LESSON MAKER PRO

Complex Plane Paths

Find distances and midpoints with complex numbers.

HIGH SCHOOL · HSN-CN.B.6

CCSS.Math.Content.HSN-CN.B.6 "(+) Calculate the distance between numbers in the complex plane as the modulus of the difference, and the midpoint of a segment as the average of the numbers at its endpoints."

NAME _____ DATE _____

DISTANCE AND MIDPOINT RULES

For z=a+bi and w=c+di, the distance between them is |w-z|=sqrt((c-a)^2+(d-b)^2). The midpoint is (z+w)/2, so average the real parts and average the imaginary parts.

WORKED EXAMPLE

Find the distance between z=7+5i and w=10+i.

1. Subtract: w-z=(10+i)-(7+5i).
2. Combine parts: w-z=3-4i.
3. Find the modulus: |3-4i|=sqrt(3^2+(-4)^2)=sqrt(25)=5.

Answer: 5

PRACTICE 6 problems

1 Find the distance between z=-2+3i and w=4+3i.

ANSWER _____

2 Find the distance between z=-1-2i and w=2+2i.

ANSWER _____

3 Find the midpoint of the segment with endpoints z=6-4i and w=-2+8i.

ANSWER _____

4 Find the midpoint of the segment with endpoints z=-5+i and w=3-7i.

ANSWER _____

5 Find the distance between z=2-5i and w=8+3i.

ANSWER _____

6 Find the midpoint of the segment with endpoints z=1/2+3i and w=7/2-i.

ANSWER _____

APPLY IT Show your work

1 A game designer uses a complex plane for an in-game map. Two collectible items are at -3+4i and 5-2i, where each unit is one map square. How many map squares apart are the items?

WORK SPACE

ANSWER _____

2 A video editor represents two animation keyframes as complex numbers -4-6i and 8+2i. What complex number represents the midpoint between the keyframes?

WORK SPACE

ANSWER _____

CHALLENGE One step up

The endpoints of a segment are z=-2+7i and w=6-i. Find both the midpoint and the distance between the endpoints.

WORK SPACE AND ANSWER

ANSWER KEY

Complex Plane Paths

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find the distance between z=-2+3i and w=4+3i.	**6**
2	Find the distance between z=-1-2i and w=2+2i.	**5**
3	Find the midpoint of the segment with endpoints z=6-4i and w=-2+8i.	**2+2i**
4	Find the midpoint of the segment with endpoints z=-5+i and w=3-7i.	**-1-3i**
5	Find the distance between z=2-5i and w=8+3i.	**10**
6	Find the midpoint of the segment with endpoints z=1/2+3i and w=7/2-i.	**2+i**

PART 2 · APPLY IT

1. **10 map squares** Subtract the locations: (5-2i)-(-3+4i)=8-6i. The distance is |8-6i|=sqrt(8^2+$(-6)^2$)=10.
2. **2-2i** Average the two complex numbers: [(-4-6i)+(8+2i)]/2=(4-4i)/2=2-2i.

CHALLENGE

Midpoint: 2+3i; distance: 8sqrt(2)

Accept equivalent exact forms, including sqrt(128) for 8sqrt(2). Accept midpoints written with the real and imaginary parts in either order if the signs are correct.