Quiz: Monday 10/17

1D Kinematics

Use the system to solve problems...

Objectives:

Students will understand what a vector is, what types of quantities are vector quantities, and why vectors are useful

Students will understand how to break vectors into components

Students will understand how to add component vectors and resolve into a resultant vector

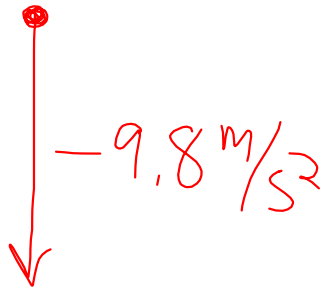
What is a vector?

Quantity that has size (magnitude) and a direction. (Ex. displacement, velocity, acceleration)

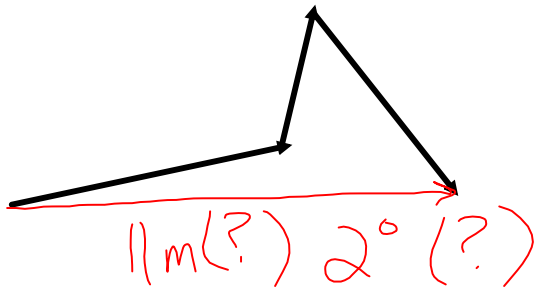
Why do we use vectors?

They are math!

- we can add, subtract, and multiply



Vector Addition:

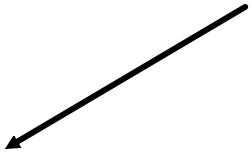


8.24, 14 degrees

4.12, 76 degrees

6.08, 170.5 degrees

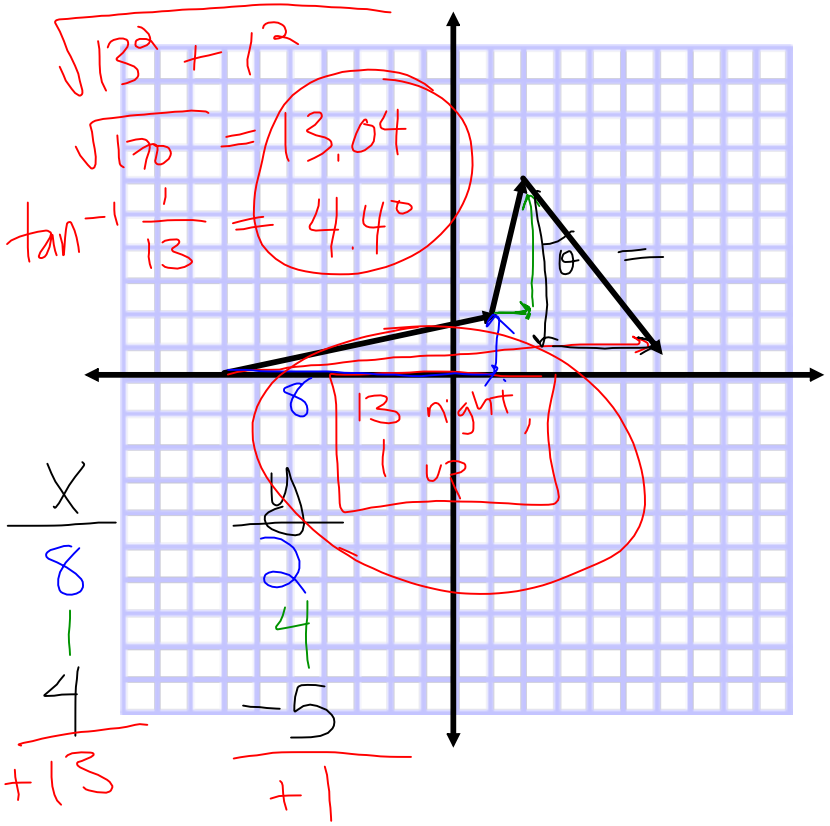
8.06, 209.7 degrees



6.4, 308.7 degrees

4.12, 346 degrees

Vector Addition:



