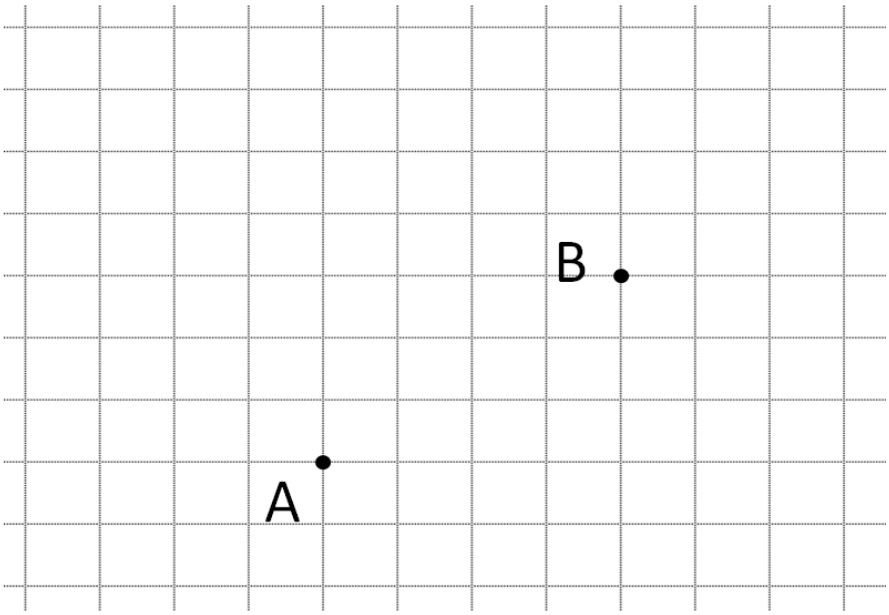
Noteguide for Types of vectors - Videos 3A **Name**_____

Make a guess, then watch the video:

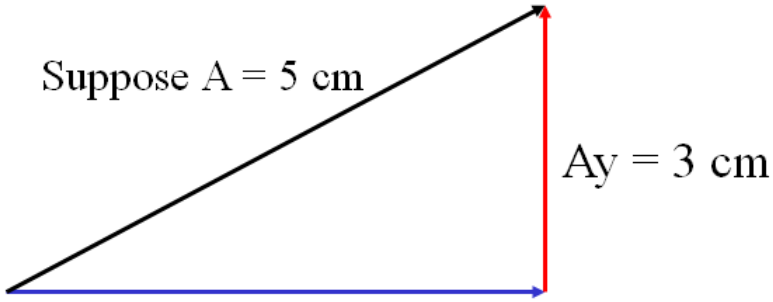
Come up with a precise set of directions for getting from Point A to Point B
Each square represents 1 m of distance



Write these directions:
Vector Component:

Angle Magnitude:

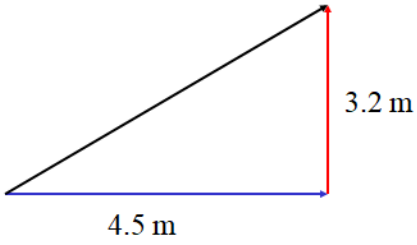
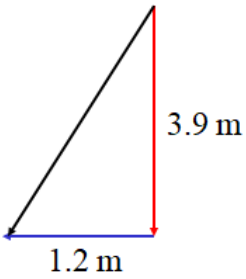
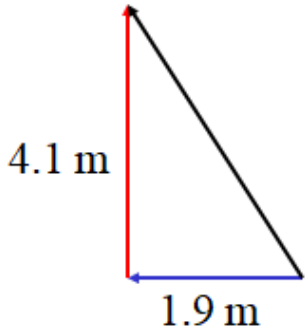
Noteguide for Finding Vector Components - Videos 3B **Name**_____



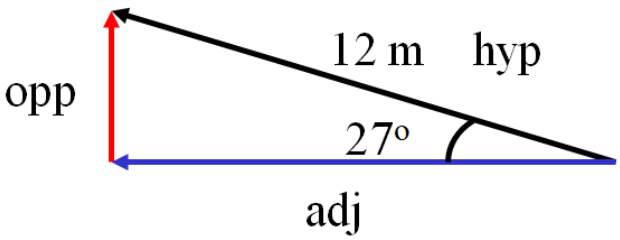
Ax = 4 cm

A = 4 cm $\hat{x}$ + 3 cm $\hat{y}$

Try to write these AM vectors as Component Vectors. Decide which side is x and which is y, which are negative, which are positive. Write it like I showed you in the previous part. Watch the videos to check your answers.

