

Operations with Complex Numbers

A **complex number** written in standard form is a number $a + bi$, where a and b are real numbers. The number a is the real part, and the number bi is the imaginary part. To add (or subtract) two complex numbers, add (or subtract) their real parts and their imaginary parts separately.

Example 1 Add or subtract. Write the answer in standard form.

a. $(6 + 3i) + (2 - 5i)$

b. $(13 + 4i) - (8 + 5i)$

a. $(6 + 3i) + (2 - 5i) = (6 + 2) + [3 + (-5)]i$
 $= 8 - 2i$

Definition of complex addition
 Write in standard form.

b. $(13 + 4i) - (8 + 5i) = (13 - 8) + (4 - 5)i$
 $= 5 - i$

Definition of complex subtraction
 Write in standard form.

To multiply two complex numbers, use the Distributive Property, or the FOIL Method, just as you do when multiplying real numbers or algebraic expressions.

Example 2 Multiply. Write the answer in standard form.

a. $3i(2 + 9i)$

b. $(4 - 2i)(11 + 8i)$

a. $3i(2 + 9i) = 6i + 27i^2$
 $= 6i + 27(-1)$
 $= -27 + 6i$

Distributive Property
 Use $i^2 = -1$.
 Write in standard form.

b. $(4 - 2i)(11 + 8i) = 44 + 32i - 22i - 16i^2$
 $= 44 + 10i - 16(-1)$
 $= 44 + 10i + 16$
 $= 60 + 10i$

Multiply using FOIL.
 Simplify and use $i^2 = -1$.
 Simplify.
 Write in standard form..

Practice

Check your answers at BigIdeasMath.com.

Perform the operation. Write the answer in standard form.

1. $(6 - i) + (9 + 5i)$ $15 + 4i$

2. $(7 + 3i) + (11 + 2i)$ $18 + 5i$

3. $(12 + 4i) - (2 - 15i)$ $10 + 19i$

4. $(3 - 7i) - (3 + 5i)$ $-12i$

5. $7 - (2 - 3i) + 6i$ $5 + 9i$

6. $-16 + (3 + 4i) - 4i$ -13

7. $3i(6 - 5i)$ $15 + 18i$

8. $-2i(8 + 2i)$ $4 - 16i$

9. $(-5 + i)(8 - 6i)$ $-34 + 38i$

10. $(3 - 6i)(-1 + 7i)$ $39 + 27i$

11. $(2 + 5i)(2 - 5i)$ 29

12. $(-3 - i)(-3 + i)$ 10

13. $(4 + i)^2$ $15 + 8i$

14. $(5 - 9i)^2$ $-56 - 90i$