8.24, 14 degrees

$x = 8.24 \cos 14 =$

$y = 8.24 \sin 14 =$

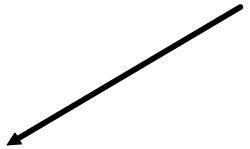
4.12, 76 degrees

$x = 4.12 \cos 76$

$y = 4.12 \sin 76$

6.08, 170.5 degrees

8.06, 209.7 degrees



6.4, 308.7 degrees

-270

$= 38.7°$ right of $-y$ axis

$x = 6.4 \sin 38.7$

$y = 6.4 \cos 38.7$

4.12, 346 degrees

Vector Arithmetic:

a. Break each vector into x- and y- components

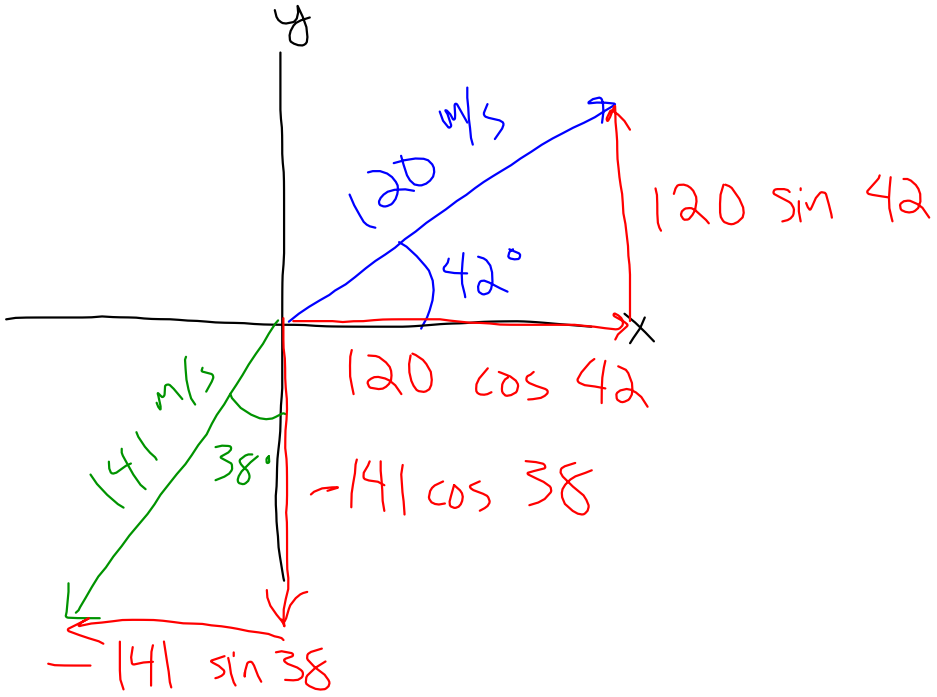
b. Add all the x- and y-components together to find the x- and y-components of the resultant vector

c. Resolve the components of the resultant vector to find its magnitude and angle

a. Breaking a vector into perpendicular components:

1. Draw the vector and sketch the components using a cartesian coordinate frame of reference.

2. Use trigonometry to determine the lengths of the component vectors (their direction will determine their sign).



$\sin\theta = \frac{o}{h}$

$o = h\sin\theta$

$\cos\theta = \frac{a}{h}$

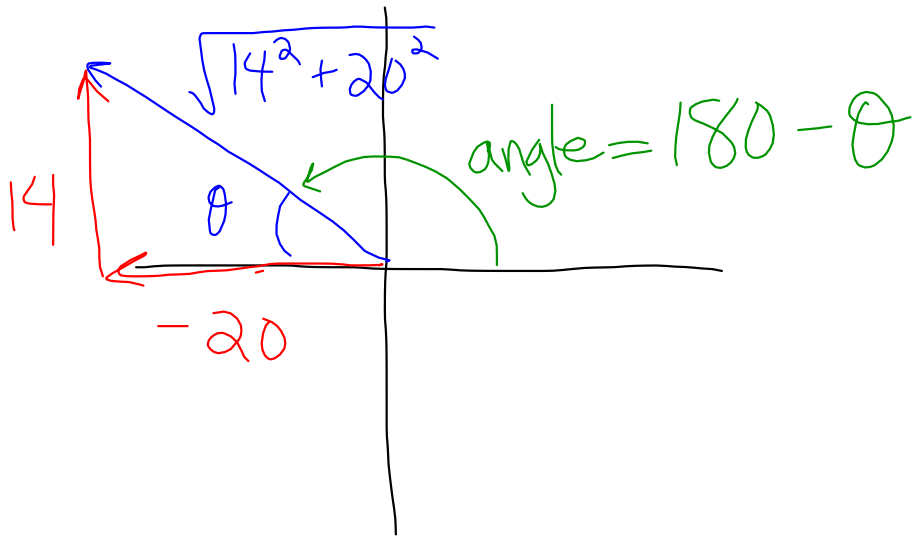
$a = h\cos\theta$

c. Resolving component vectors into a resultant:

