

Geometry 8.7

Perform vector operations geometrically

Perform vector operations on the coordinate plane

vector
magnitude
direction

← distance

← angle, N, S, etc.

resultant

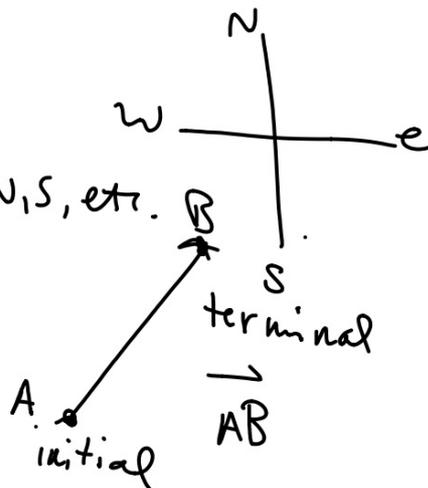
parallelogram method :(

triangle method :)

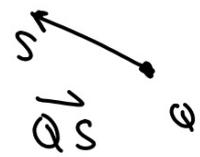
standard position

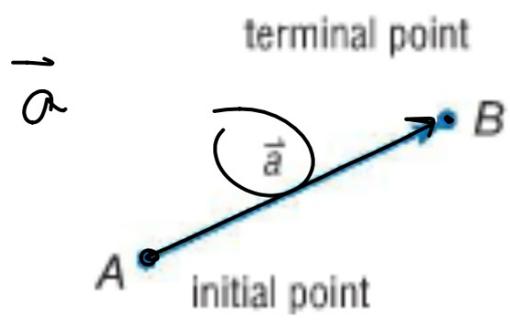
component form

protractor, ruler, tracing paper



Quiz 8.5-8.6 Thurs





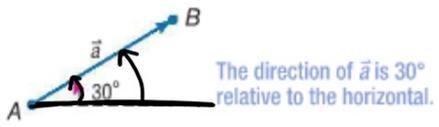
Vector.mp4

\vec{AB}
 \vec{a}

Compass rose

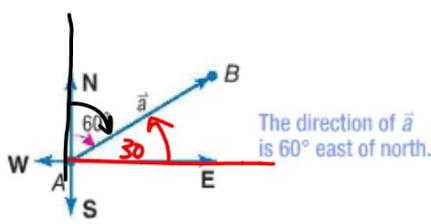
16 cm

30°



16 cm

60° E of N



30° N of E

think of it as a rotation...



Example 1 Represent Vectors Geometrically

Use a ruler and a protractor to draw each vector. Include a scale on each diagram.

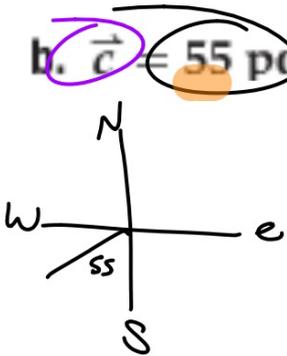
1. Identify the angle
2. Choose an appropriate scale (include in your answer)
3. Measure & mark the length (to scale)

a. \vec{m} = 15 miles per hour at 140° to the horizontal

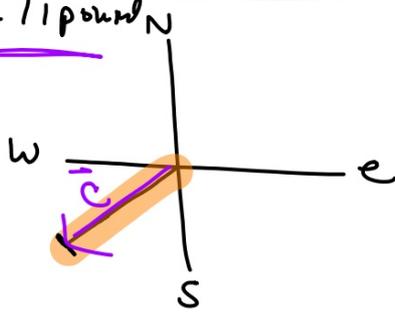


Start at S, rotate (which direction?)

b. $\vec{c} = 55$ pounds of force 55° west of south



line = 11 pound

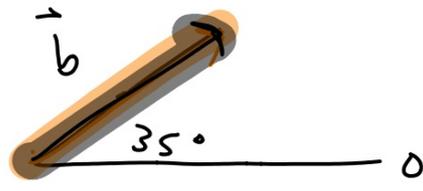


Guided Practice

1A. $\vec{b} = 40$ feet per second at 35° to the horizontal

1B. $\vec{t} = 12$ kilometers per hour at 85° east of north

$|\vec{b}| = 51.7$



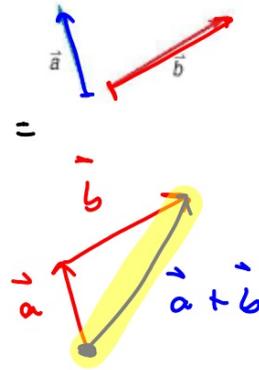
The sum of two or more vectors is a single vector called the **resultant**.

KeyConcept Vector Addition

To find the resultant of \vec{a} and \vec{b} , use one of the following methods.

