4-3 HW Answer Key

$i^0 = 1$ $i^4 = 1$ $i^8 = 1$

$i^1 = i$ $i^5 = i$ $i^9 = i$

$i^2 = -1$ $i^6 = -1$ $i^{10} = -1$

$i^3 = -i$ $i^7 = -i$ $i^{11} = -i$

1. i
2. i
3. -i
4. 1
5. i
6. -1
7. -5
8. 1
9. -9
10. -2i
11. $11 + 14i$
12. -1
13. x = 8, y = 3
14. x = -3, y = -5
15. $x = \pm 6i$
16. $x = \pm 2i$
17. $12i\sqrt{2}$
18. See attached for graph.

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Name Key Alg 2 Homework 4-3

Simplify the following:

$i^0 = 1$ $i^4 = 1$ $i^8 = 1$

$i^1 = i$ $i^5 = i$ $i^9 = i$

$i^2 = -1$ $i^6 = -1$ $i^{10} = -1$

$i^3 = -i$ $i^7 = -i$ $i^{11} = -i$

Simplify the following:

1. $i^{33} = i^{32} \cdot i = i$
2. $i^{425} = i^{424} \cdot i = i$
3. $i^{51} = i^{48} \cdot i^3 = -i$
4. $i^{64} = 1$
5. $-i^{12} = -i^8 \cdot i^3 = i$
6. $i^{18} = i^{16} \cdot i^2 = -1$
7. $5i^{30} = 5i^{28} \cdot i^2 = 5(-1) = -5$
8. $(i^3)(i^7) = i^{12} = 1$
9. $4i^2 - 5i^{28} = 4(-1) - 5(1) = -4 - 5 = -9$
10. $2i^{29} = 2i^{12} \cdot i^3 = 2(-i) = -2i$

Express each of the following in a + bi form.

11. $(8 + 9i) + (3 + 5i) = 11 + 14i$
12. $(7 + 2i) + (3 - 5i) - (11 - 3i) = 10 - 3i - 11 + 3i = -1$

Find the real values of x and y.

13. $3x + 6yi = 24 + 18i$ $3x = 24$ $6y = 18$ $x = 8$ $y = 3$
14. $5(x - 1) + 3yi = -15i - 20$ $5x - 5 = -20$ $3y = -15$ $5x = -15$ $x = -3$ $y = -5$

Solve for x and put your answer in a + bi form.

15. $2x^2 + 72 = 0$ $2x^2 = -72$ $x^2 = -36$ $x = \pm 6i$
16. $4x^2 + 16 = 0$ $4x^2 = -16$ $x^2 = -4$ $x = \pm 2i$

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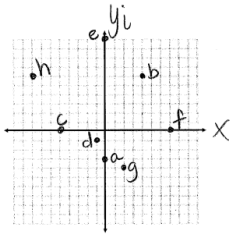
Simplify.

17. $\sqrt{-24} \cdot 2\sqrt{3} = i\sqrt{24} \cdot 2\sqrt{3}$
$= 2i\sqrt{72}$
$= 2i\sqrt{36}\sqrt{2} = 12i\sqrt{2}$

Graph and label the corresponding points on the complex plane.

a. -3i
b. 4 + 6i
c. -5
d. -1 - i
e. 0 + 10i
f. 7 - 0i
g. 2 - 4i
h. -8 + 6i



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Complex numbers as solutions to equations 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, **determine the discriminant** and then solve the following quadratic equations **using the quadratic formula**.

