LESSON MAKER PRO

Vector Route Finder

Add vector components to find one resulting move.

HIGH SCHOOL · MA.912.NSO.3.9

MA.912.NSO.3.9 "Given the magnitude and direction of two or more vectors, determine the magnitude and direction of their sum."

NAME _____ DATE _____

ADD COMPONENTS FIRST

Treat east as positive horizontal and north as positive vertical. Add all horizontal components, then add all vertical components. The magnitude is sqrt($x^2 + y^2$), and the direction angle can be written as $\tan^{-1}$(|vertical/horizontal|) from the appropriate compass direction.

WORKED EXAMPLE

One vector is 20 units east, and another vector is 21 units north. Find the magnitude and direction of their sum.

1. Horizontal sum = 20 units east; vertical sum = 21 units north.
2. Magnitude = sqrt($20^2 + 21^2$) = sqrt(841) = 29 units.
3. Direction = $\tan^{-1}$(21/20) north of east.

Answer: 29 units, $\tan^{-1}$(21/20) north of east

PRACTICE 6 problems

1 A vector is 6 units east and another vector is 8 units north. Find the magnitude and direction of their sum.

ANSWER _____

2 A vector is 9 units east and another vector is 12 units west. Find the magnitude and direction of their sum.

ANSWER _____

3 A vector is 5 units north and another vector is 12 units east. Find the magnitude and direction of their sum.

ANSWER _____

4 A vector is 7 units west and another vector is 24 units south. Find the magnitude and direction of their sum.

ANSWER _____

5 Three vectors are 10 units east, 6 units west, and 8 units north. Find the magnitude and direction of their sum.

ANSWER _____

6 Three vectors are 15 units south, 9 units north, and 8 units west. Find the magnitude and direction of their sum.

ANSWER _____

APPLY IT Show your work

1 During a drone club test, a drone travels 12 meters east while a breeze pushes it 5 meters north. What are the magnitude and direction of the drone's resulting displacement?

WORK SPACE

ANSWER _____

2 In a campus navigation game, a player moves 24 blocks west, 18 blocks south, and then 6 blocks north. What are the magnitude and direction of the player's resulting displacement?

WORK SPACE

ANSWER _____

CHALLENGE One step up

A robot moves 10 units northeast, then 6 units west, then 2 units south. Northeast means a 45-degree direction. Find the exact magnitude and direction of the robot's resulting displacement.

WORK SPACE AND ANSWER

ANSWER KEY

Vector Route Finder

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A vector is 6 units east and another vector is 8 units north. Find the magnitude and direction of their sum.	**10 units, $\tan^{-1}(4/3)$ north of east**
2	A vector is 9 units east and another vector is 12 units west. Find the magnitude and direction of their sum.	**3 units west**
3	A vector is 5 units north and another vector is 12 units east. Find the magnitude and direction of their sum.	**13 units, $\tan^{-1}(5/12)$ north of east**
4	A vector is 7 units west and another vector is 24 units south. Find the magnitude and direction of their sum.	**25 units, $\tan^{-1}(7/24)$ west of south**
5	Three vectors are 10 units east, 6 units west, and 8 units north. Find the magnitude and direction of their sum.	**4sqrt(5) units, $\tan^{-1}(2)$ north of east**
6	Three vectors are 15 units south, 9 units north, and 8 units west. Find the magnitude and direction of their sum.	**10 units, $\tan^{-1}(4/3)$ west of south**

PART 2 · APPLY IT

1. **13 meters, $\tan^{-1}(5/12)$ north of east** Add the component vectors to get 12 meters east and 5 meters north. Use sqrt(12^2 + 5^2) for the magnitude and $\tan^{-1}(5/12)$ for the direction.
2. **12sqrt(5) blocks, $\tan^{-1}(1/2)$ south of west** The north-south movements combine to 12 blocks south, so the net vector is 24 blocks west and 12 blocks south. Its magnitude is sqrt(24^2 + 12^2) = 12sqrt(5).

CHALLENGE

sqrt(140 - 80sqrt(2)) units, $\tan^{-1}$((5sqrt(2) - 2)/(5sqrt(2) - 6)) north of east

Accept equivalent direction descriptions that use a different starting compass direction, such as south of west instead of west of south when the angle is adjusted correctly. Accept correctly rounded degree measures in place of $\tan^{-1}$ expressions.