Complex Numbers

Does $x^2 = -1$ have any solutions that are real numbers? _____

Let's define a solution (called the **imaginary unit**):

$\boldsymbol{i} =$ _____

(so that $i^2 = -1$)

Ex 1.

Write as a multiple of i:

$\sqrt{-16}$

$\sqrt{-48}$

Real and imaginary numbers together make the _____, which can all be written in the form: _____

(a and b are real #'s; a is called the _____; b is called the _____)

ex: $-3 + 4i$ $5 - 2i$ 4 $7i$

Ex 2.

$(2 + 6i) - (12 - 4i) =$

Ex 3.

$7i(2 - 9i) =$

$(5 + 4i)(6 - 7i) =$

Note: When multiplying square roots with negatives inside, **pull out the *i*'s first**!

Ex 4.

$\sqrt{-5} \cdot \sqrt{-7} =$

Conjugates and Division

The **conjugate** of $a + bi$ is _____. To divide complex #'s, we can use the conjugate to help.

Ex 5.

Divide and simplify to the form $a + bi$.

$\frac{6+2i}{4-3i} =$

Ex 6.

Divide and simplify to the form $a + bi$.

$\frac{3-2i}{4i} =$

Powers of *i*

Ex 7.

Simplify:

$i^{16} =$

$i^{39} =$

$i^{50} =$

Ex 8.
Solve: $x^2 + 24 = 0$

Ex 9.
Solve: $9x^2 + 5 = 6x$

Practice

1. Express in terms of i and simplify.
$\sqrt{-28}$

2. Simplify and write the result in the form $a + bi$.
a) $(8 - 5i) - (6 + 2i)$

b) $-6i(3 - 5i)$

c) $(7 - 2i)(-3 + 6i)$

d) $\sqrt{-16} \cdot \sqrt{-8}$

e) $\frac{1-i}{1+i}$

f) $\frac{3+4i}{5i}$

g) i^{46}

h) i^{15}

3. Solve: $2x^2 - 2x = -5$

Q: Your sock drawer contains ten pairs of white socks and ten pairs of black socks. If you're only allowed to take one sock from the drawer at a time and you can't see what color sock you're taking until you've taken it, how many socks do you have to take before you're guaranteed to have at least one matching pair?