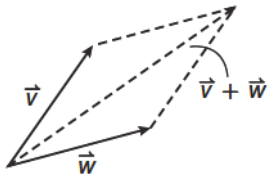
Name: _____

Date: _____

Period: _____

Geometry Lesson 83

Objective: TSW add vectors.



You have added vectors that are in the same or opposite directions, but how are vectors added when their directions are not so simple? There are two commonly used methods for adding any two vectors together. The parallelogram method is a method of adding two vectors by drawing a parallelogram using the vectors as two of the consecutive sides; the sum is a vector along the diagonal of the parallelogram.

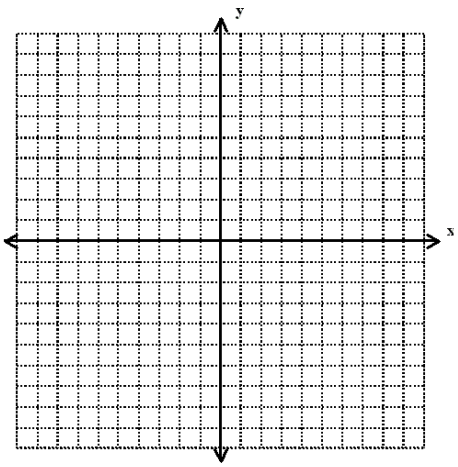
In the diagram, both $\vec{v}$ and $\vec{w}$ are drawn with the same initial point. A vector parallel to $\vec{v}$ and a vector parallel to $\vec{w}$ complete the parallelogram, and the diagonal is the resultant vector.

Example 1 Using the Parallelogram Method to Add Vectors

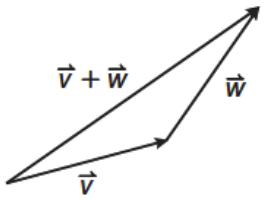
Use the parallelogram method to add the two vectors.

$\vec{a} = \langle 2, 3\rangle \;\; \vec{b} = \langle 4, -1\rangle$

SOLUTION



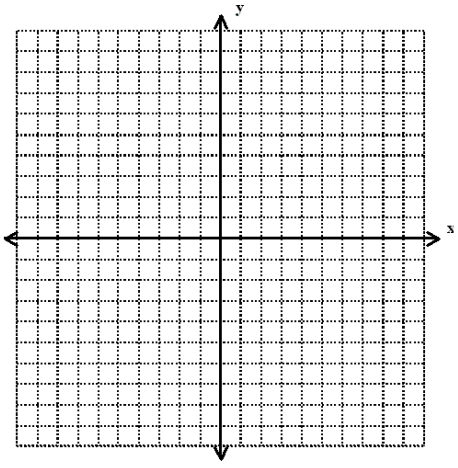
The head-to-tail method is a method of adding two vectors by placing the tail of the second vector on the head of the first vector. The sum is the vector drawn from the tail of the first vector to the head of the second vector. One benefit to using this method is that while the parallelogram method can only be used to add two vectors, the head-to-tail method can be used to add any number of vectors.



Example 2 Adding Vectors Head-to-Tail

Add the vectors $\vec{c} = \langle 5,4\rangle, \vec{d} = \langle -2,3\rangle, and\ \vec{e} = \langle -1, -1\rangle$ using the head-to-tail method.

SOLUTION



Math Language

Sometimes the direction of a vector is given using cardinal directions. For example, if the direction of a vector is "32° north of east," it means that you should start with the vector pointing east, and rotate it 32° towards the north (counterclockwise), to find its direction.

Remember that the direction of a vector must also be specified. To find a vector's direction, measure the angle it forms with the horizontal. By convention, when a vector's direction is given with an angle, the angle is measured counterclockwise from the positive *x*-axis.

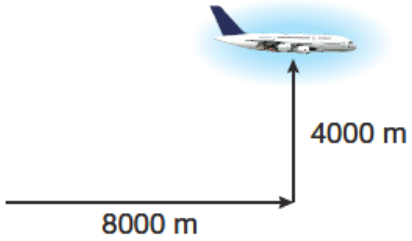
Example 3 Adding Vectors with Trigonometry

Add the vectors $\vec{a} = \langle 6,0 \rangle \; and \; \vec{b} = \langle 0,4 \rangle$, and find the magnitude and direction of the resultant vector.

Example 4 Application: Aviation

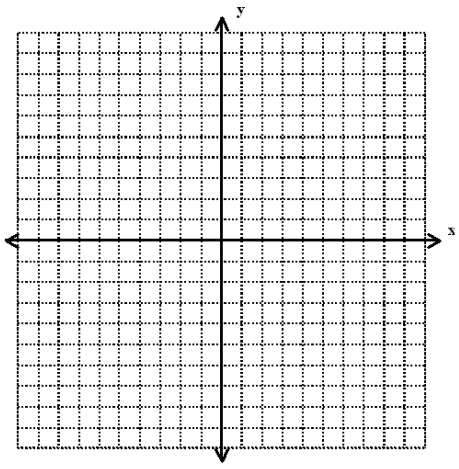
A plane has traveled a horizontal distance that can be represented by the vector ⟨8000, 0⟩, and a vertical distance represented by the vector ⟨0, 4000⟩, where the magnitude of both vectors is measured in meters. What is the magnitude of the distance it has traveled to the nearest meter?

SOLUTION

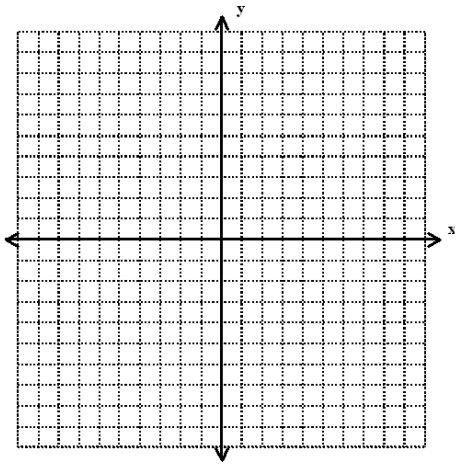


You Try!!!!!

a. Use the parallelogram method to add vectors $\vec{x} = \langle 3, 4 \rangle \; and \; \vec{y} = \langle 4, 1 \rangle$.



b. Add the vectors $\vec{a} = \langle 1, 2\rangle, \vec{b} = \langle 4, -5\rangle, and\ \vec{c} = \langle -1, 7\rangle$, using the head-to-tail method.



c. Add the vectors $\vec{u} = \langle 3{,}0\rangle\ and\ \vec{v} = \langle 0, -2\rangle$. Use trigonometry to find the magnitude and direction of the resulting vector.

d. A plane has traveled 2000 meters east while climbing to a height of 3000 meters. Write vectors to represent these two translations and find the magnitude of the resultant vector that gives the total distance the plane has traveled.