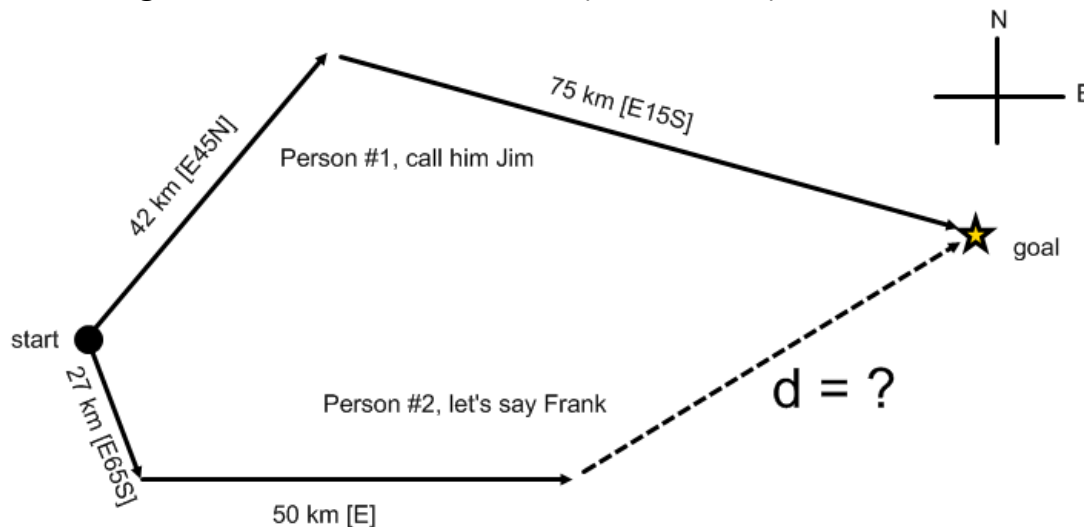


Physics 122: Application of Vectors Test

1. A plane is flying 76.4 m/s $[\text{E}32^\circ\text{S}]$ when a strong wind changes its velocity to 94.4 m/s $[\text{W}61^\circ\text{N}]$ in 180 seconds.
 - a. Calculate the acceleration acting on the plane.
 - b. Calculate the displacement of the plane.
2. A water current has a velocity of 9.5 m/s $[\text{E}25^\circ\text{S}]$. The resultant velocity of a boat needs to be 21 m/s $[\text{E}60^\circ\text{N}]$. Calculate the necessary velocity of the boat relative to the water to obtain the desired resultant velocity.
3. An asteroid is subject to four forces acting on it: $F_1 = 2400 \text{ N}$ $[\text{E}20^\circ\text{N}]$, $F_2 = 3300 \text{ N}$ $[\text{E}60^\circ\text{S}]$, $F_3 = 1750 \text{ N}$ $[\text{W}35^\circ\text{S}]$, and $F_4 = 4500 \text{ N}$ $[\text{W}45^\circ\text{N}]$. Calculate the net force on the asteroid.
4. Two people start from the same point but walk different paths to the same goal. The second person gets a bit lost; calculate the final vector for him to walk to reach the goal. See the diagram below for their vectors (not to scale).



Clearly show your work for full marks and for any part marks.

/35

1. A canon is placed 15.2 m up a castle wall and arranged to fire horizontally.

/3 a. Calculate how long the canon ball takes to hit the ground.

/3 b. Calculate how fast the canon ball has to leave the barrel to hit a target that is 35 m from the base of the cliff.

/5 c. Calculate the velocity of the canon ball the instant before it hits the target from (b).

2. Atop a building 75 m high, a soccer ball is kicked with an initial velocity of 42 m/s at an angle of 65° to the horizontal.

/5 a. Calculate the maximum height of the ball.

/5 b. Calculate the time when the ball will be 50 m above the ground.

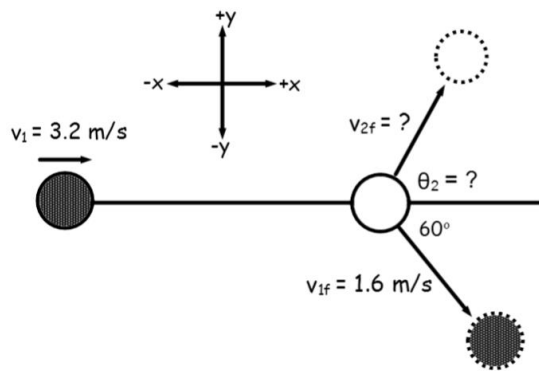
3. A baseball player approaches the batter's box and swings at the first pitch. The ball leaves the bat with a velocity of 34 m/s at an angle of 38° to the horizontal. The fence is 108 m away and 2.75m higher than where the ball was hit. Show a calculation to prove that this will be the homerun to win the game.

