LESSON MAKER PRO

Vector Motion Lab

Combine directions, speeds, and displacements with vectors.

HIGH SCHOOL · HSN-VM.A.3

CCSS.Math.Content.HSN-VM.A.3 "(+) Solve problems involving velocity and other quantities that can be represented by vectors."

NAME _____ DATE _____

COMBINE COMPONENTS

Add or subtract vectors by combining their matching horizontal and vertical components. To find the speed represented by <a, b>, calculate sqrt(a^2 + b^2), then include the correct units.

WORKED EXAMPLE

Find the resultant of <31, -22> + <-13, 47>.

1. Add the horizontal components: 31 + (-13) = 18.
2. Add the vertical components: -22 + 47 = 25.
3. Write the resultant vector as <18, 25>.

Answer: <18, 25>

PRACTICE 6 problems

1 Find <2, -9> + <7, 12>.

ANSWER _____

2 Find <15, 3> - <-4, 10>.

ANSWER _____

3 Find 3<-4, 7>.

ANSWER _____

4 Find the magnitude of <12, -9>.

ANSWER _____

5 A velocity vector is <0, -16> m/s. What is the object's speed?

ANSWER _____

6 Let w = <8, 2>. Find 2w.

ANSWER _____

APPLY IT Show your work

1 At a robotics competition, a robot moves <14, 11> feet during its first command and then moves <-6, 9> feet during its second command. What is the robot's net displacement vector?

WORK SPACE

ANSWER _____

2 A teen kayaker paddles with a velocity of <9, 4> mph relative to the water. The river current has velocity <-3, 2> mph. What is the kayaker's ground velocity and ground speed?

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

A rescue drone needs a ground velocity of <16, -11> m/s. Wind adds a velocity of <-4, 5> m/s to the drone's motion. What velocity must the drone have relative to the air? Then find its airspeed.

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_____

ANSWER KEY

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find <2, -9> + <7, 12>.	**<9, 3>**
2	Find <15, 3> - <-4, 10>.	**<19, -7>**
3	Find 3<-4, 7>.	**<-12, 21>**
4	Find the magnitude of <12, -9>.	**15**
5	A velocity vector is <0, -16> m/s. What is the object's speed?	**16 m/s**
6	Let w = <8, 2>. Find 2w.	**<16, 4>**

PART 2 · APPLY IT

1. **<8, 20> feet** Add corresponding components: <14 + (-6), 11 + 9> = <8, 20>. The positive components show an eastward and northward net displacement.
2. **Ground velocity: <6, 6> mph; ground speed: 6sqrt(2) mph** Add the paddling velocity and current: <9 + (-3), 4 + 2> = <6, 6>. The speed is sqrt(6^2 + 6^2) = sqrt(72) = 6sqrt(2) mph.

CHALLENGE

Velocity relative to the air: <20, -16> m/s; airspeed: 4sqrt(41) m/s

Accept equivalent vector notation, such as (9, 3), when the component order is clear. Accept sqrt(72) for the kayaker's speed and sqrt(656) for the drone's airspeed, although simplified radicals are preferred.