1. 	2. 
3. 	(Draw a cartoon here)

Finding the lengths of the sides
(Get your calculator out and calculate the things I do)

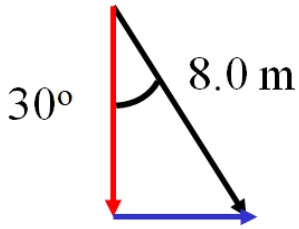


Step 1 – Draw
Tail to tip
Use Arrows

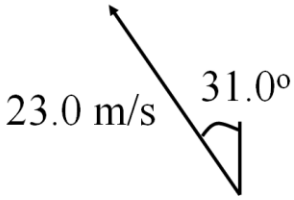
Step 2 –
Find the lengths:
adj = hyp Cosθ
opp = hyp Sinθ

Step 3
Decide x and y, + and –

Step 4
Write the vector down



Try this one yourself:



1. Draw the Components
2. Figure the components with sin and cos
3. Write the answer in VC Notation

-11.8 m/s x + 19.7 m/s y (the x and the y should have little ^ hats on them ; -)

Noteguide for Adding VC vectors - Videos 3C **Name**_____

A: 2.3 m x + 3.4 m y
B: 7.4 m x + 1.2 m y
A+B = 9.7 m x + 4.6 m y

Try these example problems. Don't freak out if you can't immediately get the answer. We will work on these as a group in class. They are solved in the linked videos that follow the main one

A = 4.5 m x + 3.2 m y B = -1.2 m x + -3.9 m y C = -1.9 m x + 4.1 m y 1. Find A + C (2.6 m x + 7.3 m y)	A = 4.5 m x + 3.2 m y B = -1.2 m x + -3.9 m y C = -1.9 m x + 4.1 m y 2. Find C + B (3.1 m x + 0.2 m y)
A = 4.5 m x + 3.2 m y B = -1.2 m x + -3.9 m y C = -1.9 m x + 4.1 m y 3. Find A - B (5.7 m x + 7.1 m y)	A = 4.5 m x + 3.2 m y B = -1.2 m x + -3.9 m y C = -1.9 m x + 4.1 m y 4. Find C - A (-6.4 m x + 0.9 m y)

Noteguide for Vector Component to Angle Magnitude - Videos 3D **Name**_____

Write down step by step directions:

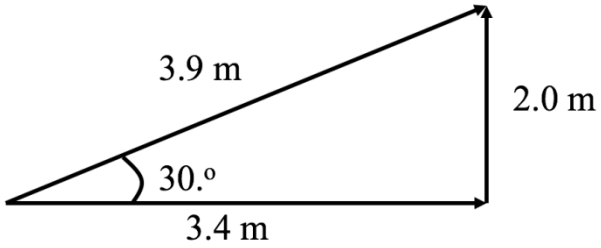
Given this VC Vector: 5.10 m x + -1.70 m y, Draw the AM vector

Try these example problems. Don't freak out if you can't immediately get the answer. We will work on these as a group in class. They are solved in the linked videos that follow the main one. Answers to these are on the back of this sheet. Be sure you can make the drawings correctly with the arrows in the right direction.

