LESSON MAKER PRO

Complex Number Moves

Conjugates, moduli, and quotients in a + bi form.

HIGH SCHOOL · HSN-CN.A.3

CCSS.Math.Content.HSN-CN.A.3 "(+) Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers."

NAME _____ DATE _____

THE BIG IDEA

For z = a + bi, the conjugate is a - bi. The modulus of a + bi is sqrt(a squared + b squared). To divide complex numbers, multiply the numerator and denominator by the conjugate of the denominator so the denominator becomes real.

WORKED EXAMPLE

Simplify (11 + 13i)/(5 - 4i).

1. The conjugate of 5 - 4i is 5 + 4i.
2. Multiply the numerator and denominator by 5 + 4i.
3. [(11 + 13i)(5 + 4i)] / [(5 - 4i)(5 + 4i)] = (3 + 109i)/41.

Answer: 3/41 + 109/41 i

PRACTICE 6 problems

1 Find the conjugate of -6 + 8i.

ANSWER _____

2 Find the conjugate of 7 - 2i.

ANSWER _____

3 Find the modulus of 9 - i.

ANSWER _____

4 Find the modulus of -8 + 15i.

ANSWER _____

5 Simplify (17 + 6i)/(2 + i). Write your answer in a + bi form.

ANSWER _____

6 Simplify (21 + 12i)/(1 + 2i). Write your answer in a + bi form.

ANSWER _____

APPLY IT Show your work

1 A student uses a music-mixing app that models a track's signal as 1 + 8i. A calibration filter is 7 - 2i, and the normalized signal is signal/filter. Find the normalized signal in a + bi form.

WORK SPACE

ANSWER _____

2 In a robotics competition, a robot's position correction is modeled by -8 + 15i centimeters, where the real and imaginary parts give perpendicular directions. The size of the correction is its modulus. Find the size of the correction.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Without using decimals, simplify (48 - 29i)/(6 + i). Then find the modulus of your quotient.

WORK SPACE AND ANSWER

ANSWER KEY

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find the conjugate of -6 + 8i.	**-6 - 8i**
2	Find the conjugate of 7 - 2i.	**7 + 2i**
3	Find the modulus of 9 - i.	**sqrt82**
4	Find the modulus of -8 + 15i.	**17**
5	Simplify (17 + 6i)/(2 + i). Write your answer in a + bi form.	**8-i**
6	Simplify (21 + 12i)/(1 + 2i). Write your answer in a + bi form.	**9 - 6i**

PART 2 · APPLY IT

1. **-9/53 + 58/53 i** Multiply the numerator and denominator by 7 + 2i, the conjugate of the filter. Simplify the resulting real denominator of 53.
2. **17 centimeters** Find sqrt((-8) squared + 15 squared). This is sqrt289, which equals 17.

CHALLENGE

Quotient: 7 - 6i; modulus: sqrt85

Accept equivalent quotient forms, including answers with separate fractional real and imaginary parts. For moduli, accept an unsimplified radical only when it is mathematically equivalent to the listed answer.