

Vector Motion Lab

Combine velocity vectors by matching components.

HIGH SCHOOL · MA.912.NSO.3.3

MA.912.NSO.3.3 "Solve mathematical and real-world problems involving velocity and other quantities that can be represented by vectors."

NAME _____

DATE _____

COMBINE COMPONENTS

To add vectors, add the x-components and add the y-components. To subtract vectors, subtract matching components. A negative component means motion opposite the chosen positive direction.

WORKED EXAMPLE

A kayak has velocity $\langle 6, -2 \rangle$ m/s, and the current has velocity $\langle -3, 5 \rangle$ m/s. Find the kayak's resultant velocity.

1. Add the x-components: $6 + (-3) = 3$.
2. Add the y-components: $-2 + 5 = 3$.
3. Write the resultant vector: $\langle 3, 3 \rangle$ m/s.

Answer: $\langle 3, 3 \rangle$ m/s

PRACTICE 6 problems

1 Find $\langle 8, 7 \rangle + \langle -1, 4 \rangle$.

ANSWER _____

2 Find $\langle 12, -7 \rangle - \langle 8, 1 \rangle$.

ANSWER _____

3 Velocity A is $\langle 11, -1 \rangle$ m/s, and velocity B is $\langle 4, 7 \rangle$ m/s. Find $A - B$.

ANSWER _____

4 Find the resultant displacement: $\langle -9, 11 \rangle + \langle 1, -4 \rangle$.

ANSWER _____

5 Multiply the force vector $\langle -1, 7 \rangle$ by 4.

ANSWER _____

6 Find the magnitude of the velocity vector $\langle 8, -15 \rangle$ m/s.

ANSWER _____

APPLY IT Show your work

- 1** In a racing game, a character's running velocity is $\langle 11, -1 \rangle$ m/s. A moving platform adds velocity $\langle -4, 8 \rangle$ m/s. What is the character's net velocity?

WORK SPACE

ANSWER _____

- 2** East and north are positive. A drone has an intended air velocity of $\langle 12, 7 \rangle$ m/s and an observed ground velocity of $\langle 4, 11 \rangle$ m/s. What is the wind velocity?

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

A robotics team wants its robot's total velocity to be $\langle 14, 11 \rangle$ cm/s. The robot's motor creates velocity $\langle 8, 11 \rangle$ cm/s, and a moving floor contributes velocity $\langle -1, -4 \rangle$ cm/s. What adjustment vector must be added?

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	Find $\langle 8, 7 \rangle + \langle -1, 4 \rangle$.	$\langle 7, 11 \rangle$
2	Find $\langle 12, -7 \rangle - \langle 8, 1 \rangle$.	$\langle 4, -8 \rangle$
3	Velocity A is $\langle 11, -1 \rangle$ m/s, and velocity B is $\langle 4, 7 \rangle$ m/s. Find A - B.	$\langle 7, -8 \rangle$ m/s
4	Find the resultant displacement: $\langle -9, 11 \rangle + \langle 1, -4 \rangle$.	$\langle -8, 7 \rangle$
5	Multiply the force vector $\langle -1, 7 \rangle$ by 4.	$\langle -4, 28 \rangle$
6	Find the magnitude of the velocity vector $\langle 8, -15 \rangle$ m/s.	17 m/s

PART 2 • APPLY IT

1. $\langle 7, 7 \rangle$ m/s Add the matching components: $11 + (-4) = 7$ and $-1 + 8 = 7$.
2. $\langle -8, 4 \rangle$ m/s Ground velocity equals air velocity plus wind velocity. Subtract the air velocity from the ground velocity: $\langle 4, 11 \rangle - \langle 12, 7 \rangle = \langle -8, 4 \rangle$.

CHALLENGE

 $\langle 7, 4 \rangle$ cm/s

Accept angle brackets or ordered-pair notation for component vectors. For the magnitude item, accept 17 m/s only, since the magnitude is positive.