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 = ±6i
16. x = ±2i
17. $12i\sqrt{2}$
18. See attached for graph.

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Name Key Alg 2 Homework 4-3

Simplify the following:

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

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

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

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

$i^4 = 1$ $i^2 = -1$

Simplify the following: $i^{33} = i^{32} \cdot i$

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. $-i^{11} = -i^8 i^3 = i$
6. $i^{18} = i^{16} \cdot i^2 = -1$
7. $5i^{10} = 5i^8 i^2 = 5(-1) = -5$
8. $(i^5)(i^7) = i^{12} = 1$
9. $4i^2 - 5i^{16} = 4(-1) - 5(1) = -4 - 5 = -9$
10. $2i^{15} = 2i^{12} i^3 = 2(-i) = -2i$

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.

$x+yi = x+yi$

13. $3x + 6yi = 24 + 18i$

$3x = 24$ $6y = 18$

$x = 8$ $y = 3$

14. $(5x - 3) + (3y) = (-18) + (-2i)$

$5x - 3 = -20$ $3y = -15$

$5x = -15$ $y = -5$

$x = -3$

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.

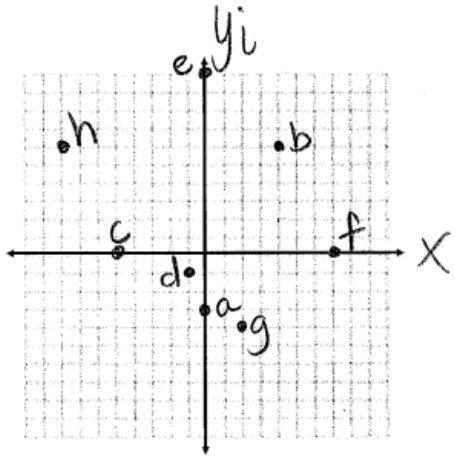
17. $\sqrt{-24} \cdot 2\sqrt{3} = i\sqrt{24} \cdot 2\sqrt{3}$

$= 2i\sqrt{72}$

$= 2i\sqrt{36}\sqrt{2} = 12i\sqrt{2}$

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**. $ax^2+bx+c=0$

1. $x^2 - 9 = 0$

$a=1, b=0, c=-9$

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

$= 0+36 = 36$

$x = \frac{-0 \pm \sqrt{36}}{2(1)} = \frac{\pm 6}{2} = \pm 3$

$x = 3$ or $x = -3$

discrim = +, > 0

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

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

$= 0$

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

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

$x = 3$

discrim = 0

3. $x^2 + 9 = 0$

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

$= -36$

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

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

$x = \pm 3i$

discrim < 0

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

#3 If discriminant < 0, we get 2 complex solutions

#2 If discriminant = 0, we get 1 real solution

If discriminant > 0, we get 2 real solutions

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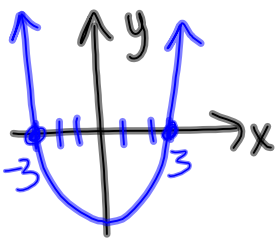
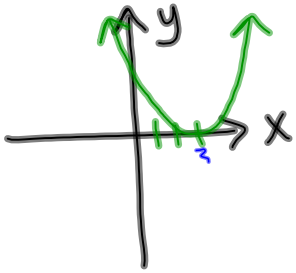
Using your graphing calculator, sketch a graph of each of the quadratic equations from above.

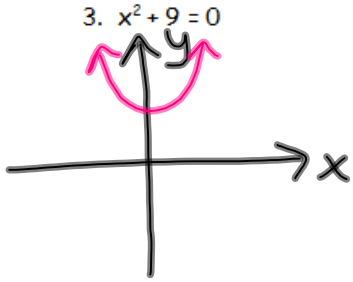
1. $x^2 - 9 = 0$



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



3. $x^2 + 9 = 0$



Conclusions:

#2 When the graph intersects x-axis only once, then there is one real solution, and the discriminant is zero.

#1 When the graph intersects x-axis twice, then there are two real solutions, and the discriminant is positive, >0

#3 When the graph does not intersects x-axis, then there are two complex solutions and the discriminant is negative, <0

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For 1- 7 do the following:

Correct typo on #7: change 'factor' to 'divide'.

1. Compute the value of the discriminant of the quadratic equation. b^2-4ac
2. Use the value of the discriminant to predict the number and type of solutions. 2 real solutions, 1 real solution, 2 complex solutions
3. Find all real and complex solutions.

$ax^2+bx+c=0$

Do first one together:

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

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

$a=1, b=3, c=7$

① $b^2-4ac=(3)^2-4(1)(7)=9-28=-19$

② Predict: 2 complex solutions

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

$a+bi$

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

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

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

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

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

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

① $b^2 - 4ac = 4 - 4(1)(1)$
$= 0$

② 1 real solution

③ $x = \frac{-2 \pm \sqrt{0}}{2(1)}$
$= \frac{-2}{2}$
$= -1$ $\{-1\}$

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

$b^2 - 4ac = 16 - 4(3)(2)$
$= -8$

2 complex solutions

$x = \frac{-4 \pm \sqrt{-8}}{2(3)}$
$= \frac{-4 \pm i\sqrt{4}\sqrt{2}}{6}$
$= \frac{-4 \pm 2i\sqrt{2}}{6}$
$= \frac{-2 \pm i\sqrt{2}}{3}$ $\left\{-\frac{2}{3} \pm \frac{i\sqrt{2}}{3}\right\}$

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