☺ triangle method
"tip to tail"

$$\vec{a} + \vec{b} =$$



Parallelogram Method

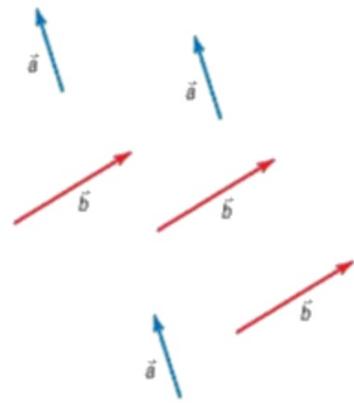
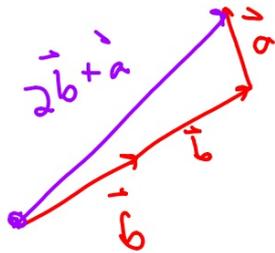
Triangle Method

:(

:)

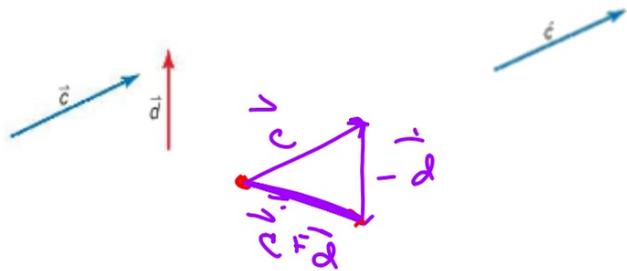
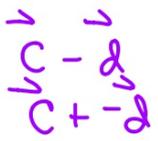
*triangle method is better

$$\vec{2b} + \vec{a}$$



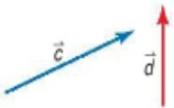
Label resultant (answer)!

$c+d$
 $c-d$ (smato)



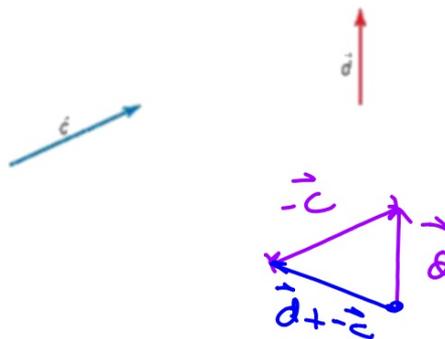
Example 2 Find the Resultant of Two Vectors

Copy the vectors. Then find $\vec{c} - \vec{d}$.



GuidedPractice

2A. Find $\vec{c} + \vec{d}$.



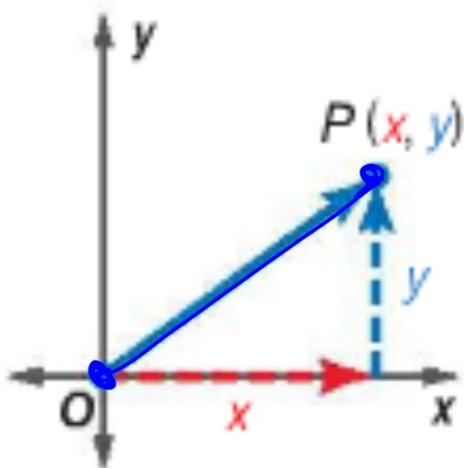
2B. Find $\vec{d} - \vec{c}$.

$$\vec{d} + -\vec{c}$$

Tracing paper

2 Vectors on the Coordinate Plane Vectors can also be represented on a coordinate plane.

A vector is in **standard position** if its initial point is at the origin. In this position, a vector can be uniquely described by its terminal point $P(x, y)$.



$$\langle 4, 2 \rangle$$

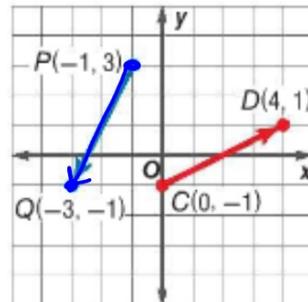
< frackets >

x y
<horizontal component, vertical component>
(always refers to standard position)

Example 3 Write a Vector in Component Form

Write the component form of \overrightarrow{CD} .

$$\begin{aligned}\overrightarrow{CD} &= \langle x_2 - x_1, y_2 - y_1 \rangle && \text{Component form of a vector} \\ &= \langle 4 - 0, 1 - (-1) \rangle && (x_1, y_1) = (0, -1) \text{ and } (x_2, y_2) = (4, 1) \\ &= \langle 4, 2 \rangle && \text{Simplify.}\end{aligned}$$