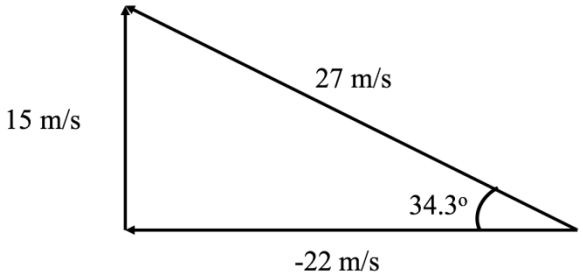
1. Draw this vector, and find its magnitude and the angle it forms with the x-axis: 3.4 m x + 2.0 m y	2. Draw this vector, and find its magnitude and the angle it forms with the x-axis: -22 m/s x + 15 m/s y
3. Draw this vector, and find its magnitude and the angle it forms with the x-axis: 9.00 N x + -15.0 N y	4. Draw this vector, and find its magnitude and the angle it forms with the x-axis: 15.00 m/s/s x + -9.80 m/s/s y

Answers to whiteboards – be sure you have drawn the arrows the right way. Don't worry if the videos do something with a trig angle – that is not a thing anymore

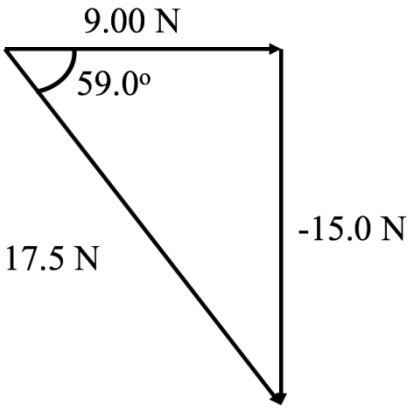
1.



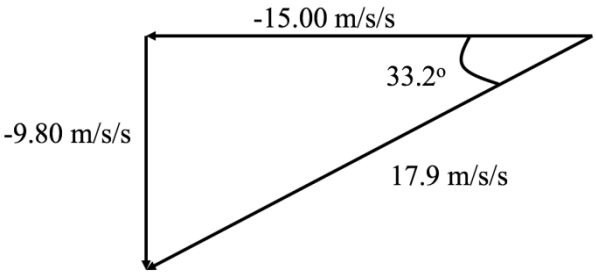
2.



3.

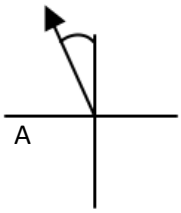


4.



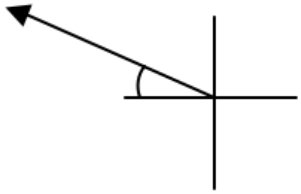
Noteguide for Adding two AM vectors - Videos 3E **Name**_____

Write down the steps for this:



Mag. = 129 m, $\theta = 21.0^{o}$

A



Mag. = 173 m, $\theta = 35.0^{o}$

B

Noteguide for Cliff Problems - Videos 3F

Red Elk runs off a 3.8 m tall cliff with a horizontal velocity of 4.2 m/s, and does a faceplant in a snow drift.

a. What time is he in the air?

b. How far out does he land?

c. What is his velocity of impact with the snow drift?

Cliff Problem Note Guide - Videos 3G **Name**_____

Red Elk throws a ball with a purely horizontal velocity from the roof of a building that is 21 m tall. The ball lands 17 m from the base of the building.

a) What time is the ball in the air? b) What is the final vertical velocity?
c) What is the horizontal velocity?
d) What is the velocity of impact in terms of an angle and a magnitude?

H	V
x	x
v_i	v_i
v_f	v_f
a	a
t	t

(Do the back side too)

Red Elk runs at 4.5 m/s horizontally from the top of a cliff and lands in the water 6.2 m from the base of the cliff.

a) What time is he in the air? b) What is his final vertical velocity?

c) How tall is the cliff?

d) What is the velocity of impact in terms of an angle and a magnitude?

