Objectives:

- I can add, subtract, and multiply complex numbers

What happens when you type $\sqrt{-1}$ in your calculator? What does this mean?

domain error / non real answer

Historical Note: French mathematician René Descartes suggested the imaginary unit *i* be defined so that $i^2 = -1$. The imaginary unit enables us to solve problems that we would not otherwise be able to solve. Problems involving electricity often use the imaginary unit.

Standard Form of a Complex Number:

- Form: $a + bi$
- a and b are real numbers and i is the imaginary unit.
- a is the real part of the complex number, and bi is the imaginary part of the complex number.

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

$i \cdot i = (\sqrt{-1})(\sqrt{-1})$ $\quad i \cdot i^2 = i(-1) = -i$ $\quad i^2 \cdot i^2 = (-1)(-1) = 1$

Example 1:

Simplify $\sqrt{-32}$ by using the imaginary number i.

$\sqrt{-1 \cdot 32} = \sqrt{-1} \cdot \sqrt{32} = i\sqrt{32}$

16 2

4 4

$4i\sqrt{2}$

Example 2:

Write the complex number $\sqrt{-4} + 3$ in standard from: $a+bi$

$i\sqrt{4}$

$3 + 2i$

Example 3: Perform the indicated operation.

$(17 - 2i) + (4 + 5i)$

$17 - 2i + 4 + 5i$

$17 + 4 - 2i + 5i$

$21 + 3i$

$(3 + 2i) - (-8 + 2i)$

$3 + 2i + 8 - 2i$

$11 + 0i$

11

$(12 + 5i) - (2 - i)$

$12 + 5i - 2 + i$

$10 + 6i$

Example 4: Perform the indicated operation.

$4i(2 - 3i)$

$4i(2) - 4i(3i)$

$8i - 12i^2$

$8i - 12(-1)$

$+12$

$12 + 8i$

$(4 - 3i)(5 + 2i)$

$20 + 8i - 15i - 6i^2$

$20 + -7i - 6(-1)$

$20 - 7i + 6$

$26 - 7i$

$\sqrt{-6} \cdot \sqrt{-2}$

$i\sqrt{6} \cdot i\sqrt{2}$

$i^2\sqrt{6 \cdot 2}$

$i^2\sqrt{12}$

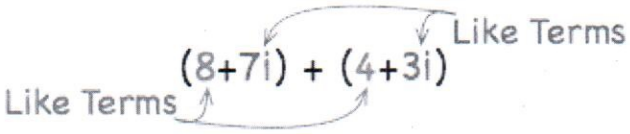
$(-1)\sqrt{12}$

$-\sqrt{12}$ $\quad \frac{6}{2} < \frac{3}{2}$

$-2\sqrt{3}$

Examples of complex numbers:

Adding Complex Numbers



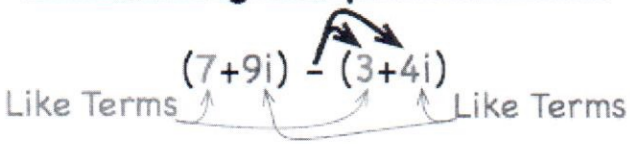
$= (8 + 4) + (7i + 3i)$

$= \boxed{12 + 10i}$

$i = \sqrt{-1}$

$7x + 3x = 10x$

Subtracting Complex Numbers



$= 7 + 9i - 3 - 4i$

$= 7 - 3 + 9i - 4i$

$= \boxed{4 + 5i}$

$i = \sqrt{-1}$

$9x - 4x = 5x$

MULTIPLY

$(3+2i)\cdot(4+5i)$

$i = \sqrt{-1}$

$i^2 = -1$

$= 12 + 15i + 8i + 10i^2$

$= 12 + 15i + 8i - 10$

$= \boxed{2 + 23i}$

Secondary Math 2 Name_____ ID: 1

Assignment

Date_____ Period____

Simplify.

1) $(6 + 8i) - (-4 + 5i)$

$10+3i$

2) $(3 - 7i) + (-4 + 8i)$

3) $(4 + 5i) + (-1 - 5i)$

3 OR $3+0i$

4) $(3 - 5i) + 6 - (8i)$

5) $(-7i) - 3 + (5 + 4i)$

$2-3i$

6) $(8 + 4i) + (7 + 6i)$

7) $(3 + i)(4 + 8i)$

$12+24i+4i+8i^2$

$4+28i$

8) $(6 - 5i)^2$

9) $(8 - 3i)(3 + 6i)$

$24+48i-9i-18i^2$

$42+39i$

10) $(-1 - 8i)(5 + 6i)$

11) $4(2i)(-8 + 6i)$

$(8i)(-8+6i)$

$-64i+48i^2 = -48-64i$

12) $(1 + i)(-6 - 7i)$

13) $(4 - 5i)(-6 + 5i)$

$-24+20i+30i-25i^2$

$1+50i$

14) $(5 - 6i)(8 + 8i)$

15) $(-6 + 4i)^2 = (-6+4i)(-6+4i)$

$36-24i-24i+16i^2$

$20-48i$

16) $(4 + 6i)(6 - 6i)$

17) $(-5 - 2i)^2 = (-5-2i)(-5-2i)$

$25+10i+10i+4i^2$

$21+20i$

18) $\sqrt{256m^2}$

19) $\sqrt{32x^3}$

4 8 xxx

4 2

$4x\sqrt{2x}$

20) $\sqrt[3]{24x^5}$

21) $\sqrt{448r^4}$

rr rr

28 16

7 4 4 4

2 2 2 2 2 2

$8r^2\sqrt{7}$

22) $\sqrt[3]{16a^3}$