Guided Practice

3. Write the component form of \overrightarrow{PQ} .

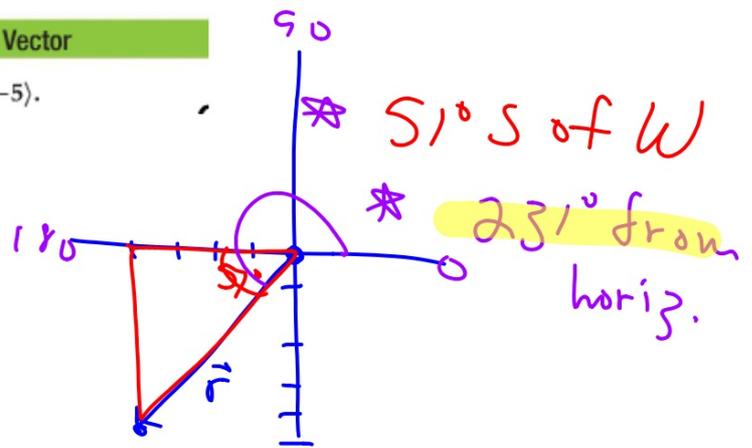
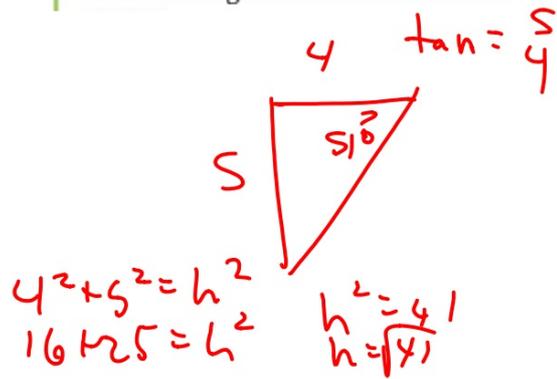
$$\langle -2, -4 \rangle$$

$$m = 6.4$$

magnitude (distance)
direction (angle in std form)

Example 4 Find the Magnitude and Direction of a Vector

Find the magnitude and direction of $\vec{r} = \langle -4, -5 \rangle$.

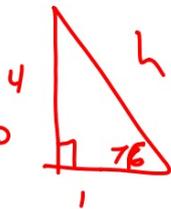
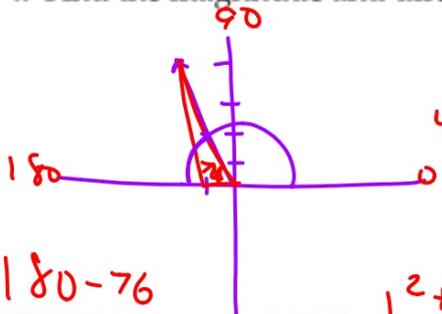


Guided Practice

4. Find the magnitude and direction of $\vec{p} = \langle -1, 4 \rangle$.

$m = 4.1$

P 605
13-41022



$\tan \frac{4}{1}$

$180 - 76$

$1^2 + 4^2 = h^2$

$1 + 16 = h^2$

$4.1 = h$

104° from horiz
76° W of N

combine components

KeyConcept Vector Operations

If $\langle a, b \rangle$ and $\langle c, d \rangle$ are vectors and k is a scalar, then the following are true.

Vector Addition $\langle a, b \rangle + \langle c, d \rangle = \langle a + c, b + d \rangle$

Vector Subtraction $\langle a, b \rangle - \langle c, d \rangle = \langle a - c, b - d \rangle$

Scalar Multiplication $k\langle a, b \rangle = \langle ka, kb \rangle$

How can you tell if it is a vector already?
(vs an ordered pair?)

Example 5 Operations with Vectors

Find each of the following for $\vec{r} = \langle 3, 4 \rangle$, $\vec{s} = \langle 5, -1 \rangle$, and $\vec{t} = \langle 1, -2 \rangle$.
Check your answers graphically.

a. $\vec{r} + \vec{t}$

Solve Algebraically

Check Graphically

Find each of the following for $\vec{r} = \langle 3, 4 \rangle$, $\vec{s} = \langle 5, -1 \rangle$, and $\vec{t} = \langle 1, -2 \rangle$.

b. $\vec{s} - \vec{r}$

c. $2\vec{t} - \vec{s}$

Find each of the following for $\vec{r} = \langle 3, 4 \rangle$, $\vec{s} = \langle 5, -1 \rangle$, and $\vec{t} = \langle 1, -2 \rangle$.

Guided Practice

Find each of the following for $\vec{r} = \langle 3, 4 \rangle$, $\vec{s} = \langle 5, -1 \rangle$, and $\vec{t} = \langle 1, -2 \rangle$.

5A. $\vec{t} - \vec{r}$

5B. $\vec{s} + 2\vec{t}$

5C. $\vec{s} - \vec{t}$