

Complex Plane Moves

Operate with complex numbers and track their points.

HIGH SCHOOL • MA.912.NSO.2.2

MA.912.NSO.2.2 "Represent addition, subtraction, multiplication and conjugation of complex numbers geometrically on the complex plane."

NAME _____

DATE _____

POINTS, VECTORS, AND TURNS

A complex number $a+bi$ is the point (a, b) on the complex plane. To add or subtract, combine the real parts and the imaginary parts, then write the new point. To multiply, use distribution and $i^2=-1$, then plot the product. The conjugate of $a+bi$ is $a-bi$, which reflects the point across the real axis.

WORKED EXAMPLE

Represent $(8+9i)+(3-4i)$ on the complex plane.

1. Add the real parts: $8+3=11$.
2. Add the imaginary parts: $9i+(-4i)=5i$.
3. Write the sum as $11+5i$ and use coordinates $(11, 5)$.

Answer: $11+5i$, point $(11, 5)$

PRACTICE 6 problems

- 1** Let $z=1+2i$ and $w=-6+7i$. Find $z+w$. Write the result and its point on the complex plane.

ANSWER _____

- 2** Find $(-1+6i)-(7+2i)$. Write the result and its point on the complex plane.

ANSWER _____

- 3** Find $(5+i)(-2+6i)$. Write the product and its point on the complex plane.

ANSWER _____

- 4** Find the conjugate of $6-i$. Write the conjugate and the coordinate of its point.

ANSWER _____

- 5** The points for z and w are $(-6, 2)$ and $(7, -1)$. Find $z+w$ and give the coordinate of the sum.

ANSWER _____

- 6** A point represents $z=-2+7i$. Find the conjugate of z and give the coordinate of the reflected point.

ANSWER _____

APPLY IT Show your work

- 1** A game design club uses complex numbers for movement on a screen. A character first moves by $2+6i$, then moves by $-7+i$. What is the character's total movement, and what point represents it?

WORK SPACE

ANSWER _____

- 2** A music production app represents an audio signal by $6+i$. An effect multiplies the signal by $2-i$. What complex number represents the changed signal, and what is its point on the complex plane?

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

Let $z=-1+6i$ and $w=2-i$. Find $z*w$ and $z*\text{conjugate}(w)$. Give both results as complex numbers and points on the complex plane.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	Let $z=1+2i$ and $w=-6+7i$. Find $z+w$. Write the result and its point on the complex plane.	$-5+9i$, point $(-5, 9)$
2	Find $(-1+6i)-(7+2i)$. Write the result and its point on the complex plane.	$-8+4i$, point $(-8, 4)$
3	Find $(5+i)(-2+6i)$. Write the product and its point on the complex plane.	$-16+28i$, point $(-16, 28)$
4	Find the conjugate of $6-i$. Write the conjugate and the coordinate of its point.	$6+i$, point $(6, 1)$
5	The points for z and w are $(-6, 2)$ and $(7, -1)$. Find $z+w$ and give the coordinate of the sum.	$1+i$, point $(1, 1)$
6	A point represents $z=-2+7i$. Find the conjugate of z and give the coordinate of the reflected point.	$-2-7i$, point $(-2, -7)$

PART 2 • APPLY IT

- $-5+7i$, point $(-5, 7)$** Add the horizontal changes, $2+(-7)=-5$, and the vertical changes, $6+1=7$. The total movement is the point $(-5, 7)$.
- $13-4i$, point $(13, -4)$** Distribute: $(6+i)(2-i)=12-6i+2i-i^2=13-4i$. The real and imaginary parts give the point $(13, -4)$.

CHALLENGE

$z*w=4+13i$, point $(4, 13)$. $\text{conjugate}(w)=2+i$, so $z*\text{conjugate}(w)=-8+11i$, point $(-8, 11)$.

Accept equivalent coordinate notation and complex-number forms such as $1+1i$ for $1+i$. For conjugation items, accept a correct statement that the point is reflected across the real axis.