4-2 HW Answer Key

1. $3 + 5i$

2. Yes, real numbers can be written as $a + bi$ where $b = 0$. (Ex. $3 + 0i$)

3. 24

4. -12

5. $6i\sqrt{3}$

6. $20 - i$ 7. $13 - 9i$

8. $-5 + 31i$ 9. $3 - 3i$

10. $22 + 14i$ 11. $16 - 38i$

12. $3 - 2i$, $-4 + 6i$, $x + 5i$

13. $x^2 + 49$

14. 34

See attached for graph key

Name Key Alg 2 Homework 4-2

1. Give an example of a complex number. $3+5i$

2. Are real numbers complex? Yes

Explain. Real #'s can be written as $a+bi$ where $b=0$.
Ex. $3=3+0i$

Simplify:

3. $(2\sqrt{6})^2 = 4(6) = 24$

4. $(\sqrt{-6})(\sqrt{-24}) = i\sqrt{6} \cdot i\sqrt{24} = i^2\sqrt{144} = -1(12) = -12$

5. $(\sqrt{6})(\sqrt{-18}) = \sqrt{6} \cdot i\sqrt{18} = i\sqrt{108} = i\sqrt{36}\sqrt{3} = 6i\sqrt{3}$

Add, subtract or multiply the following complex numbers.

6. $(13 + 4i) + (7 - 5i) = 20 - i$

7. $(8 - 6i) + (5 - 3i) = 13 - 9i$

8. $(3 + 11i) - (8 - 20i) = -5 + 31i$

9. $(8 - 6i) - (5 - 3i) = 3 - 3i$

10. $(2 + 4i)(5 - 3i) = 10 - 6i + 20i - 12i^2$
$= 10 + 14i + 12$
$= 22 + 14i$

11. $(7 - i)(3 - 5i) = 21 - 35i - 3i + 5i^2$
$= 21 - 38i - 5$
$= 16 - 38i$

(Continued on back→)

12. What are the conjugates of:

(3 + 2i)? $3-2i$ (4 - 6i)? $-4+6i$ (x - 5i)? $x+5i$

<u>Multiply the following complex numbers with its conjugate:</u>

13. (x + 7i)(x - 7i) = $x^2-7xi+7xi-49i^2$

$= x^2+49$

14. (3 + 5i)(3 - 5i) = $9-15i+15i-25i^2$

$= 9+25$

$= 34$

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

1. (-3 + 2i) + (-3 - 2i) $= -6+0i$

2. (3 + 2i) - (3 - 2i) $= 4i$

3. (4 + 5i) - (7 - 3i) $= -3+8i$

4. (4 + 5i) + (5 - 3i) $= 9+2i$

5. (2 + 2i)(2 - 2i) = $4-4i+4i-4i^2$

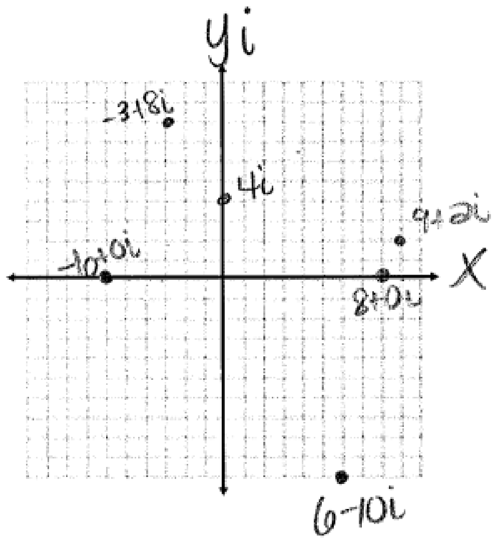
$= 4+4$

$= 8+0i$

6. (-4 + i)(-2 + 2i) $= 8-8i-2i+2i^2$

$= 8-10i-2$

$= 6-10i$



Powers of i and more operations with complex numbers

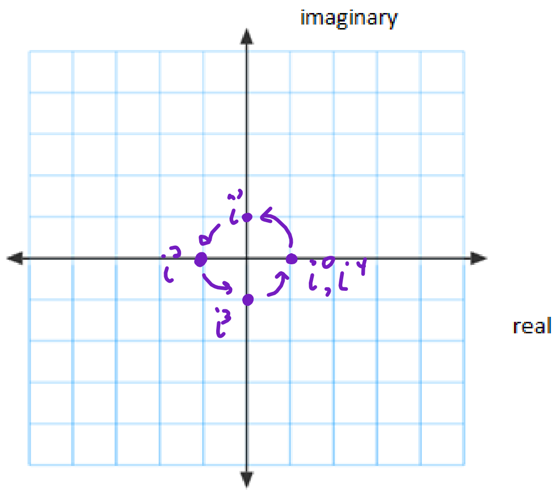
$i^1 = i$ $i^2 = -1$

Since $i^2 = -1$, we can see that:

$i^3 = i^1 \cdot i^2 = i(-1) = -i$

$i^4 = i^2 \cdot i^2 = (-1)(-1) = 1$

Plot i, i^2, i^3 and i^4 on the complex plane to the r



Simplify the following:

