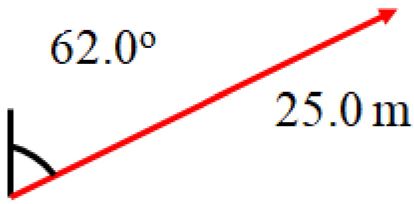
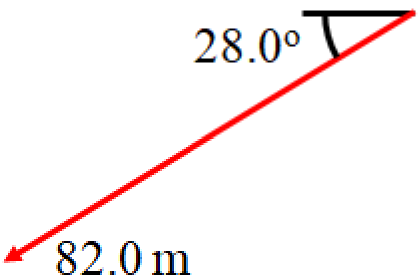
3.1 Vector Quizlette **(turn this in)** **Name**________________________

B. Find these Vector Components and write each vector as a proper component vector:

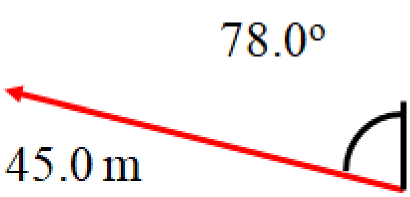
#1



#2



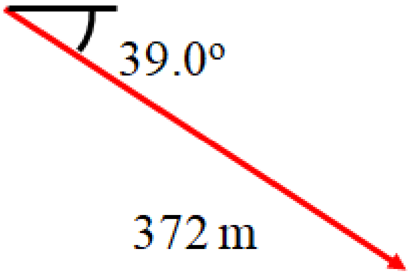
#3



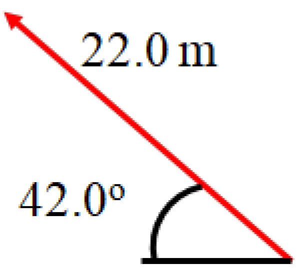
#1: 22.1 m x + 11.7 m y #2: -72.4 m, x + -38.5 m y #3: -44.0 m x + 9.36 m y

3.1 Vector Quizlette

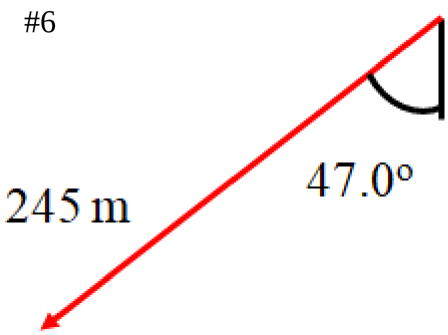
#4



#5



#6



#4: 289 m x + -234 m y #5: -16.3 m x + 14.7 m y #6: -179 m x + -167 m y

3.1 Vector Quizlette

C. Add these component vectors:

A: 12 m x + 34 m y B: 16 m x + 9.0 m y A+ B: #a 28 m x + 43 m y	A: 1.20 m x + 3.10 m y B: -5.30 m x + 1.30 m y A+ B: #b -4.1 m x + 4.4 m y
A: 3.60 m x + -5.60 m y B: 12.5 m x + 8.10 m y A+ B: #c 16.1 m x + 2.50 m y	A: 12.6 m x + 58.1 m y B: 16.5 m x + -96.0 m y A+ B: #d 29.1 m x + -37.9 m y

D. Draw these vectors as Angle Magnitude vectors. The vector should be an arrow, and calculate and label its magnitude (hypotenuse) and the angle:

1) 6.00 m x + 8.00 m y

2) -4.50 m x + 6.40 m y

3) -5.12 m x + -3.90 m y

4) 56.3 m x + -37.0 m y

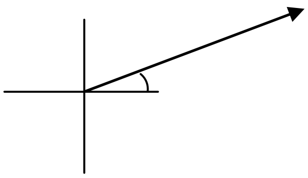
1) 10.0 m right and up 53.1^{o} above the x axis, 2) 7.82 m left and up at 54.9^{o} above the x axis
3) 6.44 m left and down 37.3^{o} below the x axis, 4) 67.4 m right and down 33.3^{o} below the x axis

3.1 Vector Quizlette

E1: Adding two Angle Magnitude Vectors (Just like the test…)

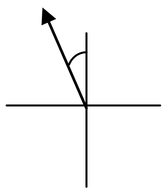
Find the Components of these two vectors:
Carry three decimal places in your calculations.