H	V
x	x
v_i	v_i
v_f	v_f
a	a
t	t

P3.2 Cliff Practice Problems

Round to three figures, Ignore air friction and use the convention that down is negative. g = 9.80 m/s/s

1.25 s 9.07 m/s -12.2 m/s 15.2 m/s, 53.4^{o} blw hrz	1. A ball is projected with a purely horizontal velocity from an 7.60 m tall cliff and lands 11.3 m from the base of the cliff. a. What time is the ball in the air? b. With what purely horizontal velocity was it projected from the top of the cliff? c. What is the final vertical velocity? (Just before it hits the ground) d. Draw a picture of the final velocity of impact. Calculate the speed it is traveling, and find the angle below horizontal the velocity makes.
19.6 m 2.00 s -19.6 m/s 23.2 m/s, 57.5^{o} blw hrz	2. A ball leaves the edge of a cliff with a purely horizontal velocity of 12.5 m/s, and lands 25.0 m from the base of the cliff a. How high is the cliff? b. What time does it take the ball to hit the ground? c. What is the final vertical velocity? (Just before it hits the ground) d. Draw a picture of the final velocity of impact. Calculate the speed it is traveling, and find the angle below horizontal the velocity makes.
9.88 m high 12.9 m -13.9 m/s 16.6 m/s, 56.8^{o} blw hrz	3. A ball rolls off the edge of a cliff. The instant it leaves the edge, it has a purely horizontal velocity of 9.10 m/s, and it strikes the ground after 1.42 seconds. a. How high is the cliff? b. How far from the base of the cliff does the ball land? c. What is the final vertical velocity? (Just before it hits the ground) d. Draw a picture of the final velocity of impact. Calculate the speed it is traveling, and find the angle below horizontal the velocity makes.
1.41 s 19.0 m -13.8 m/s 19.3 m/s, 45.6^{o} blw hrz	4. A ball is projected sideways at 13.5 m/s from the top of a 9.70 m tall cliff. a. What time is the ball in the air? b. How far from the base of the cliff does the ball land? c. What is the final vertical velocity? (Just before it hits the ground) d. Draw a picture of the final velocity of impact. Calculate the speed it is traveling, and find the angle below horizontal the velocity makes.
20.6 m high 10.5 m/s -20.1 m/s 22.7 m/s, 62.3^{o} blw hrz	5. A ball rolls off the edge of a cliff with a purely horizontal velocity, and strikes the ground 2.05 s later at a distance of 21.6 m from the base of the cliff. a. How high is the cliff? b. What was the ball's horizontal velocity? c. What is the final vertical velocity? (Just before it hits the ground) d. Draw a picture of the final velocity of impact. Calculate the speed it is traveling, and find the angle below horizontal the velocity makes.

Arc Problem Note Guide - Videos 3H **Name**_____

Red Elk hits a golf ball at a speed of 41.3 m/s at an angle of 78.2^{o} above the horizontal. Assume that the ground is level, and ignore air friction.

a) What time is the ball in the air?

b) What is the horizontal distance that the ball goes before striking the ground?

c) What is the speed at the highest point on the ball's trajectory, and what is the greatest height?

H	V
x	x
v_i	v_i
v_f	v_f
a	a
t	t

Use the range equation to find these ranges for the velocities and launch angles. Write down what you put into your calculator. Take the time to see if you can get the same answer with your own calculator.

Velocity = 12.0 m/s, Launch Angle = 52.0^o Range = _____

Velocity = 21.0 m/s, Launch Angle = 67.0^o Range = _____

Velocity = 31.0 m/s, Launch Angle = 32.0^o Range = _____

Use the range equation to find the proper launch angles for the following velocities and ranges. Write down what you put into your calculator. Take the time to see if you can get the same answer with your own calculator.