1. Draw the component vectors and sketch the resultant on a cartesian coordinate plane.

2. Use the pythagorean theorem to find the length of the resultant.

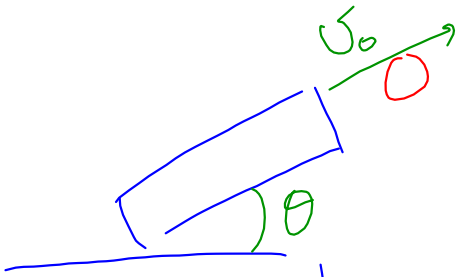
3. Use trigonometry to find the angle of the resultant - and specify what that angle is relative to!



$$\tan = \frac{o}{a}$$

$$\tan^{-1}\frac{o}{a} = \theta$$

$$\tan^{-1}\frac{14}{20} = \theta$$



$v_0 =$

$\theta =$

$x = v_0, \theta, t$

$y = v_0, \theta, t, a$

- where will it be @ 0.21 s
- how high will it be when it's 0.14m away horizontally?
- how far away horizontally will it be when it's 0.11m below
- how long will it take to be 0.8m away horizontally?

EXAMPLE 1: A bionic bunny bounces along a trail and travels 56 meters 18° west of due north. It spies a hawk, gets scared, and bolts in a direction that is 39° west of due south. Unfortunately, after going 35 meters he encounters a burly bear. For the bionic bouncing bunny to avoid the burly bear, the bouncing bunny darts away in a direction of 27° north of due east and runs for 98 meters. Where does the bunny end up relative to its starting point?

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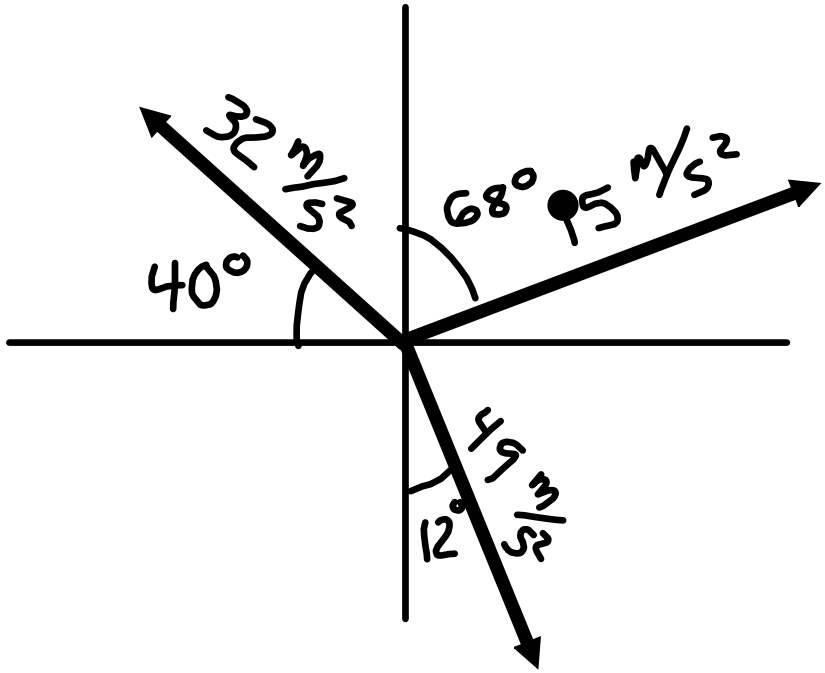
EXAMPLE 2: A micro meteor experiences the simultaneous accelerations of three different stars as shown. What is the meteor's net acceleration?



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