Mag. = 12.0 m, $\theta = 21.0^{o}$



1 = ______________x + ______________y

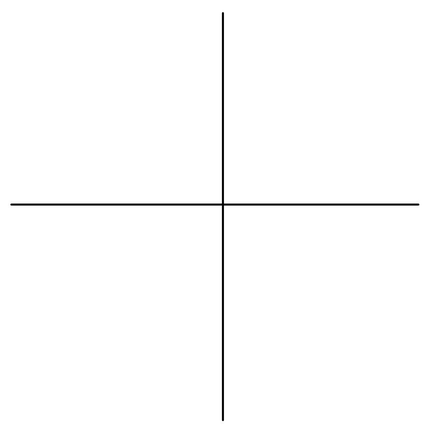
2 = ______________x + ______________y



Mag. = 8.00 m, $\theta = 17.0^{o}$

Add the Two Vectors: 1+2 = ____________x + ______________y

Draw a picture of the resultant vector with its tail on the origin, find its magnitude, and label an angle indicating its direction:



mag	angle	x	y	
12	21	11.203	4.300	
8	107	-2.339	7.650	
		8.864	11.951	
		mag	14.9	m
		anglex	53.4	o

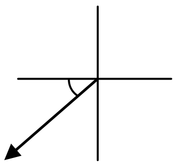
14.9 m, up and right, above 53.4^{o} the x-axis

3.1 Vector Quizlette

E2: Adding two Angle Magnitude Vectors

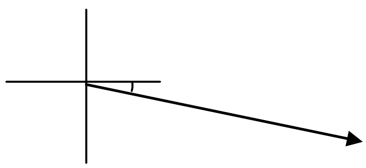
Find the Components of these two vectors:

Carry three decimal places in your calculations.



Mag. = 18.0 m, θ = 43.0°

1 = ______________x + ______________y

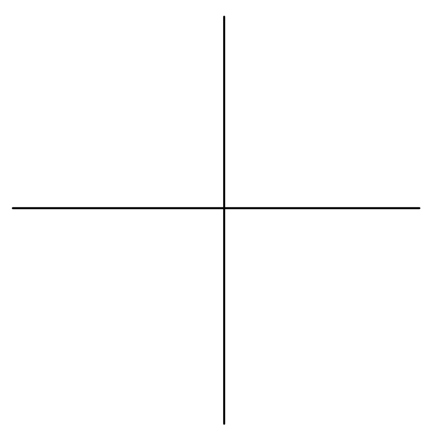


2 = ______________x + ______________y

Mag. = 42.0 m, θ = 12°

Add the Two Vectors: 1+2 = ____________x + ______________y

Draw a picture of the resultant vector with its tail on the origin, find its magnitude, and label an angle indicating its direction:



mag	angle	x	y	
18	223	-13.164	-12.276	
42	348	41.082	-8.732	
		27.918	-21.008	
		mag	34.9	m
		anglex	-37.0	o

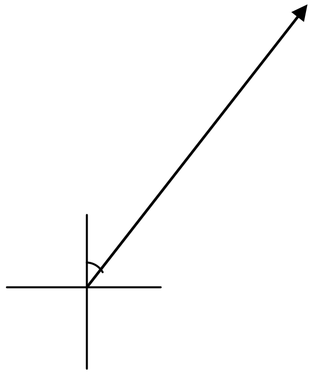
34.9 m, right and down at 37° below the x axis

Physics
FA 3.1 – Vectors

Name____________________________

Carry three decimal places in your calculations.
When you have finished this, go to the website and check your answers. If you got a problem wrong, cross it off on the front, and do it correctly on the back.

