate a units horizontally along the real axis and b units vertically along the imaginary axis.

Are real numbers also complex numbers? Explain.

Yes $6+0i$ $32+0i$ You can add a $0i$ onto any real part.

Plot and label the following complex numbers on the graph below.

1. $-3-2i \rightarrow (-3,-2)$
2. $-i \rightarrow 0-i \rightarrow (0,-1)$
3. $5+0i$ $(5,0)$
4. $-1+4i$ $(-1,4)$
5. $2+(9/2)i$ $(2,9/2)$
6. $4-5i$ $(4,-5)$
7. $9i+4$ $(4,9)$
8. $-5i-6$ $(-6,-5)$
9. $5i \rightarrow 0+5i$ $(0,5)$
10. $-6 \rightarrow -6+0i$ $(-6,0)$



Sep 1-1:56 PM

Since complex numbers are built from real numbers, we should be able to add, subtract, multiply and divide them. **Note: We are not going to look at division.**

Addition with Complex Numbers

Example 1: (3 + 4i) + (7 - 20i)

$: 10-16i$

You try: (6 - i) + (3 - 2i)

$: 9-3i$

Subtraction with Complex Numbers

Example 2: (3 + 4i) - (7 - 20i)

$: 3+4i-7+20i$

$: -4+24i$

You try: (6 - i) - (3 - 2i)

$: 6-i-3+2i$

$: 3+i$

Sep 1-1:57 PM

Multiplication with Complex Numbers (Note: rewrite i^2 as -1)

Example 3: (1 + 3i)(4 - 2i)

$: 4-2i+12i-6i^2$

$: 4+10i+6$

$: 10+10i$

You try: (6 - i)(3 - 2i)

$= 18-12i-3i+2i^2$

$= 18-15i-2$

$= 16-15i$

Multiply the following complex numbers with its conjugate:

1. (x + i)(x - i)= $x^2 - \cancel{xi} + \cancel{xi} - i^2 : x^2+1$
2. (x + 5i)(x - 5i)= $x^2 - \cancel{5xi} + \cancel{5xi} - 25i^2 : x^2+25$
3. (5 + 4i)(5 - 4i)= $25-20i+20i-16i^2$ $: 25+16 : 41$

What patterns do you notice?

Middle terms will always cancel out. Final answer will always be a real number

Show that for any real numbers a and b, (a + bi)(a - bi) is a real number.

$(a+bi)(a-bi)$

$: a^2 - \cancel{abi} + \cancel{abi} - b^2i^2 = a^2+b^2$

The product of a complex # and its conjugate is a polynomial with real coefficients.

Sep 1-1:57 PM

Example 4: How would you verify that -1 + 2i and -1 - 2i are solutions to $x^2 + 2x + 5 = 0$? Go ahead and see.

$-1+2i \xrightarrow{sto} x$

x^2+2x+5 on your home screen

Jun 30-10:21 AM

You do:

Express the quantities below in a + bi form, then graph and label the corresponding points on the complex plane.

1. (1 + i) - (1 - i)

$: 1+i-1+i$

$: 2i : 0+2i$ $(0,2)$

2. (1 + i)(1 - i)

$: 1 - \cancel{i} + \cancel{i} - i^2$

$: 1+1 : 2 : 2+0i$ $(2,0)$

3. i(2 - i)(1 + 2i)

$(2i-i^2)(1+2i)$

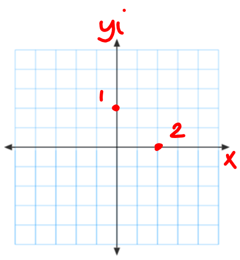
$: (2i+1)(1+2i)$

$: (1+2i)(1+2i)$

$: 1+2i+2i+4i^2$

$: 1+4i-4$

$: -3+4i$



Sep 1-1:57 PM

Oct 26-7:51 AM