Answer Key

Unit 2 Day 10 NOTES – Radicals and Complex Numbers

Name: _____ Period: _____

SWBAT: perform operations with complex numbers

M2H Review: Perfect Square: product of a rational # multiplied by itself ex: 1, 4

List of Perfect Squares from 1^2 - 15^2 (These are numbers you want to recognize!)

1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225

Square Root: A # that produces a specified quanity when multiplied by itself.

7 is the square root of 49

Radicals: $\sqrt{a}$ (index #, radicand)

Simplify Radicals – These are perfect squares:

$\sqrt{4} = 2$	$\sqrt{16} = 4$	$\sqrt{25} = 5$
$\sqrt{100} = 10$	$\sqrt{144} = 12$	$\sqrt{625} = 25$

M2H Review: Simplify Radicals – The radicand is not a perfect square!

1) Find the prime factors of the radicand **2)** circle the 2-of-a-kind, and take one out of the radical.

You try it – these are not perfect squares!

$\sqrt{8} = \sqrt{4 \cdot 2} = 2\sqrt{2}$	$3\sqrt{20} = 3\sqrt{4 \cdot 5}$ $3 \cdot 2\sqrt{5} = 6\sqrt{5}$	$-5\sqrt{32} = -5\sqrt{16 \cdot 2}$ $-20\sqrt{2}$
$2\sqrt{75} = 2\sqrt{25 \cdot 3}$ $10\sqrt{3}$	$-\sqrt{40} = -\sqrt{10 \cdot 4}$ $-2\sqrt{10}$	$\sqrt{48} = \sqrt{16 \cdot 3}$ $4\sqrt{3}$
$3\sqrt{80} = 3\sqrt{16 \cdot 5}$ $12\sqrt{5}$	$-4\sqrt{45} = -4 \cdot \sqrt{9 \cdot 5}$ $-12\sqrt{5}$	$2\sqrt{125} = 2\sqrt{25 \cdot 5}$ $10\sqrt{5}$

Can we take a square root of a negative number? NO **Try it:** $\sqrt{-4}$ is ?? $-2 \cdot -2 = 4$, $2 \cdot 2 = 4$

The imaginary number, i $i = \sqrt{-1}$ **Now we can take the square root of any negative number!**

Let's practice – these are imaginary numbers!

$\sqrt{-16}$ $\sqrt{-1 \cdot 16} = 4i$	$\sqrt{-81} = 9i$	$\sqrt{-45} = \sqrt{-1 \cdot 9 \cdot 5}$ $3i\sqrt{5}$	$\sqrt{-200} = \sqrt{-1 \cdot 2 \cdot 100}$ $10i\sqrt{2}$

Simplifying Powers of *i* (Change the calculator **Mode** to *a + bi*)

$i = \sqrt{-1}$ $i^2 = -1$ $i^3 = -i$ $i^4 = 1$

i^5 1 r 1

To simplify higher powers of *i*, Divide the exponent by 4 and find the remainder.

1	2	3
i	-1	$-i$

$i^4 \cdot i$
$1 \cdot i = i$

No remainder: answer is 1. Remainder of 1: answer is i.

Remainder of 2: answer is -1. Remainder of 3: answer is $-i$.

i^{23} 5 r 3 so: $-i$	i^{2006} 501 r 2 = -1	i^{37} 9 r 1 i	i^{828} 207 r 0 1
i^{45} 11 r 1 i	i^{400} 100 r 0 1	i^{67} 16 r 3 $-i$	i^{58} 14 r 2 -1

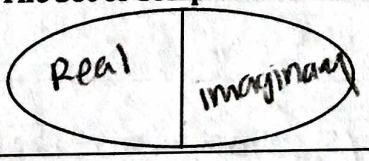
Operations with Complex Numbers

Complex Numbers, *a + bi*

a = real part **bi =** imaginary part

Conjugate of a + bi is $a - bi$

The Set of Complex Numbers



+ – x / With Complex Numbers – By hand, check in the calculator ☺

$7i + 9i$ $16i$	$(-5 + 6i) + (2 - 11i)$ $-3 - 5i$	$(2 + 3i) - (4 + 2i)$ $-2 + i$
$(-3 + 4i) - (1 + 3i)$ $-4 + i$	$(2 + 5i)(7 + 2i)$ $14 + 4i + 35i + 10i^2$ $14 + 39i + 10(-1)$ $4 + 39i$	$(7 - 4i)(3 + 4i)$ $21 + 28i - 12i - 16i^2$ $21 + 16i - 16(-1)$ $37 + 16i$
$(2 + 3i)(14 + 8i)$ $28 + 16i + 42i + 24i^2$ $28 + 58i + 24(-1)$ $4 + 58i$	$(3 - 4i) + (2 - 7i) - (5 - 12i)$ i	$(5 - 4i)(-11 + 15i)$ $-55 + 75i + 44i - 60i^2$ $-55 + 119i + 60$ $5 + 119i$

How to divide by hand: Multiply the top and bottom by the conjugate of the bottom!

$\frac{(-3 + i)}{(5 - 2i)} \cdot \frac{5 + 2i}{5 + 2i} = \frac{-15 - 6i + 5i + 2i^2}{25 + 10i - 10i - 4i^2} = \frac{-15 - 1 + 2(-1)}{25 - 4(-1)} = \frac{-17 - i}{29}$

$(60 + 90i) \div (14 + 8i)$ $\frac{60 + 90i}{8i + 14} \cdot \frac{8i - 14}{8i - 14} = \frac{-1560 - 780i}{-260}$ $6 + 3i$	$\frac{(-33 - 56i)}{(5 - 12i)} \cdot \frac{5 + 12i}{5 + 12i}$ $= \frac{507 - 676i}{169} = 3 - 4i$	$(-63 + 23i) \div (-11 + 15i)$ $\frac{-63 + 23i}{-11 + 15i} \cdot \frac{-11 - 15i}{-11 - 15i} = \frac{1037 + 692i}{346}$ $= 3 + 2i$