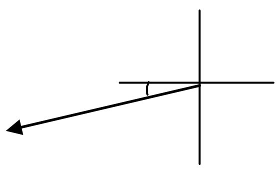
Find the Components of these two vectors:



Mag. = 13.4 m, $\theta = 42.0^{o}$

1 = _______________x + _______________y

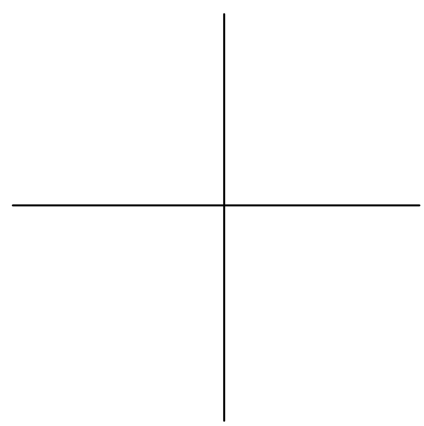
2 = _______________x + _______________y



Mag. = 6.12 m, $\theta = 11.3^{o}$

Add the Two Vectors: 1+2 = _____________x + _______________y

Draw a picture of the resultant vector with its tail on the origin, find its magnitude, and label an angle indicating its direction:



3.2 Cliff Problem Quizlette (turn this in) Name________________________

1. Red Elk runs at a speed of 9.20 m/s horizontally off a cliff that is 6.40 m above the water.

A) Set up your horizontal/vertical table, fill it with known quantities, and solve for everything you don't know. (You know horizontally: both velocities and the acceleration, and vertically: the displacement, the initial velocity, and the acceleration)

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

B) What time is he in the air? (1.14 s)	C) What is his final vertical velocity of impact? (Just before he hits the water) (-11.2 m/s)	D) How far from the base of the cliff does he hit the water? (10.5 m)
E) Draw a picture of his final velocity of impact. Calculate the speed he is traveling, and find the angle below horizontal his velocity makes. (14.5 m/s, 50.6° below horiz.)		F) What is his speed of impact with the water? (14.5 m/s)

2. Red Elk runs with a purely horizontal velocity and lands 8.50 m from the base of the cliff 1.20 seconds later.

a. How high is the cliff?	b. What was his horizontal velocity?	c. What is his final vertical velocity?

d. Draw a picture of his final velocity of impact. Calculate the speed he is traveling, and find the angle below horizontal his velocity makes.

a) 7.06 m, b) 7.08 m/s, c) -11.76 m/s, d) 13.7 m/s at 58.9° below horiz.

3. Red Elk runs with a purely horizontal velocity of 5.60 m/s and hits the water 1.80 seconds later.

a. How high is the cliff?	b. How far from the base of the cliff does he land?	c. What is his final vertical velocity?

d. Draw a picture of his final velocity of impact. Calculate the speed he is traveling, and find the angle below horizontal his velocity makes.

a) 15.9 m, b) 10.1 m, c) -17.64 m/s, d) 18.5 m/s at 72.4° below horiz.

4. Red Elk runs with a purely horizontal velocity of 4.30 m/s and lands 5.10 m from the base of the cliff .

a. What time was he in the air?	b. How high is the cliff?	c. What is his final vertical velocity?

d. Draw a picture of his final velocity of impact. Calculate the speed he is traveling, and find the angle below horizontal his velocity makes.

a) 1.186 s, b) 6.89 m, c) -11.6 m/s, d) 12.4 m/s at 69.7° below horiz.

