Phys 211 – Physics 1 Seminar
Module 2

Name:_____ Peer Leader:_____

Date: _____ _____

Vectors and Vector Operations, and Projectile Motion

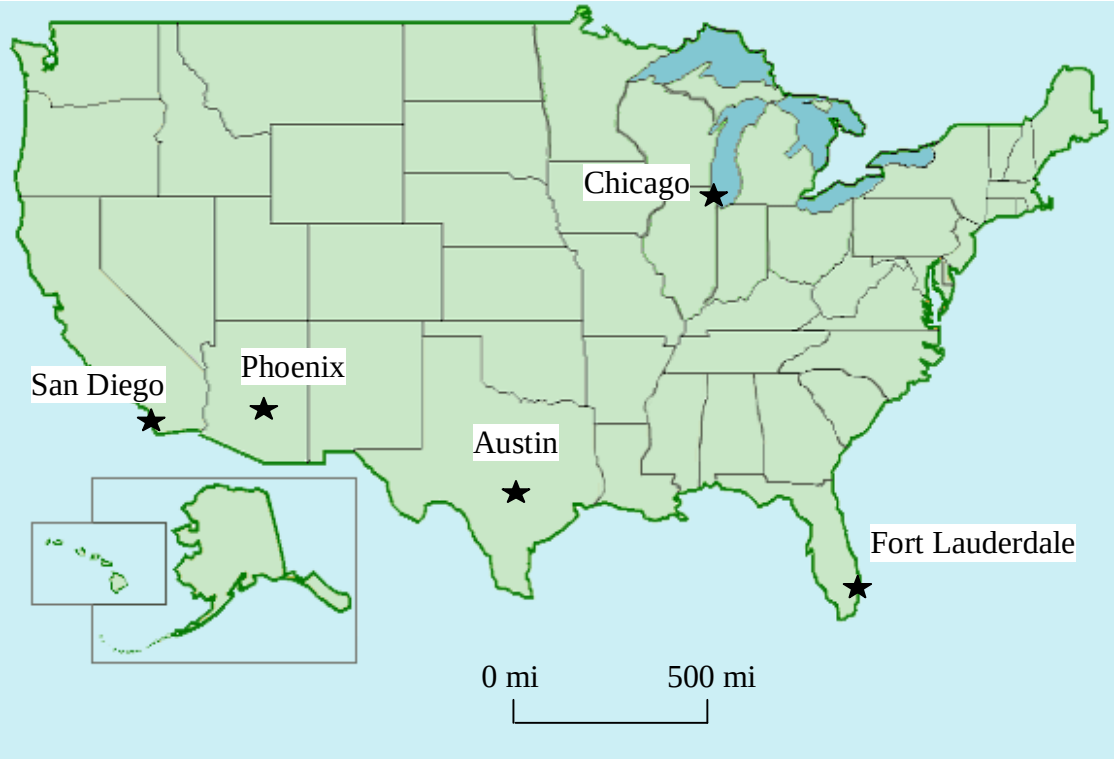
This workshop focuses on the understanding of vectors, vector operations, and projectile motion.

Activity 1:

A traveller goes from San Diego, CA to Fort Lauderdale, FL making stops in Phoenix, AZ and Chicago, IL. The return trip makes one stop in Austin, TX. In the table below are the travel times for each of the legs of the trip:

Departure City	Arrival City	Travel Time
San Diego	Phoenix	1 hour and 20 minutes
Phoenix	Chicago	3 hours and 25 minutes
Chicago	Fort Lauderdale	2 hours and 10 minutes
Fort Lauderdale	Austin	2 hours and 30 minutes
Austin	San Diego	2 hours and 50 minutes

For the next few questions you are not required to perform any calculations and you are allowed to use the table above and the map below to support your answers. **Use complete sentences to justify your answers.**



Question 1.1 Is the magnitude of the displacement of the trip from San Diego to Fort Lauderdale less, the same, or more than the displacement of the trip from Fort Lauderdale to San Diego?

Question 1.2. What is the net dispacement for the entire trip?

Question 1.3. Is the magnitude of the average velocity of the trip from San Diego to Fort Lauderdale less, the same, or more than the average velocity of the trip from Fort Lauderdale to San Diego?

Question 1.4. Use San Diego as the origin of a Cartesian axis that has the *y*-axis pointing to the North and the *x*-axis pointing to the East. Determine the magnitude and direction of the displacement vectors for each leg of the trip.