Velocity = 24.0 m/s, Range = 45.7 m, Launch Angles =_____and_____degrees

Velocity = 13.0 m/s, Range = 9.00 m, Launch Angles =_____and_____degrees

Velocity = 12.0 m/s, Range = 200. m, Launch Angles =_____and_____degrees

Noteguide for Range Equation - Videos 3I **Name** _____

$$Range = \frac{v^2}{g}\sin(2\theta)$$

V = 32.1 m/s

Solve for θ:

How to find angle to hit 90.0 m:

How to find angle hit 200. m:

P3.3 Arc Practice Problems

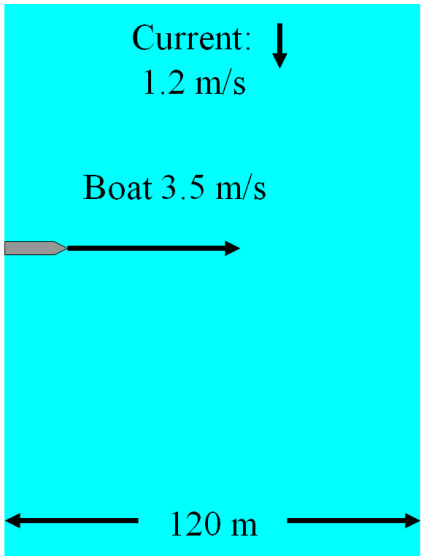
Round to the correct three figures, Ignore air friction and use the convention that down is negative. g = 9.80 m/s/s

8.45 s 149 m 87.5 m 17.6 m/s	1. A flaming projectile is launched on a level range at a speed of 45.0 m/s at an angle of 67.0^o above the horizontal. a. For how long does it stay in the air? b. What horizontal distance does it travel? c. What is its greatest height? d. What is its speed at its highest point?
6.96 s 326 m 59.3 m 46.9 m/s	2. A donut is launched on a level range at a speed of 58.0 m/s at an angle of 36.0^o above the horizontal. a. For how long does it stay in the air? b. What horizontal distance does it travel? c. What is its greatest height? d. What is its speed at its highest point?
4.59 s 22.0 m 25.8 m 4.78 m/s	3. A hazelnut is launched on a level range at a speed of 23.0 m/s at an angle of 78.0^o above the horizontal. a. For how long does it stay in the air? b. What horizontal distance does it travel? c. What is its greatest height? d. What is its speed at its highest point?
5.67 s 147 m 39.4 m 25.9 m/s	4. A 1968 VW Beetle is launched on a level range at a speed of 38.0 m/s at an angle of 47.0^o above the horizontal. a. For how long does it stay in the air? b. What horizontal distance does it travel? c. What is its greatest height? d. What is its speed at its highest point?
3.06 s 24.4 m 11.5 m 7.98 m/s	5. A soccer ball is kicked on a level range at a speed of 17.0 m/s at an angle of 62.0^o above the horizontal. a. For how long does it stay in the air? b. What horizontal distance does it travel? c. What is its greatest height? d. What is its speed at its highest point?
50.0 m 104 m 41.7 m 40.0 m 83.3 m 48.9 m	6. A rocket is launched at speed of 23.0 m/s at 34.0^o above horizontal. Range = ? A rocket is launched at speed of 32.0 m/s at 45.0^o above horizontal. Range = ? A rocket is launched at speed of 21.0 m/s at 56.0^o above horizontal. Range = ? A rocket is launched at speed of 28.0 m/s at 75.0^o above horizontal. Range = ? A rocket is launched at speed of 29.0 m/s at 52.0^o above horizontal. Range = ? A rocket is launched at speed of 22.0 m/s at 49.0^o above horizontal. Range = ?
17.3^o 72.7^o 32.8^o 57.2^o 36.5^o 53.5^o 15.4^o 74.6^o 28.9^o 61.1^o 23.7^o 66.3^o	7. Range = 67.0 m, velocity = 34.0 m/s, angle = ? and ? Range = 45.0 m, velocity = 22.0 m/s, angle = ? and ? Range = 61.0 m, velocity = 25.0 m/s, angle = ? and ? Range = 23.0 m, velocity = 21.0 m/s, angle = ? and ? Range = 54.0 m, velocity = 25.0 m/s, angle = ? and ? Range = 92.0 m, velocity = 35.0 m/s, angle = ? and ?

Noteguide for Boat Crossing River - Videos 3J **Name** _____

Example 1- Pointed Straight Across

Find:
•Time to cross
•Where it lands
•Vel as seen from above



Example 2:

A boat with a velocity (in still water) of 1.49 m/s points straight across river with a current of 0.750 m/s In doing this it is carried downstream 25.2 m.