5. Red Elk runs with a purely horizontal velocity and lands 8.60 m from the base of a 13.0 m tall cliff.

a. What time is he in the air?	b. What is his horizontal velocity?	c. What is his final vertical velocity?

d. Draw a picture of his final velocity of impact. Calculate the speed he is traveling, and find the angle below horizontal his velocity makes.

a) 1.629 s, b) 5.280 m/s, c) -15.962 m/s, d) 16.8 m/s at 71.7° below horiz.

Physics
FA 3.2 - Cliff Problems

Name__________________________

Show your work and circle your answers to receive full credit.   Ignore air friction, use the convention that down is negative, and use g = 9.80 m/s/s.

When you have finished this, go to the website and check your answers. If you got a problem wrong, cross it off on the front, and do it correctly on the back.

A ball rolls off the edge of a 15.0 m tall cliff with a purely horizontal velocity, and strikes the ground at a distance of 12.4 m from the base of the cliff.

1. What time was the ball in the air?

2. What was the ball's horizontal velocity?

3. What is the final vertical velocity?
(Just before it hits the ground)

4-5: Draw a picture of the final velocity of impact. Calculate the speed it is traveling, and find the angle below horizontal the velocity makes.

P3.2 Cliff Practice Problems (Optional)

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° 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° 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° 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° 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° 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.

3.3 Arc Problem Quizlette (turn this in) Name________________________

Red Elk shoots an air rocket at a speed of 25.0 m/s at an angle of 57.0° above the horizontal on a very level field.

A) Break the velocity vector into components. (These become your initial velocities for x and y) Set up your horizontal/vertical table, fill it with known quantities, and solve for everything you don't know. (You know horizontally: both velocities and the acceleration, and vertically: the displacement, both velocities, and the acceleration) (13.616 m/s x + 20.967 m/s y)

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

B) What are the initial horizontal and vertical velocity components? (13.616 m/s x + 20.967 m/s y)	C) What time is the rocket in the air? (4.27 s)	D) How far does the rocket go before hitting the ground? (58.2 m)
E) What is the greatest height the rocket reaches? (22.4 m)		F) What is the speed of the rocket at the highest point? (13.6 m/s)

Red Elk kicks a ball at a speed of 28.0 m/s at an angle of 34.0^o above the horizontal on a very level field.

1. What time is the ball in the air? (3.20 s)

2. What horizontal distance does it travel before hitting the ground again? (74.2 m)

3. What is the greatest height the ball reaches? What is its speed at this height? (12.5 m, 23.2 m/s)

Use the range equation to find these ranges for the velocities and launch angles. Write down what you put into your calculator:

Velocity = 32.0 m/s, Launch Angle = 47.0^o Range = ___________
(104 m)

Velocity = 11.0 m/s, Launch Angle = 26.0^o Range = ___________
(9.73 m)

Use the range equation to find the proper launch angles for the following velocities and ranges. Write down what you put into your calculator:

Velocity = 29.0 m/s, Range = 32.0 m, Launch Angles =__________and__________degrees
(10.9^o and 79.1^o)

Velocity = 12.0 m/s, Range = 14.5 m, Launch Angles =__________and__________degrees
(40.3^o and 49.7^o)

Physics
FA 3.3 - Arc Problems

Name___________________________

Show your work and circle your answers to receive full credit (but don't round until the end) Ignore air friction, use the convention that down is negative, and use g = 9.80 m/s/s.

When you have finished this, go to the website and check your answers. If you got a problem wrong, cross it off on the front, and do it correctly on the back.

1-3: A ball is launched at 27.2 m/s at an angle of 75.0^{o} above horizontal on a level field.

1. What time is the ball in the air?

2. What horizontal distance does it travel before hitting the ground again?

3. What is the greatest height the ball reaches? What is its speed at this height?

4. Use the range equation to find these ranges for the velocities and launch angles:

Velocity = 34.0 m/s, Launch Angle = 43.0^{o} Range = ___________

Velocity = 15.0 m/s, Launch Angle = 17.0^{o} Range = ___________

5. Use the range equation to find the proper launch angles for the following velocities and ranges:

Velocity = 34.0 m/s, Range = 100. m, Launch Angles =__________and__________degrees

Velocity = 12.0 m/s, Range = 5.00 m, Launch Angles =__________and__________degrees

P3.3 Arc Practice Problems (Optional)

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 ?

