LESSON MAKER PRO

Vector Resultants

Add direction vectors with components.

HIGH SCHOOL · HSN-VM.B.4b

CCSS.Math.Content.HSN-VM.B.4b "Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum."

NAME _____ DATE _____

ADD THE COMPONENTS

Treat east as 0°, and measure angles counterclockwise from east. Find each vector's horizontal and vertical components, add matching components, then use the Pythagorean theorem for the magnitude. Use the component signs to name the direction of the sum.

WORKED EXAMPLE

Vector A has magnitude 14 units at 0°. Vector B has magnitude 14 units at 90°. Find the magnitude and direction of A + B.

1. A = (14, 0) and B = (0, 14).
2. A + B = (14, 14).
3. Magnitude = sqrt($14^2 + 14^2$) = 14sqrt(2).
4. The equal positive components point at 45°.

Answer: 14sqrt(2) units at 45°

PRACTICE 6 problems

1 Vector A has magnitude 6 units at 0°. Vector B has magnitude 6 units at 90°. Find the magnitude and direction of A + B.

ANSWER _____

2 Vector A has magnitude 12 units at 0°. Vector B has magnitude 5 units at 90°. Find the magnitude and direction of A + B.

ANSWER _____

3 Vector A has magnitude 8 units at 45°. Vector B has magnitude 8 units at 135°. Find the magnitude and direction of A + B.

ANSWER _____

4 Vector A has magnitude 4 units at 30°. Vector B has magnitude 4 units at 150°. Find the magnitude and direction of A + B.

ANSWER _____

5 Vector A has magnitude 10 units at 0°. Vector B has magnitude 10 units at 180°. Find the magnitude and direction of A + B.

ANSWER _____

6 Vector A has magnitude 6 units at 30°. Vector B has magnitude 6 units at 150°. Find the magnitude and direction of A + B.

ANSWER _____

APPLY IT Show your work

1 A robotics club programs a small delivery robot to travel 8 meters east, then 8 meters north. What are the magnitude and direction of the robot's total displacement from its starting point?

WORK SPACE

ANSWER _____

2 During a campus video project, a student walks 5 meters east and then 12 meters north while carrying a camera. What are the magnitude and direction of the student's total displacement from the starting point?

WORK SPACE

ANSWER _____

CHALLENGE One step up

Three vectors are added: A has magnitude 10 units at 30°, B has magnitude 10 units at 150°, and C has magnitude 8 units at 270°. Find the magnitude and direction of A + B + C. Explain why the horizontal components of A and B cancel.

WORK SPACE AND ANSWER

ANSWER KEY

Vector Resultants

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Vector A has magnitude 6 units at 0°. Vector B has magnitude 6 units at 90°. Find the magnitude and direction of A + B.	**6sqrt(2) units at 45°**
2	Vector A has magnitude 12 units at 0°. Vector B has magnitude 5 units at 90°. Find the magnitude and direction of A + B.	**13 units at arctan(5/12)° north of east**
3	Vector A has magnitude 8 units at 45°. Vector B has magnitude 8 units at 135°. Find the magnitude and direction of A + B.	**8sqrt(2) units at 90°**
4	Vector A has magnitude 4 units at 30°. Vector B has magnitude 4 units at 150°. Find the magnitude and direction of A + B.	**4 units at 90°**
5	Vector A has magnitude 10 units at 0°. Vector B has magnitude 10 units at 180°. Find the magnitude and direction of A + B.	**0 units; direction is undefined**
6	Vector A has magnitude 6 units at 30°. Vector B has magnitude 6 units at 150°. Find the magnitude and direction of A + B.	**6 units at 90°**

PART 2 · APPLY IT

1. **8sqrt(2) meters at 45° north of east** The displacement components are (8, 8). Its magnitude is sqrt(8^2 + 8^2) = 8sqrt(2), and equal positive components give a 45° direction.
2. **13 meters at arctan(12/5)° north of east** Add the displacement components to get (5, 12). The magnitude is 13 meters, and the direction is arctan(12/5)° north of east.

CHALLENGE

2 units at 90°. A has horizontal component 5sqrt(3) and B has horizontal component -5sqrt(3), so they cancel. Their vertical components total 10 units north, and C contributes 8 units south, leaving 2 units north.

Accept equivalent direction wording, such as 45° north of east for 45°. For arctan answers, accept a correct decimal angle rounded reasonably, about 22.6° for arctan(5/12) and about 67.4° for arctan(12/5).