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:

$i^{16} =$

$i^{39} =$

$i^{50} =$

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}

Q: A man while looking at a photograph said, "Brothers and sisters have I none. That man's father is my father's son." Who was the person in the photograph?