LESSON MAKER PRO

Complex Number Lab

Calculate with complex numbers in games, audio, and equations.

HIGH SCHOOL · PC.T.4

PC.T.4 "Explore complex numbers. Use the relation $i^2 = -1$ and the mathematical properties to add, subtract, and multiply complex numbers. Find the conjugate of a complex number in rectangular forms and quotients of complex numbers..."

NAME _____ **DATE** _____

THE BIG IDEA

Combine real parts with real parts and imaginary parts with imaginary parts. When you multiply, distribute and replace i^2 with −1. To divide, multiply by the denominator's conjugate, which changes the sign of its imaginary part.

WORKED EXAMPLE

Multiply $(7 + 8i)(9 - 10i)$.

1. Distribute: $63 - 70i + 72i - 80i^2$.
2. Replace i^2 with −1: $63 - 70i + 72i + 80$.
3. Combine like terms: $143 + 2i$.

Answer: 143 + 2i

PRACTICE 6 problems

1 Add $(2 + 3i) + (5 - i)$.

ANSWER _____

2 Subtract $(6 - 2i) - (1 + 4i)$.

ANSWER _____

3 Multiply $(3 + 2i)(1 - 4i)$.

ANSWER _____

4 Find the conjugate of $-5 + 6i$.

ANSWER _____

5 Write $(2 + 4i)/(1 - i)$ in the form $a + bi$.

ANSWER _____

6 Solve $x^2 + 25 = 0$.

ANSWER _____

APPLY IT Show your work

1 In a game, a point's position is 2 + 3i. Its real part gives the horizontal position, and its imaginary part gives the vertical position. An effect multiplies the position by 1 + 2i. What is the new position?

WORK SPACE

ANSWER _____

2 In an audio app, a filter multiplies a complex input signal by 1 + 2i to produce 5 + i. What was the input signal? Write your answer in the form a + bi.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Solve $x^2 - 4x + 20 = 0$. Explain why your two solutions are conjugates.

WORK SPACE AND ANSWER

Complex Number Lab

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Add (2 + 3i) + (5 − i).	**7 + 2i**
2	Subtract (6 − 2i) − (1 + 4i).	**5 − 6i**
3	Multiply (3 + 2i)(1 − 4i).	**11 − 10i**
4	Find the conjugate of −5 + 6i.	**−5 − 6i**
5	Write (2 + 4i)/(1 − i) in the form a + bi.	**−1 + 3i**
6	Solve $x^2 + 25 = 0$.	**$x = \pm 5i$**

PART 2 · APPLY IT

1. **−4 + 7i** Multiply (2 + 3i)(1 + 2i) to get $2 + 7i + 6i^2$. Replace i^2 with −1 and combine terms.
2. **7/5 − 9/5i** Divide 5 + i by 1 + 2i. Multiply the numerator and denominator by 1 − 2i to get (7 − 9i)/5.

CHALLENGE

Completing the square gives $(x - 2)^2 = -16$, so $x = 2 + 4i$ or $x = 2 - 4i$. The solutions are conjugates because they have the same real part and opposite imaginary parts.

Accept equivalent exact forms, such as (7 − 9i)/5 for the second word problem. Both solutions are required for each quadratic equation.