$i^5 = \cancel{i^4} \cdot i^1 = i$

$i^6 = \cancel{i^4} \cdot i^2 = -1$

$i^7 = \cancel{i^4} \cdot i^3 = -i$

$i^8 = \cancel{i^4} \cdot \cancel{i^4} = 1$

$i^9 = \cancel{i^4} \cdot \cancel{i^4} \cdot i^1 = i$

$(i^4)^2 \cdot i^1$

Powers of i

$$\boxed{\begin{aligned} i^0 &= 1 \\ i^1 &= i \\ i^2 &= -1 \\ i^3 &= -i \\ i^4 &= 1 \end{aligned}}$$

Simplify i^{102}. Divide exponent by 4

$$4\overline{)102}\;=\;25\text{ R}2 \qquad \begin{array}{r} 102 \\ -8 \\ \hline 22 \\ -20 \\ \hline 2 \end{array}$$

$i^{102} = (\cancel{i^4})^{25}(i)^2 = i^2 = -1$

calculator .25 = R1 .5 = R2 .75 = R3

Simplify the following:

1. $i^{26} = (i)\, i \cdot i^2 = -1$

$26/4 = 6R2$

2. $i^{43} = i^3 = -i$

$43/4 = 10R3$

3. $i^{60} = i^0 = 1$

$60/4 = 15R0$

4. $i^{421} = i^1 = i$

$421/4 = 105R1$

5. $(i^6)(i^7) = i^{13} = i^1 = i$

$13/4 = 3R1$

6. $3i^2 - 6i^{12} =$

$3(-1) - 6(i^0)$

$-3 - 6 = -9$

More practice simplifying.

7. $\sqrt{-4} - \sqrt{-100} =$

$i\sqrt{4} - i\sqrt{100}$

$2i - 10i = -8i$

8. $2\sqrt{-25} - 3\sqrt{-49} = 2(5i) - 3(7i)$

$= 10i - 21i$

$= -11i$

9. $2\sqrt{-50} + \sqrt{-32} =$

$2i\sqrt{50} + i\sqrt{32}$

$2i\sqrt{25}\sqrt{2} + i\sqrt{16}\sqrt{2}$

$10i\sqrt{2} + 4i\sqrt{2}$

$14i\sqrt{2}$

10. $\sqrt{-81} \bullet \sqrt{-25} =$

$i\sqrt{81} \cdot i\sqrt{25}$

$9i \cdot 5i = 45i^2 = -45$

11. $\sqrt{-5} \bullet \sqrt{-80} =$

$i\sqrt{5} \cdot i\sqrt{80}$

$i^2\sqrt{400} = -20$

12. $-3\sqrt{-10} \bullet \sqrt{-10} = -3(-10) = 30$

$-3i\sqrt{10} \cdot i\sqrt{10}$

$-3i^2\sqrt{100}$

30

Express each of the following in a + bi form.

13. $(2 + 5i) + (4 + 3i) =$

$6 + 8i$

14. $(-1 + 2i) - (4 - 3i) = -5+5i$

$-1+2i-4+3i$

15. $(4 + i) + (2 - i) - (1 - i) =$

$4+i+2-i-1+i = 5+i$

16. $(5 + 3i)(5 - 3i) = 25-15i+15i-9i^2$

mult!

$= 25+9$

$= 34$

Find the real values of x and y using the fact that if a + bi = c + di, then a = c and b = d.

$bi = di$

17. $5x + 3yi = 20 + 9i$

Real	Imag.
$5x = 20$	$\frac{3yi}{3i} = \frac{9i}{3i}$
$x = 4$	$y = 3$

18. $-4 + yi = -12x - i + 8$

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Real	Imag.
$-4 = -12x+8$	$\frac{yi}{i} = \frac{-i}{i}$
$-8 \quad -8$	
$-12 = -12x$	$y = -1$
$1 = x$	

<u>*Complex numbers as solutions to equations*</u> Algebra 2 Unit 4 Day 4

Today, we are going to use the quadratic formula to solve quadratic equations.

Recall the quadratic formula: $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$

The discriminant is the number under the radical or b^2-4ac.

Working with your partner, **<u>determine the discriminant</u>** and then solve the following quadratic equations **<u>using the quadratic formula</u>**.

$a=1 \quad b=0 \quad c=-9$

1. $x^2 - 9 = 0$

$b^2-4ac = 0-4(1)(-9)$
$= 36$

$x = \frac{0 \pm \sqrt{36}}{2(1)} = \frac{\pm 6}{2}$

$x = \pm 3$

2. $x^2 - 6x + 9 = 0$

$b^2-4ac = 36-4(1)(9)$
$= 0$

$x = \frac{6 \pm \sqrt{0}}{2(1)}$

$= \frac{6}{2} = 3$

3. $x^2 + 9 = 0$

$b^2-4ac = 0-4(1)(9)$
$= -36$

$x = \frac{0 \pm \sqrt{-36}}{2(1)}$

$= \frac{\pm 6i}{2} = \pm 3i$

How does the value of the discriminant relate to the solutions you found?

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