LESSON MAKER PRO

Vector Route Builder

Add displacement vectors and compare vector lengths.

HIGH SCHOOL · HSN-VM.B.4a

CCSS.Math.Content.HSN-VM.B.4a "Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes."

NAME _____ DATE _____

COMBINE VECTOR MOVES

To add vectors component-wise, add the horizontal components and add the vertical components. You can also place vectors end-to-end or use them as adjacent sides of a parallelogram, and the resultant is the vector from the start to the final point. The magnitude of a resultant is usually not the same as the sum of the two magnitudes.

WORKED EXAMPLE

Find a + b if a = <31, -41> and b = <-52, 61>.

1. Add horizontal components: 31 + (-52) = -21.
2. Add vertical components: -41 + 61 = 20.
3. Write the resultant as <-21, 20>.

Answer: a + b = <-21, 20>

PRACTICE 6 problems

1 Find u + v if u = <4, -6> and v = <-8, 10>.

ANSWER _____

2 Find r + s if r = <1, 8> and s = <9, -4>.

ANSWER _____

3 Let u = <6, 0> and v = <0, 8>. Find |u + v| and |u| + |v|.

ANSWER _____

_____

4 Vectors p = <-8, 1> and q = <4, 9> are adjacent sides of a parallelogram. Use the parallelogram rule to find the diagonal resultant p + q.

ANSWER _____

5 Find m + n if m = <1/8, -1/8> and n = <1/8, 1/8>.

ANSWER _____

6 A move from A(-9, 1) to B(-1, 9) is followed by a move from B to C(9, -8). Find AB + BC and the direct displacement AC.

ANSWER _____

_____

APPLY IT Show your work

1 During a game design test, a character moves 12 units right and 9 units up. Then the character moves 4 units left and 10 units up. Write the character's total displacement vector.

WORK SPACE

ANSWER _____

2 At a robotics competition, a robot moves 8 meters east and 15 meters north, then moves 1 meter west. Find the resultant displacement vector and its magnitude. Does that magnitude equal the sum of the magnitudes of the two moves?

WORK SPACE

ANSWER _____

CHALLENGE One step up

Let p = <x, 8> and q = <6, -8>. Find all values of x for which |p + q| = 16. Show the equation you use.

WORK SPACE AND ANSWER

ANSWER KEY

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find u + v if u = <4, -6> and v = <-8, 10>.	**<-4, 4>**
2	Find r + s if r = <1, 8> and s = <9, -4>.	**<10, 4>**
3	Let u = <6, 0> and v = <0, 8>. Find |u + v| and |u| + |v|.	**|u + v| = 10; |u| + |v| = 14**
4	Vectors p = <-8, 1> and q = <4, 9> are adjacent sides of a parallelogram. Use the parallelogram rule to find the diagonal resultant p + q.	**<-4, 10>**
5	Find m + n if m = <1/8, -1/8> and n = <1/8, 1/8>.	**<1/4, 0>**
6	A move from A(-9, 1) to B(-1, 9) is followed by a move from B to C(9, -8). Find AB + BC and the direct displacement AC.	**AB + BC = <18, -9>; AC = <18, -9>**

PART 2 · APPLY IT

1. **<8, 19>** Represent the two moves as <12, 9> and <-4, 10>. Add corresponding components to get <8, 19>.
2. **Resultant vector: <7, 15>; magnitude: sqrt(274) meters; no, sqrt(274) does not equal 18 meters.** Add <8, 15> and <-1, 0> to get <7, 15>, whose magnitude is sqrt(7^2 + 15^2) = sqrt(274). The individual magnitudes are 17 and 1, so their sum is 18.

CHALLENGE

x = 10 or x = -22, because p + q = <x + 6, 0> and |x + 6| = 16.

Accept ordered-pair notation in place of angle-bracket notation. For the robotics magnitude, accept sqrt(274) only as the exact form.