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

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.

Things to Memorize:

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

Example 1:
Simplify $\sqrt{-32}$ by using the imaginary number i.

$= i\sqrt{32}$

$16 \cdot 2$

$4 \cdot 4$

$= 4i\sqrt{2}$

Example 2:
Write the complex number $\sqrt{-4} + 3$ in standard from:

$= 3 + i\sqrt{4}$

$= 3 + 2i$

Example 3: Simplify each complex number

i^5

$i^4 \cdot i^1$

$1 \cdot i$

i

i^{95}

$= i^{92} \cdot i^3$

$= (i^4)^{23} \cdot -i$

$= 1 \cdot -i$

$= -i$

i^{7321}

$= i^{7321} \cdot i$

$= (i^4)^{1830} \cdot i$

$= 1 \cdot i$

$= i$

Example 4: Perform the indicated operation.

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

$= 21 + 3i$

$(3 + 2i) + (+8 - 2i)$ distribute the negative

$11 + 0i$

$= 11$

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

$10 + 6i$

Example 5: Perform the indicated operation.

$4i(2 - 3i)$

$8i - 12i^2$

$8i - (12 \cdot -1)$

$8i - -12$

$12 + 8i$

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

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

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

$= 20 - 7i + 6$

$= 26 - 7i$

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

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

$= i^2\sqrt{12}$

$= -1 \cdot 2\sqrt{3}$

$= -2\sqrt{3}$