Find the distance from M to N, given M(-4, 7) and N(-1, 5).

$$\sqrt{(-4+1)^2+(7-5)^2}$$

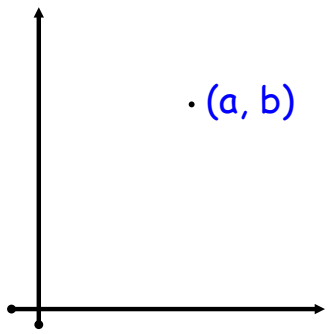
$$\sqrt{3^2+2^2}$$

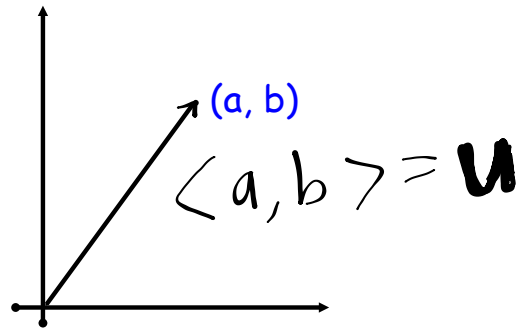
$$\sqrt{13}$$

6.1 Vectors

scalar: some quantities are represented by a single number - this indicates magnitude or size
distance, temperature, height

directed line segment: quantities with magnitude and direction such as force, velocity, acceleration (we use vectors)





(a,b) denotes a point in the coordinate plane.

Does (a,b) have any direction? What about magnitude?

How can we make it have magnitude?

How can we give it direction?

vectors are usually named with lower case bold letters

terminal point (head) where we end

initial point (tail) where we start

direction - angle
magnitude - length of vector

2 vectors are equal - if 2 directed line segments are equivalent (direction and magnitude are equal)

Vector Vocabulary

Standard Position: the arrow from the origin to the point (a,b) = $\langle a,b \rangle$

component form: shows the components of the vector (Δx and Δy) from standard position
(sometimes called the postion vector)

component form uses pointy parentheses

(x_1, y_1) tail

(x_2, y_2) head

$$\langle (x_2 - x_1), (y_2 - y_1) \rangle$$

$$\langle \Delta x, \Delta y \rangle$$

Magnitude: length of the vector (use distance formula)

$|u|$ ← magnitude of vector u

Zero vector: has 0 length and no direction

Find the component form and magnitude of:

given M (6, 5) and N (7, 12)

$\overrightarrow{MN}$

$\langle (7-6), (12-5) \rangle$

$\langle 1, 7 \rangle$

$\sqrt{1^2+7^2} = \sqrt{50}$

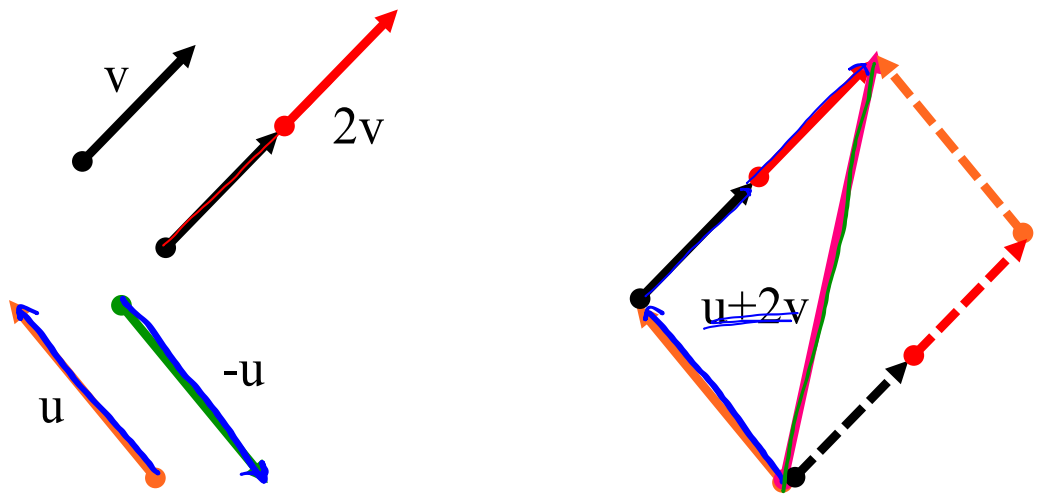
$\overrightarrow{NM}$

$\langle (6-7), (5-12) \rangle$

$\langle -1, -7 \rangle$

$\sqrt{1+49} = \sqrt{50}$

Operations with Vectors #232



vector addition and subtraction: add or subtract the components

scalars: distribute to both the x and y components

Example: $u = \langle 1, 4 \rangle \quad v = \langle -4, 5 \rangle$

$3v = \langle -12, 15 \rangle$

$u - v = \langle 5, -1 \rangle$

$u + v = \langle -3, 9 \rangle$

$2u - 3v = \langle 14, -7 \rangle$

More Vocab. #231a

Unit Vector: vector with magnitude of 1

to change to a unit vector in the direction of u: $\frac{u}{|u|}$

Standard Unit Vectors: $i = \langle 1, 0 \rangle$ (Horizontal) $j = \langle 0, 1 \rangle$ (vertical)

all vectors can be written using a linear combination of the standard unit vectors