1. $x^2 - 9 = 0$
$a = 1 \quad b = 0 \quad c = -9$
$(0)^2 - 4(1)(-9) = 36$
$x = \frac{0 \pm \sqrt{36}}{2(1)}$
$x = \pm\frac{6}{2} = \pm 3$

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. $x^2 + 9 = 0$
$b^2 - 4ac = 0 - 4(1)(9) = -36$
$x = \frac{0 \pm \sqrt{-36}}{2(1)}$
$= \pm\frac{6i}{2} = \pm 3i$

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

Discriminant is positive → 2 real solutions
Discriminant is zero → 1 real solution
Discriminant is negative → 2 complex solutions

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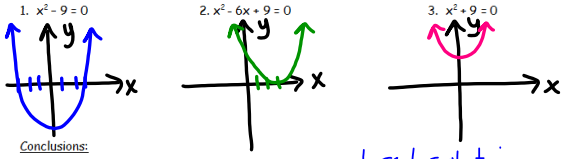
Using your graphing calculator, sketch a graph of each of the quadratic equations from above.

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



Conclusions:

When the graph intersects x-axis only once, then there is 1 real solution, and the discriminant is 0.

When the graph intersects x-axis twice, then there are 2 real solutions and the discriminant is positive.

When the graph does not intersects x-axis, then there are 2 complex solutions and the discriminant is negative.

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For 1- 7 do the following:

1. Compute the value of the discriminant of the quadratic equation.
2. Use the value of the discriminant to predict the number and type of solutions.
3. Find all real and complex solutions.

a+bi form

Do first one together:

1. $3x + x^2 = -7$

$x^2 + 3x + 7 = 0$

a: 1 b: 3 c: 7

$b^2 - 4ac$

$(3)^2 - 4(1)(7) = -19$

2 complex solutions

$x = \frac{-3 \pm \sqrt{-19}}{2(1)}$

$x = \frac{-3 \pm i\sqrt{19}}{2} = -\frac{3}{2} \pm \frac{i\sqrt{19}}{2}$

Work on the following individually, checking your answers with your partner as you complete each one.

2. $x^2 + 4 = 0$

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

$= -16$

2 complex solutions

$x = \frac{0 \pm \sqrt{-16}}{2(1)}$

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

$= \pm 2i$ $\{\pm 2i\}$

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3. $x^2 + 2x + 1 = 0$

$b^2 - 4ac = 4 - 4(1)(1)$

$= 0$

1 real solution

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

$= \frac{-2}{2}$

$= -1$ $\{-1\}$

4. $3x^2 + 4x + 2 = 0$

$b^2 - 4ac = 16 - 4(3)(2)$

$= -8$

2 complex solutions

a+bi

$x = \frac{-4 \pm \sqrt{-8}}{2(3)}$

$= \frac{-4 \pm i\sqrt{4}\sqrt{2}}{6}$

$= \frac{-4 \pm 2i\sqrt{2}}{6}$

$= \frac{-2 \pm i\sqrt{2}}{3}$ $\left\{-\frac{2}{3} \pm \frac{i\sqrt{2}}{3}\right\}$

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5. $x = 2x^2 + 5$

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

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

$= -39$

2 complex solutions

$x = \frac{1 \pm \sqrt{-39}}{2(2)}$

$= \frac{1 \pm i\sqrt{39}}{4}$

$\left\{\frac{1}{4} \pm \frac{i\sqrt{39}}{4}\right\}$

6. $9x^2 - 4x - 14 = 0$

$b^2 - 4ac = 16 - 4(9)(-14)$

$= 520$

2 real solutions

$x = \frac{4 \pm \sqrt{520}}{2(9)}$

$= \frac{4 \pm \sqrt{4}\sqrt{130}}{18}$

$= \frac{4 \pm 2\sqrt{130}}{18}$

$= \frac{2 \pm \sqrt{130}}{9}$ $\left\{\frac{2 \pm \sqrt{130}}{9}\right\}$

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7. $\frac{8x^2 + 4x + 32}{4} = 0$ (Note: Easier if you factor first)

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

$b^2 - 4ac = 1 - 4(2)(8)$

$= -63$

2 complex solutions

$x = \frac{-1 \pm \sqrt{-63}}{2(2)}$

$= \frac{-1 \pm i\sqrt{9}\sqrt{7}}{4}$

$= \frac{-1 \pm 3i\sqrt{7}}{4}$ $\left\{-\frac{1}{4} \pm \frac{3i\sqrt{7}}{4}\right\}$

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