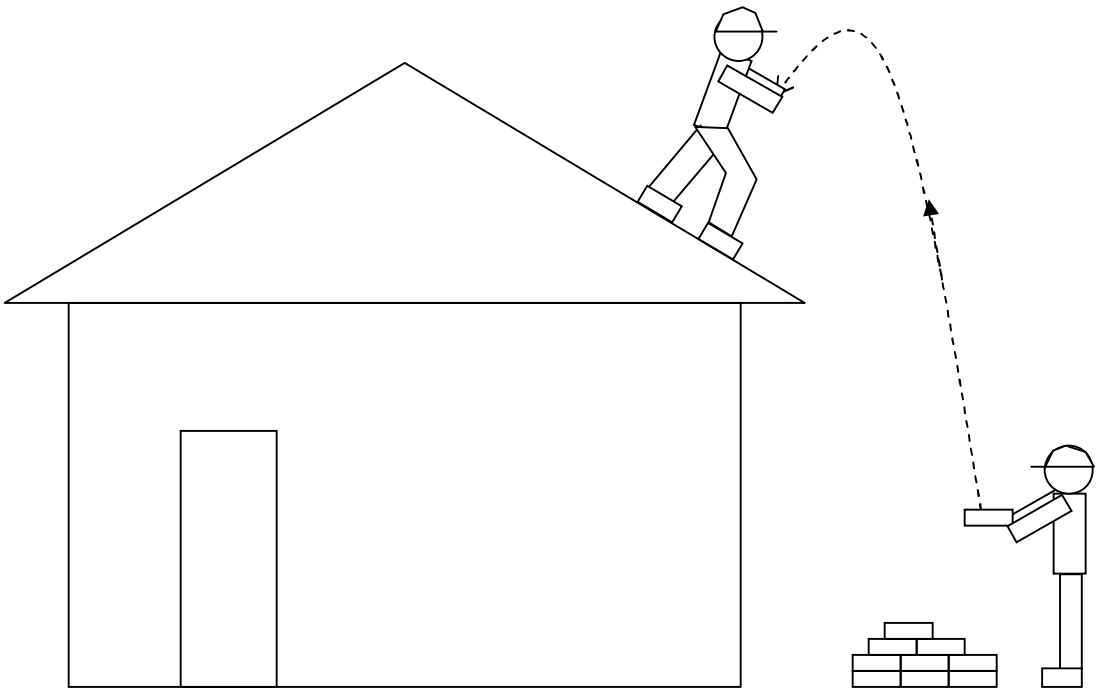
Question 1.5. Using the same Cartesian axis as in the previous question, determine the *x* and *y* components of the velocity vector for each leg of the trip.

Question 1.6. Using the vectors from the previous question determine the magnitude and direction of the displacement and velocity vectors of the trip from San Diego to Fort Lauderdale and of the trip from Fort Lauderdale to San Diego. Are these results in agreement with your answers to questions 1.1 and 1.3? If not analyze your answers and find where is the disagreement.

Projectile Motion

Activity 2:

In many construction sites it is common to see a worker throwing bricks from the ground to the roof of a house or to a higher story in the building (see figure below).



Question 2.1 Describe using complete sentences how the worker on the ground should throw the brick so that the worker on the roof can catch it safely.

Question 2.2 What should be the ideal speed of the brick when is close to the hands of the worker on the roof? Can this speed be achieved in the situation described in the picture above?

Question 2.3 How would you determine the initial velocity needed to achieve the conditions in question 2?

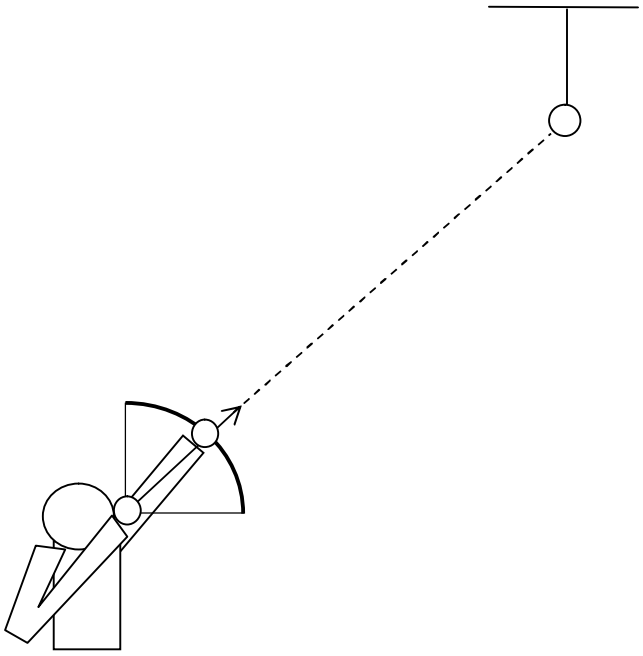
Question 2.4 Assume that the worker on the ground is 2 m from the house and that the worker on the roof is going to catch the bricks at a height 4 m above their initial height of the bricks. Calculate the initial velocity the worker on the ground can throw the brick up and the worker on the top will have a better chance to catch it safely. **Show all your work.**

Question 2.5 The worker on the roof notices that one of the bricks he catches is defective and sends it back to the worker below. Is it safe for the worker on the ground to catch it? **Justify your answer.**

Projectile Motion

Activity 3:

In the figure below an archer is trying to hit a target. The archer is aiming directly at the target.



Question 3.1 The target is dropped at exactly the same time as the arrow is shot. Will the arrow hit the target? If not will it miss above or below? **Justify you answer using complete sentences.**

Question 3.2 Suppose that the arrow speed is 70 m/s and that the target is initially hanging 10 meters higher than the tip of the arrow and at a horizontal distance of 40 meters. Using the equations of motion of the arrow and of the target confirm your answer to question 1. (Neglect air resistance)

Question 3.3 Suppose that the target is dropped before the arrow is shot and has fallen to half its initial height. Where should the archer aim its arrow? Above, bellow or exactly at the target. **Justify you answer using complete sentences.**

Question 3.4 Suppose that the arrow speed is 70 m/s and that the target has fallen 5 meter from its initial height of 10 meters and that the horizontal distance is still 40 meters. Using the equations of motion of the arrow and of the target determine where should the archer aim the arrow so that it hits the target.