Name:	Date:	Period:

4.4 Complex Numbers Notes

Warm up

Add: $(2x-3)+(-4x+2)$

$-2x-1$

collect like terms

Multiply: $(x-3)(2x+4)$

$2x^2+4x-6x-12$

$2x^2-2x-12$

Complex Numbers

Complex Numbers

A Complex Number consist of a Real Part and an Imaginary Part

$a+bi$

Real Part — Imaginary Part

$i^2=-1$

$i=\sqrt{-1}$

Examples of complex numbers in standard form

$-3-2i$; $\frac{3}{2}+\frac{5}{2}i$

Adding and Subtracting Complex Numbers

EX 1. $(-11+3i)+(9+2i)$

$-2+5i$

Ex 2. $6i-(14-i)+(5-3i)$

$6i-14+i+5-3i$

$-9+4i$

Add the real number parts and add the imaginary parts.

Adding and subtracting complex numbers equals a complex number $a+bi$

standard complex form $a+bi$

Multiplying Complex Numbers

Ex3: $2i(8-3i)$

$16i - 6i^2$

$16i - 6(-1)$

$16i + 6$

$6 + 16i$

Ex 4: $(6-2i)^2$

$(6-2i)(6-2i)$

Like perfect square trinomial product.

$36 - 24i + 4i^2$

$36 - 24i + 4(-1)$

$32 - 24i$

Ex4: $(2-4i)(-5-3i)$

$-10 - 6i + 20i + 12i^2$

$-10 + 14i + 12(-1)$

$-10 + 14i - 12$

$-22 + 14i$

Ex 5:

$(1+7i)(9+3i) - (4+2i)$

$9 + 3i + 63i + 21i^2 - 4 - 2i$

$9 + 66i + 21(-1) - 4 - 2i$

$9 + 64i - 21 - 4$

$-16 + 64i$

Complex Conjugates

Two complex numbers in the form of

$a+bi$ and $a-bi$

are called complex conjugates.

The **product** or the **sum** of complex conjugates are

real numbers.

Ex 6:

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

Product is difference of 2 squares.

$64 - i^2$

$64 - (-1)$

$64 + 1$

65

Ex 7:

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

$10 + 0$

10

Dividing Complex Numbers

Simplified complex numbers can not contain an ___i___ in the denominator.

- **If the denominator is a pure imaginary,** ___multiply___ the numerator and denominator by ___i___
- **If the denominator is a complex number,** ___multiply___ the numerator and denominator by ___complex conjugate___ The product of the denominator equals a real number.

Ex 8. $\frac{10}{2i}$

$\frac{10}{2i} \cdot \frac{i}{i} = \frac{10i}{2i^2} = \frac{10i}{-2}$

-5

$\frac{5}{i}$

Ex 9. $\frac{4}{9i} \cdot \frac{i}{i}$

$\frac{4i}{9i^2} = \frac{4i}{-9}$

$-\frac{4}{9}i$

Ex 10. $\frac{-2}{5-i}$

$\frac{-2}{(5-i)} \cdot \frac{(5+i)}{(5+i)} = \frac{-10-2i}{25-i^2}$

$\frac{-10-2i}{25+1} = \frac{-10-2i}{26}$

$\frac{-10}{26} - \frac{2i}{26} = \frac{-5}{13} - \frac{i}{13}$

Ex 11. $\frac{1+8i}{2-4i}$

$\frac{(1+8i)}{(2-4i)} \cdot \frac{(2+4i)}{(2+4i)}$

$\frac{2+4i+16i+32i^2}{4-16i^2}$

$\frac{2+20i-32}{4+16}$

$\frac{-30+20i}{20} = \frac{-30}{20} + \frac{20i}{20}$

$-\frac{3}{2} + i$