

4.8B Operations with Complex Numbers

<p>The Complex Numbers (C)</p>	<p>Consider the number $5 + 2i$. Because 5 is a real number and $2i$ is a pure imaginary number, they are not like terms and cannot be combined. This type of expression is called a complex number</p> <p>Standard Form of a Complex Number: <u>$a+bi$</u></p>	
<p>Adding and Subtracting Complex Numbers</p> <p><i>Combine like terms</i> <i>dot (-)</i></p>	<p>Directions: Simplify the expressions below. Final answers must be in $a+bi$ form.</p>	
<p>Multiplying Complex Numbers</p> <p><i>FOIL</i> <i>$i^2 = -1$</i></p>	<p>1. $(-11 + 3i) + (9 + 2i)$ $-2 + 5i$</p>	<p>2. $(4 + i) + (7 - 5i)$ $11 - 4i$</p>
	<p>3. $(7 - 2i) - (2 + 6i)$ $7 - 2i - 2 - 6i$ $5 - 8i$</p>	<p>4. $6i - (14 - i) - (5 - 3i)$ $6i - 14 + i - 5 + 3i$ $-19 + 10i$</p>
	<p>5. $2i(8 - 3i)$ $16i - 6i^2$ $16i - 6(-1)$ $6 + 16i$</p>	<p>6. $-i(2 + 10i)$ $-2i - 10i^2$ $-2i - 10(-1)$ $10 - 2i$</p>
<p>Complex Conjugates</p>	<p>7. $(7 + i)(4 - i)$ $28 - 7i + 4i - i^2$ $28 - 3i - (-1)$ $29 - 3i$</p>	<p>8. $(6 - 2i)^2$ $(6 - 2i)(6 - 2i)$ $36 - 12i - 12i + 4i^2$ $36 - 24i + 4(-1)$ $32 - 24i$</p>
	<p>9. $(8 + i)(8 - i)$ $64 - 8i + 8i - i^2$ $64 - (-1)$ 65</p>	<p>10. $(5 - 4i)(5 + 4i)$ $25 + 20i - 20i - 16i^2$ $25 - 16(-1)$ 41</p>

Dividing Complex Numbers

Watch out! "i" cannot be in the denominator of a complex number.

- If the denominator is a monomial: Multiply the numerator and denominator by "i"
- If the denominator is a binomial: Multiply the numerator and denominator by the conjugate

11. $\frac{10}{2i} \frac{i}{i}$

$$\frac{10i}{2i^2} = \frac{10i}{2(-1)} = \frac{10i}{-2}$$

$$-5i$$

12. $\frac{(28-8i)}{4i} \frac{i}{i}$

$$\frac{28i - 8i^2}{4i^2} = \frac{28i - 8(-1)}{4(-1)}$$

$$\frac{8 + 28i}{-4} = -2 - 7i$$

13. $\frac{-2(5+i)}{5-i(5+i)}$

$$\frac{-10 - 2i}{25 + 5i - 5i - i^2} = \frac{-10 - 2i}{25 - (-1)}$$

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

$$-\frac{5}{13} - \frac{1}{13}i$$

14. $\frac{5i(6-2i)}{6+2i(6-2i)}$

$$\frac{30i - 10i^2}{36 - 12i + 12i - 4i^2} = \frac{30i - 10(-1)}{36 - 4(-1)}$$

$$\frac{10 + 30i}{40} = \frac{1 + 3i}{4}$$

$$\frac{1}{4} + \frac{3}{4}i$$

15. $\frac{7+3i(2-i)}{2+i(2-i)}$

$$\frac{14 - 7i + 6i - 3i^2}{4 - 2i + 2i - i^2}$$

$$\frac{14 - i - 3(-1)}{4 - (-1)} = \frac{17 - i}{5}$$

$$\frac{17}{5} - \frac{1}{5}i$$

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

$$\frac{2 + 4i + 16i + 32i^2}{4 + 8i - 8i - 16i^2}$$

$$\frac{2 + 20i + 32(-1)}{4 - 16(-1)} = \frac{-30 + 20i}{20}$$

$$-\frac{30}{20} + \frac{20i}{20} = -\frac{3}{2} + i$$