Name: ______________________ Date: __________

Skill and Practice

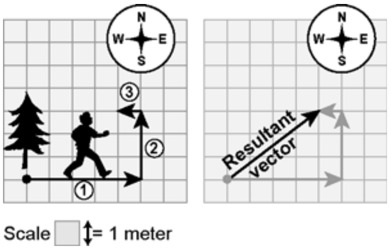
6A Adding Displacement Vectors

Read:

A displacement vector is a quantity that contains two separate pieces of information: (1) magnitude or size, and (2) direction. When you add displacement vectors, you end up at a certain position. This new position is the total displacement from the original position. A vector that connects the starting position with the final position is called the resultant vector (x).

Example:

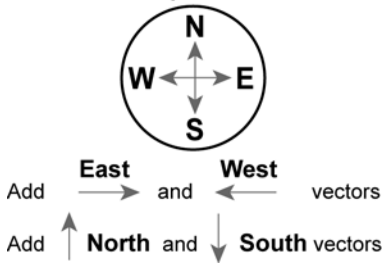
Andreas walked 5 meters east away from a tree. Then, he walked 3 meters north. Finally, he walked 1 meter west. Each of these three pathways is a displacement vector. Use these displacement vectors to find Andreas's total displacement from the tree.



Displacement vector	Direction	Magnitude (meters)	Total magnitude (total meters walked)
1	east	5	5
2	north	3	5 + 3 = 8
3	west	1	8 + 1 = 9

Andreas's motion can be represented on a graph. To determine his total displacement from the tree, do the following:

How to add displacement vectors:



1. Add the east and west displacement vectors. These are in the *x*-axis direction on a graph.
   Andreas's walk = 5 m east + (- 1)m west = 4 m east

2. Add the north and south displacement vectors. These are in the *y*-axis direction on a graph.
   Andreas's walk = 3 m north

The total displacement is 4 meters east and 3 meters north.
Andreas walked a total of 9 meters. The resultant vector (*x*) goes from the starting position to the final position of total displacement.

1. What is the total displacement of a bee that flies 2 meters east, 5 meters north, and 3 meters east?

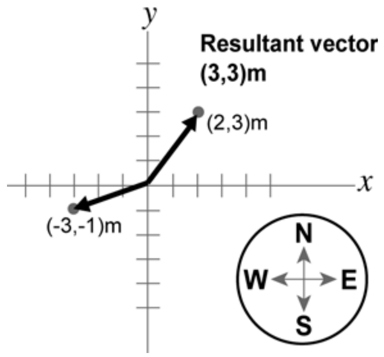
2. What is the total displacement of an ant that walks 2 meters west, 3 meters south, 4 meters east, and 1 meter north?

3. A ball is kicked 10 meters north, 5 meters west, 15 meters south, 5 meters east, and 5 meters north. Find the total displacement and the total distance it traveled.

Skill and Practice

Adding displacement vectors using *x-y* coordinates

A resultant vector can be written using *x-y* coordinates on a graph. The original position is the origin of a graph where the axes represent east-west and north-south positions. For example, (2,3)m is a resultant vector with the following components: 2 meters east and 3 meters north. A resultant vector, (-3,-1)m, has components 3 meters west and 1 meter south. Use this information to solve the following problems. Write your answers using *x-y* coordinates.



Example:

Add the following four vectors to find the resultant vector, x_R:

x_1 = (5,0)m, x_2 = (0,–5)m, x_3 = (3,0)m, x_4 = (–7,0) m

Add the east-west components: 5 m east + 0 m + 3 m east + (- 7) m west = 1 m east
Add the north-south components: 0 m + (-5) m south + 0 m + 0 m = (-5) m south xR = (1,-5)m.

1. Add the following three vectors to find the resultant vector, x_R:

   x_1 = (–2,0)m, x_2= (0,–5,)m, x_3 = (3,0)m

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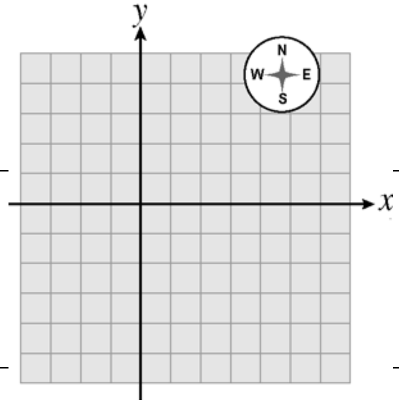
2. Add the following vectors to find the resultant vector. Plot the resultant vector (x_R) on the grid to the right:

   x_1 = (4,0)m, x_2= (–1,2)m, x_3 = (0,1)m



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3. Add the following three vectors to find the resultant vector, x_R:

   x_1 = (5,3)m, x_2 = (–5,0)m, x_3 = (5,2)m

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4. Add the following three vectors to find the resultant vector, x_R:

   x_1 = (6,-2)m, x_2 = (-3,1)m, x_3 = (3,3)m

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5. Add the following three vectors to find the resultant vector, x_R:

   x_1 = (4,4)m, x_2 = (-2,-6)m, x_3 = (0,2)m