3.4 Boat x River Quizlette **(turn this in)** **Name**________________________

1. 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 and label and calculate the angle it makes downstream, and the magnitude of the velocity.

a) 148.6 s, b) 121.8 m, c) 3.59 m/s at 13.2º downstream of straight across

Ac	Ds
x	x
v	v
t	t

2. 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.

a. What is the speed of the boat with respect to the water?

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 and label and calculate the angle it makes downstream, and the magnitude of the velocity.

a) 4.76 m/s, b) 24.84 m, c) 4.78 m/s at 5.52º downstream of straight across

3. A boat points straight across a river that is 142 m wide, with a current of 1.20 m/s. It lands 45.0 m downstream of where it started.

a. What time will it take to cross the river?

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 and label and calculate the angle it makes downstream, and the magnitude of the velocity.

a) 37.5 s, b) 3.787 m/s, c) 3.97 m/s at 17.6º downstream of straight across

4. A boat pointed straight across a 116 m wide river crosses in 67.0 seconds. In crossing it is carried 82.0 m downstream.

a. What is the speed of the boat with respect to the water?

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 and label and calculate the angle it makes downstream, and the magnitude of the velocity.

a) 1.73 m/s, b) 1.22, c) 2.12 m/s at 35.3º downstream of straight across

Physics
FA 3.4 - Boat Crossing River

Name__________________________

College you would like to go to____

Show your work and circle your answers to receive full credit.

When you have finished this, go to the website and check your answers. If you got a problem wrong, cross it off on the front, and do it correctly on the back.

1-3: A boat points straight across a 68.0 m wide river and crosses it in 18.2 seconds. In doing this it is carried downstream 23.7 m

1. What the boat's velocity 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.

4-5: A boat pointed straight across has a velocity of 3.72 m/s in a river with a current of 1.31 m/s. The river is 47.2 m wide.

4.What time will it take you to cross?

5. How far downstream is the boat carried as it crosses the river?

P3.4 Boat Crossing River Problems (Optional)

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?

Trajectory of a Marble Lab

Name_______________________________________

You will need a marble, a ruler ramp, a cup, 3 meter sticks, and a stopwatch.

Part 1 - Determining the horizontal speed of the marble:

1. Set up a ramp on a table exactly 1 meter from the edge of the table, using two meter sticks as a guide. The marble should be able to roll down the ramp, across **exactly one meter** of table, and off the edge of the table presumably striking the floor some distance from the edge of the table. The ramp should be around 5 cm high on one end, so prop it up on a notebook or something not too high. (See my setup for reference)
2. Pick a unique distance **(each partner should choose their own unique distance)** up the ramp, and release it from rest 3 times from this position, timing the marble for the time it takes it to go 1.00 m

Times: ________________ _______________ _______________ Average_______________

Velocity: ______________

Part 2 - Predicting where the marble will land on the floor:

Fill in the a H|V table below:

1. Measure the height of the table in meters. This is your vertical displacement (X). Be careful to make it negative. On the "V" side you also know the initial velocity and acceleration.
2. Make the Vi and Vf on the "H" side your velocity from part 1
3. Solve for the X on the "H" side of your table. Show your calculations on the sides.

H	V
X = NOT from above	X = -height of table
V_i = from above	V_i = 0
V_f = from above	V_f =
a = 0	a = -9.8
t = NOT from above	t = NOT from above

Part 3 - Testing your prediction:

Put the target cup at that distance from the edge of the table (IQ on the line!) , release from your unique position, and see if it goes in the cup. If this happens, you are obliged by long tradition to say "Eureka" loudly enough to be heard across the room.