1. What time does it take to cross?
2. How wide is the river?
3. What is the velocity (in angle magnitude notation) of the boat as it moves across the river? Draw a picture of the velocity.

(Do the example on the back side too)

Example 3:

A boat crosses a 62.0 m wide river in 45.2 s by pointing straight across. In so doing, it is carried downstream a distance of 17.5 m

1. What is the velocity of the boat with respect to the water?
2. What is the speed of the current?
3. What is the velocity (in angle magnitude notation) of the boat as it moves across the river? Draw a picture of the velocity.

P3.4 Boat Crossing River Problems

149 s 122 m 3.59 m/s 13.2^{o} DS 4.76 m/s 24.8 m	**1. a-c: A boat with a velocity in still water of 3.50 m/s points straight across a 520. m wide river with a current of 0.820 m/s** a. What time will it take to cross the river? b. How far downstream will the boat be carried in crossing the river? c. What is the velocity (in angle magnitude notation) of the boat as it moves across the river? Draw a picture of the velocity. **d-e: A boat pointed straight across a 257 m wide river crosses it in 54.0 s. The river has a current of 0.460 m/s.** d. What is the speed of the boat with respect to the water? e. How far downstream will the boat be carried in crossing the river?
66.0 s 87.2 m 2.52 m/s, 31.5^{o} DS 2.57 m/s 0.533 m/s	**2. a-c: A boat that can go 2.15 m/s points straight across a 142.0 m wide river with a current of 1.32 m/s** a. What time will it take to cross? b. How far downstream will the boat be carried in this time? c. What is the velocity (in angle magnitude notation) of the boat as it moves across the river? Draw a picture of the velocity. **d-e: A boat takes 43.5 s to cross a river when it points straight across. The river is 112 m wide, and the boat is carried downstream 23.2 m in crossing.** d. What is the speed of the boat with respect to the water? e. What is the speed of the current?
67.1 s 194 m 3.10 m/s 21.2^{o} DS 391 m 104 m	**3. a-c: A boat with a velocity (in still water) of 2.89 m/s points straight across river with a current of 1.12 m/s In doing this it is carried downstream 75.1 m.** a. What time does it take to cross? b. How wide is the river? c. What is the velocity (in angle magnitude notation) of the boat as it moves across the river? Draw a picture of the velocity. **d-e: A boat has a velocity of 5.43 m/s (in still water) is pointed straight across a river with a current of 1.45 m/s. The boat makes the crossing in 72.0 s.** d. How wide is the river? e. How far downstream will the boat be carried in crossing the river?
19.7 s 1.21 m/s 4.67 m/s, 15.0^{o} DS 2.92 m/s 0.901 m/s	**4. a-c: A boat with a speed of 4.51 m/s points straight across a 89.0 m wide river and is carried downstream 23.8 m in crossing.** a. What time does it take to cross the river? b. What is the speed of the current? c. What is the velocity (in angle magnitude notation) of the boat as it moves across the river? Draw a picture of the velocity. **d-e: A boat takes 87.0 s to cross a river when it points straight across. The river is 254 m wide, and the boat is carried downstream 78.4 m in crossing.** d. What is the speed of the boat with respect to the water? e. What is the speed of the current?
52.7 s 2.81 m/s 3.07 m/s, 23.8^{o} DS 287 m 1.68 m/s	**5. a-c: A boat points straight across a 148 m wide river with a current of 1.24 m/s. In crossing it is carried downstream a distance of 65.3 m.** a. What time did it take to cross? b. What is the speed of the boat with respect to the water? c. What is the velocity (in angle magnitude notation) of the boat as it moves across the river? Draw a picture of the velocity. **d-e: A boat pointed straight across has a velocity of 5.21 m/s with respect to the water, and crosses in 55.0 s. In crossing the boat is carried downstream a distance of 92.4 m.** d. How wide is the river? e. What is the speed of the current?