Advancement **V**ia **I**ndividual **D**etermination — AVID Decades *of* College Dreams	Topic:	Name: ____________ Class: ____________ Period: ____ Date: ____________

Essential Question (s): How do I simplify radical involving negative integer?

Questions:	Notes:
	1. What is complex number? Why would you have complex number when solving equations?
	2. What is the discriminant of $9x^2 - 3x - 8 = -10$? How many solutions are expected?
	3. What are the solutions for the equation $9x^2 + 11 = 6x$?

4. What are the zeros of the equation $4x^2 + 4x + 8 = -1$?

5. Write a quadratic equation that has two imaginary solutions.

6. Explaining the meaning of simplifying radical. Provide example.

7. Simplify the following radical.

   a. $\sqrt{512}$

   b. $\sqrt{20}$

   c. $\sqrt{45}$

   d. $\sqrt{98}$

Summary:

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Complex Solutions and Radical

You will have complex/imaginary roots when taking square root of negative number while solving for quadratic equations. It is considered partial complex solution because the other part is real number. For example, you completed all the steps and have

$x = 3 \pm \sqrt{-4}$.

The number 3 is a real number, but $\sqrt{-4}$ is imaginary roots because you cannot take square root of negative number. In mathematics, we use letter i to represent imaginary solution so $\sqrt{-4}$ can be represent as $i\sqrt{4}$. By doing so, you are permit to take square to negative value.

$x = 3 \pm \sqrt{-4}$ can be simplify to $x = 3 \pm i\sqrt{4}$; therefore, $x = 3 \pm 2i$.

Remember, 3 is real solution, but $2i$ is imaginary part.

Complex solution, $i = \sqrt{-1}$, which mean $i^2 = -1$.

Quadratic Function

$f(x) = ax^2 + bx + c$

When solving non-factorable quadratic equations either by complete the square or quadratic formula, you may encounter complex solutions. You can determine the type of solutions for quadratic equation by identify the discriminant.

Quadratic Formula, $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ where $b^2 - 4ac$ is the discriminant.

Discriminant, D > 0, you will have 2 real solutions. They can be integer, rational or irrational solutions.
Discriminant, D < 0, you will have 2 imaginary solutions.
Discriminant, D = 0, you will have 1 solution.

Example 1 Determine the roots and solve.

$f(x) = 4x - 3x^2 - 5$

$f(x) = -3x^2 + 4x - 5$

$D = 4^2 - 4(-3)(-5) = 16 - 60$

D = – 44, which mean this function has imaginary roots.

$x = \frac{-4 \pm \sqrt{-44}}{2(-3)} = \frac{-4 \pm \sqrt{-44}}{-6}$

$x = \frac{-4 \pm \sqrt{-44}}{-6} = \frac{-4 \pm i\sqrt{44}}{-6}$

$x = \frac{-4 + i\sqrt{44}}{-6}$ and $x = \frac{-4 - i\sqrt{44}}{-6}$

To determine the type of solution, we use the discriminant, $D = b^2 - 4ac$

Make sure that the equation is in order.

$ax^2 + bx + c = 0$

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

We already found $b^2 - 4ac = -44$

We can simplify the solution by applying the concept of complex roots, i = -1

The next step is to simplify the radical.

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Simplifying Radical

$\sqrt{}$

We say that a square root radical is simplified, or in its simplest form, when the radicand has no square factors. Radicand is the value under the radical.

Let say after completed all the steps and you obtained x = $\sqrt{12}$. This solution is not simplified because the radicand still has square factor.

x = $\sqrt{12}$ = $\sqrt{4*3}$ where 4 is a perfect square.
x =$\sqrt{4*3}$ can be expressed as x = $\sqrt{4}*\sqrt{3}$
x = $\sqrt{4}*\sqrt{3}$ you can take square root of 4
x = $\pm 2*\sqrt{3}$ which is equivalent to x = $\pm 2\sqrt{3}$

x = $\pm 2\sqrt{3}$ Now your square root radical is simplified to its simplest form.

Example 2 Simplify the answer	Earlier in **Example 1**, we obtained the complex solutions. Now we have to simplify these solutions to their simplest form.
x = $\frac{-4+i\sqrt{44}}{-6}$ and x = $\frac{-4-i\sqrt{44}}{-6}$	
x = $\frac{-4\pm i\sqrt{4*11}}{-6}$	The radicand has perfect root, 4∗11
x = $\frac{-4\pm i\sqrt{4}*\sqrt{11}}{-6}$	You can rewrite radical multiplies another radical.
x = $\frac{-4\pm 2i*\sqrt{11}}{-6}$	Take square root of the perfect square.
x = $\frac{-4\pm 2i\sqrt{11}}{-6}$	Now you have simplified the solution in its simplest form.