/6

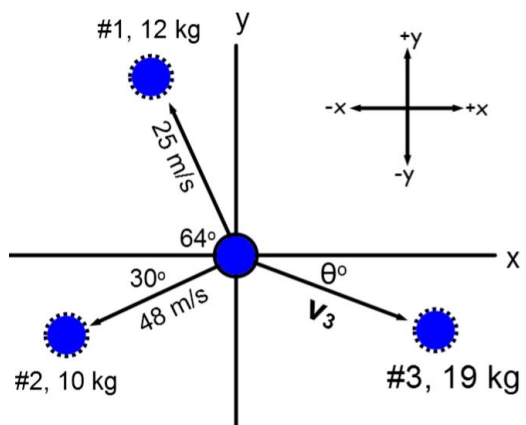
4. A golfer is attempting the hole in one shot. The range to the hole is 165 m and is raised 15m from the tee. Calculate the velocity of the ball that will result in a hole-in-one if the ball is hit at an angle of 75° .

/8

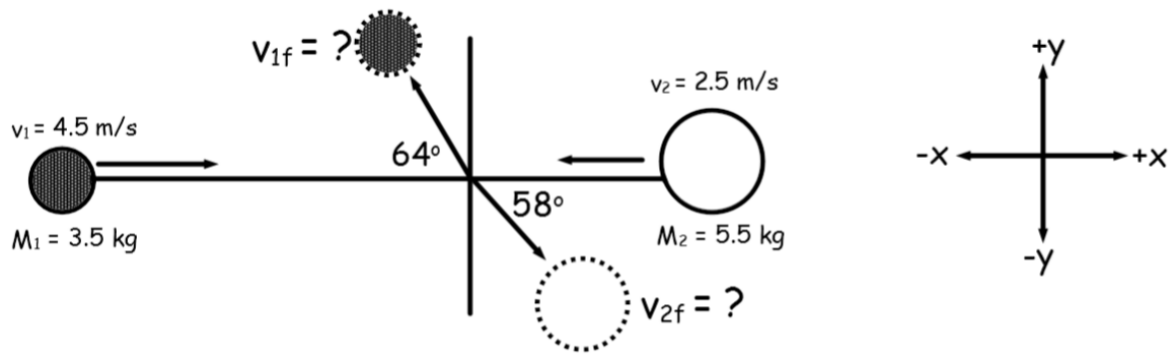
1. A pool ball traveling to the right strikes another, stationary ball. Each ball has the same mass. Use the information given in the diagram to calculate the velocity of pool ball #2.



2. An object explodes into three pieces. Given the information in the diagram below, calculate the velocity of the third piece. Note: the diagram may not be accurate in depicting the direction (quadrant) of the third piece.



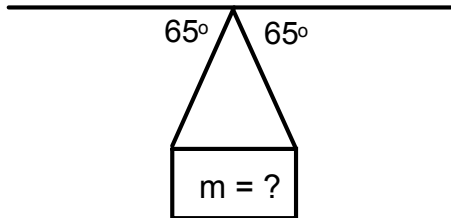
3. Calculate the magnitude of each object's velocity after the collision.



Name _____

1) An 55.0 kg object on a flat surface is pushed so that it moves under a net force of 12 N. The applied force necessary is 320 N at an angle of 30.0° to the horizontal. Calculate the coefficient of kinetic friction.

/10



2) The cable used to hang a sign will break if under the tension of 1200 N. What is the largest mass the cables can hold?

/5

3) A 675 N block is placed on a ramp inclined at 30.0° to the horizontal. A person pulling the block up the ramp must exert a force of 400 N to obtain an acceleration of 0.52 m/s^2 . Calculate the coefficient of kinetic friction.

/10

4) A counter weight is used to help slide objects up a 40° ramp. The counter weight is 42 kg. The coefficient of kinetic friction is 0.21. Calculate the mass to place on the ramp so that the mass will travel up the ramp with an acceleration of 0.25 m/s^2 .

/10

5) A very long, inclined ramp is at a high enough angle for a mass to slide down with a constant acceleration. Using the terminology of forces describe what would most likely happen to the motion of the mass as the ramp was slowly lowered to the ground.

/5