Precalculus 2.4 Complex Numbers

The imaginary unit, i, is defined as $i=\sqrt{-1}$

Powers of i: $i^2= -1$ $i^3=-i$ $i^4= 1$

$i^2 \cdot i$ $-1 \cdot i$ $i^2 \cdot i^2 =$

-to simplify $\sqrt{-45}$, first get in terms of i

$\sqrt{45} * \sqrt{-1} = \sqrt{9} * \sqrt{5} * i = 3i\sqrt{5}$

$\sqrt{9 \cdot 5}$ $3i\sqrt{5}$

60
1 · 60
2 · 30
3 · 20
4 · 15
5 · 12
6 · 10

Example Simplify into terms of *i* $\sqrt{-60}$

$\sqrt{60} \cdot \sqrt{-1}$

$\sqrt{4} \cdot \sqrt{15} \cdot i$ $\sqrt{3} \cdot \sqrt{5}$

$2i\sqrt{15}$

- a complex number written in standard form is $a+bi$

real part imaginary part

both *a* and *b* are real numbers

$5+6i$ $3-2i$

-two complex numbers are equal if all their parts are equal.

$a+bi=c+di$ if and only if $a=c$ and $b=d$

Find the real numbers a and b so that,

$a+(b-2)i=7-3i$

$a=7$

$b-2=-3$

$+2 \quad +2$

$b=-1$

Operations with Complex Numbers

-When adding, subtracting, or multiplying treat *i* like a variable and go with like terms.

$a+bi$

Examples

Perform the operation and write answer in standard form

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

$3-11i$

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

$-8(-1)$

$6-2i+24i-8i^2$

$6+22i+8$

$14+22i$

-When dividing by a complex number, you multiply the *numerator and denominator* by conjugate of the denominator.

-Complex conjugate is obtained by switching the sign of the imaginary term. For example, the conjugate of $2+3i$ is $2-3i$

$-3-7i$ $-3+7i$

Example

Perform the operation and write answer in standard form

$$\frac{(2+3i)}{(4-5i)}\cdot\frac{(4+5i)}{(4+5i)} = \frac{8+10i+12i+15i^2}{16+20i-20i-25i^2} = \frac{-7+22i}{41}$$

$$= \frac{-7}{41} + \frac{22}{41}i$$

#2 $(b+3)i$

$\sqrt{a}\cdot\sqrt{b} \neq \sqrt{a\cdot b}$

$a>0$
$b>0$

10 $\sqrt{-6}\cdot\sqrt{-2} \rightarrow i\sqrt{6}\cdot i\sqrt{2}$

$i^2\sqrt{12}$

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

$-2\sqrt{3}$

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

$\sqrt{12}$

$2\sqrt{3}$