LESSON MAKER PRO

# Complex Number Moves

*Use powers of i and complex number operations.*

**HIGH SCHOOL · A2.N.1**

**A2.N.1** "Extend the understanding of numbers and operations to include complex numbers, radical expressions, and expressions written with rational exponents. Find the value of $i^n$ for any whole number n. Simplify, add, subtract, multiply..."

NAME _____ DATE _____

## THE BIG IDEA

Use $i^2 = -1$ and the repeating pattern i, -1, -i, 1 to simplify powers of i. Add or subtract real parts and imaginary parts separately. To multiply, distribute; to divide, multiply the top and bottom by the denominator's conjugate, which has the opposite sign before i.

## WORKED EXAMPLE

Simplify $(9 + 11i)/(5 - 2i)$.

1. Multiply the top and bottom by $5 + 2i$.
2. Top: $(9 + 11i)(5 + 2i) = 45 + 73i + 22i^2 = 23 + 73i$.
3. Bottom: $(5 - 2i)(5 + 2i) = 25 - 4i^2 = 29$.

**Answer: (23 + 73i)/29**

## PRACTICE 6 problems

**1** Find the value of $i^{31}$.

**ANSWER** _____

**2** Simplify $(3 - 6i) + (-4 + 8i)$.

**ANSWER** _____

**3** Simplify $(-3 + 8i) - (6 - 4i)$.

**ANSWER** _____

**4** Simplify $(3 - 4i)(-1 + 6i)$.

**ANSWER** _____

**5** Simplify $(8 + 6i)/(1 + i)$.

**ANSWER** _____

**6** Simplify $i^{14}(4 - 3i)$.

**ANSWER** _____

## APPLY IT Show your work

**1** A game programmer uses the real part of a complex number for horizontal movement and the imaginary part for vertical movement. A character moves 3 + 4i units, then -1 + 6i units. What is the character's total move?

WORK SPACE

**ANSWER** _____

**2** In a robotics club project, an AC motor has complex current 2 + i amps and complex impedance 3 - 2i ohms. Its complex voltage is current times impedance. What is the complex voltage?

WORK SPACE

**ANSWER** _____

## CHALLENGE One step up

Simplify $i^{27}(4 - 7i)/(3 + 2i)$. Explain how you used the cycle of i and a conjugate.

WORK SPACE AND ANSWER

**ANSWER KEY**

# Complex Number Moves



## PART 1 · PRACTICE

| # | PROBLEM | ANSWER |
|---|---|---|
| 1 | Find the value of $i^{31}$. | **-i** |
| 2 | Simplify (3 - 6i) + (-4 + 8i). | **-1 + 2i** |
| 3 | Simplify (-3 + 8i) - (6 - 4i). | **-9 + 12i** |
| 4 | Simplify (3 - 4i)(-1 + 6i). | **21 + 22i** |
| 5 | Simplify (8 + 6i)/(1 + i). | **7 - i** |
| 6 | Simplify $i^{14}$(4 - 3i). | **-4 + 3i** |

## PART 2 · APPLY IT

1. **2 + 10i units** Add the real parts and the imaginary parts separately: (3 - 1) + (4 + 6)i = 2 + 10i.
2. **8 - i volts** Multiply (2 + i)(3 - 2i) = 6 - i - $2i^2$ = 8 - i.

## CHALLENGE

**Since $i^{27}$ = -i, the numerator becomes -7 - 4i. Multiplying the top and bottom by 3 - 2i gives (-29 + 2i)/13.**

Accept equivalent simplified forms, including -29/13 + (2/13)i for the challenge. In the challenge explanation, look for $i^{27}$ = -i and use of the conjugate 3 - 2i.