$v = \langle a, b \rangle$ $\quad$ $v = ai + bj$

$v = a\langle 1,0\rangle + b\langle 0,1\rangle$

$v = \langle a,0\rangle + \langle 0,b\rangle$

$v = \langle a,b\rangle$

Example: $u = \langle -3, 2 \rangle$

find the unit vector and write it in linear combination form

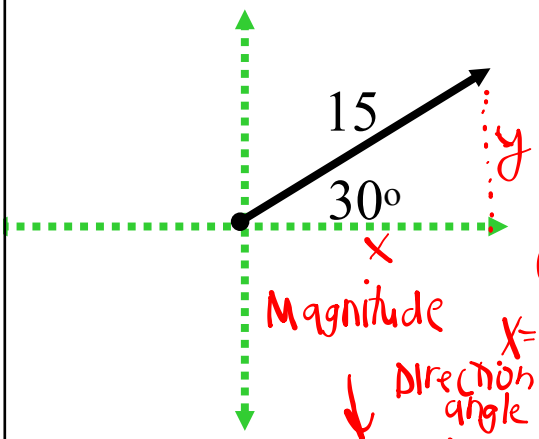
$|u| = \sqrt{(-3)^2 + (2)^2} = \sqrt{9+4} = \sqrt{13}$

unit vector: $\langle -3/\sqrt{13}, 2/\sqrt{13} \rangle$

$u = \left(\frac{-3}{\sqrt{13}}\right)i + \left(\frac{2}{\sqrt{13}}\right)j$

Applications of Vectors #233

Direction Angles: angles measured on unit circle in standard position (From the + x-axis)



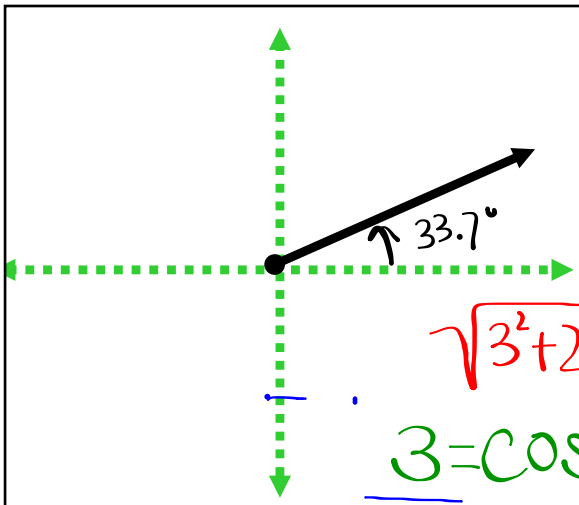
Given the direction angle and the magnitude, find the components of the vector:

$\cos 30° = \frac{x}{15}$ $\sin 30° = \frac{y}{15}$

$x = 15\cos 30°$ $y = 15\sin 30°$

Direction angle

$$u = \langle |u|\cos\theta, |u|\sin\theta \rangle$$



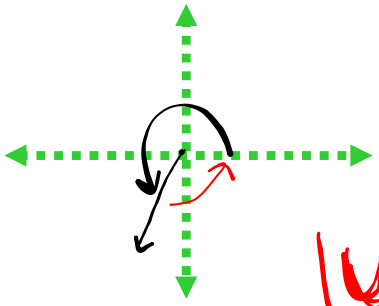
$$u = \langle 3, 2 \rangle$$

Find the magnitude and direction of u:

$\sqrt{3^2+2^2} = \sqrt{9+4} = \sqrt{13}$

$\frac{3}{\sqrt{13}} = \frac{\cos\theta(\sqrt{13})}{\sqrt{13}}$

$\cos^{-1}\left(3/\sqrt{13}\right) = \theta = 33.7°$



Find the magnitude and direction of u:

$$u = \langle -2, -5 \rangle$$

$|u| = \sqrt{4+25} = \sqrt{29}$

$\frac{-2}{\sqrt{29}} = \frac{\sqrt{29}\cos\theta}{\sqrt{29}}$

$\theta = \cos^{-1}(-2/\sqrt{29}) = 111.8^\circ$

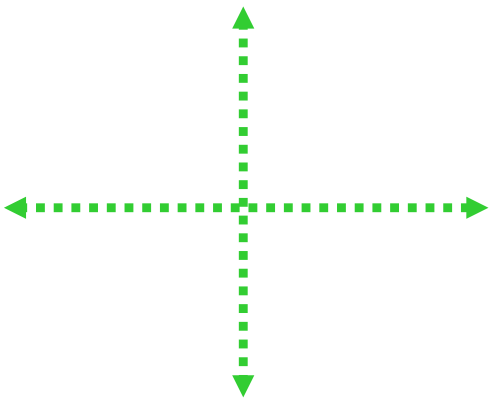
$360^\circ - 111.8^\circ$

$\boxed{248.2^\circ}$

Bearings vs. Direction Angles

You have to convert from bearings to direction angles 1st!!

An airplane is flying at a bearing of 170° at 460 mph. Find the component form of the velocity of the plane.



The wind is blowing with the bearing of 200° at 80 mph. Find the component form of the velocity of the wind.

p 511 1-37 odds, 30, 41, 42

February 13, 2013