

9.2.3: Resolving Vectors into Components

Resolving Vectors into Axial Components

We know that when two vectors are in the same dimension, they can be added arithmetically. Suppose we have two vectors that are on a north-south, east-west grid, as shown below. One of the methods we can use to add these vectors is to resolve each one into a pair of vectors that lay on the north-south and east-west axes.

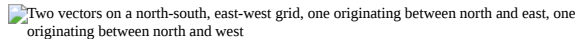


Figure 1.5.1

The two vectors we are to add is a force of 65 N at 30° north of east and a force of 35 N at 60° north of west.

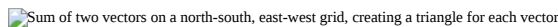


Figure 1.5.2

We can resolve each of the vectors into two components on the axes lines. Each vector is resolved into a component on the north-south axis and a component on the east-west axis.

Using trigonometry, we can resolve (break down) each of these vectors into a pair of vectors that lay on the axial lines (shown in red above).

The east-west component of the first vector is $(65 \text{ N})(\cos 30^\circ) = (65 \text{ N})(0.866) = 56.3 \text{ N east}$

The north-south component of the first vector is $(65 \text{ N})(\sin 30^\circ) = (65 \text{ N})(0.500) = 32.5 \text{ N north}$

The east-west component of the 2nd vector is $(35 \text{ N})(\cos 60^\circ) = (35 \text{ N})(0.500) = 17.5 \text{ N west}$

The north-south component of the 2nd vector is $(35 \text{ N})(\sin 60^\circ) = (35 \text{ N})(0.866) = 30.3 \text{ N north}$

Explore how to resolve vectors into axial components by hanging portraits of legendary physicists in the simulation below. The angle of each string determines how its tension force is distributed in both the horizontal and vertical dimensions. Under what conditions will the strings holding the portrait snap?

Summary

- Vectors can be resolved into component vectors that lie on the axes lines.

Review

1. A force of 150. N is exerted 22° north of east. Find the northward and eastward components of this force.
2. An automobile travels a displacement of 75 km 45° north of east. How far east does it travel and how far north does it travel?

Explore More

Use this resource to answer the questions that follow.



1. What does SohCahToa mean?
2. Why is SohCahToa relevant to resolving a vector into components?
3. Why is the sum of the components larger than the resultant vector?

Additional Resources

Real World Application: Physics Behind Darts

PLIX: Play, Learn, Interact, eXplore: Bow and Arrow

Video:



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