Names: ______________________ ______________________

______________________ ______________________

Grade	

Angular Size

<u>Pre-Lab Quiz:</u>

Record you team's answer as well as your reasonings and explanations.

1.
2.
3.
4.

Part 1: Equations of Angular Size

1.) Consult the lab webpage. In the picture at the bottom, suppose the building in the picture is 50 feet tall and 30 feet away from you (H = 50 ft., D = 30 ft.). Which side (H or D) is the opposite side of the tangent relationship? Which side is the adjacent side?

2.) If you were to calculate θ, could you use the Small Angle Formula in this instance? Why or why not?

3.) Calculate the apparent angular size θ of the building using the appropriate formula (tangent relationship or Small Angle Formula), showing your work.

4.) Using WolframAlpha or another resource, using the small angles (< 10 degrees) below, show that the tangent of a small angle is roughly equal to the angle in radians. Round your answers to three decimal places.
Hint: Use the value from the second column as θ for the third column.
Hint: 1 radian = 57.3 degrees.

θ (degrees)	θ (radians)	*tan*(θ (radians))
1		
2		
3		
6		
9		

5.) Show that this relationship starts to break down for larger angles (> 10 degrees). Round your answers to three decimal places.

θ (degrees)	θ (radians)	*tan*θ (θ in radians)
20		
30		

Part 2: Angular Measurement Tool Calculations

1.) Construct an angular size measurement tool with your group, calibrating it with the help of the sign in the back of the lab room (which is accurate when viewed from next to the lab room door). Describe how you constructed your angular size measurement tool below. Explain how the tool is used, making sure to include a drawing of it in the space provided. Label important features, distances, and angles in the diagram.

2.) Estimate the precision of your measuring device. (For example, does it measure angles to within a half-degree? Better?)

3.) Try standing at a few different distances from one of your group members and observe their angular size each time. Does the angular size of your group member depend on where you stand when observing them? If so, how does it change?

4.) Pick an observation location in your lab room or in the hall (your TA will direct you) and measure and record in the table below a group member's distance. Then use your angular size measurement device to calculate the height of this group member using the appropriate formula, showing your work and including a diagram. Did you use the Small Angle Formula? Why or why not?

Student Distance (m)	Student Angular Size θ (degrees)	Calculated/Experimental Student Height (m)

5.) Measure your group member's actual height in meters and record this below. Then, use the Percent Error Formula to determine the accuracy of your result from Question 4.

Part 3: Measuring the Old Capital Dome

1.) Use *Google Maps* to find and record in the table below the distance of the Old Capital Building dome. Then use your angular size measurement device to calculate the diameter of the Old Capital Building dome from the Van Allen Hall roof using the appropriate formula, showing your work and including a diagram. Did you use the Small Angle Formula? Why or why not?
Note: If the weather does not permit going to the roof, VAN 666 students should measure the width of the top rectangular portion of the Tower Place Parking Ramp clock tower, and VAN 665 students should measure the width of the top rectangular portion of the church clock tower to the north.

Dome Distance (m)	Dome Angular Size θ (degrees)	Calculated/Experimental Dome Diameter (m)

2.) Now use *Google Maps* with the *Satellite Layers* option to find and record below the actual diameter of the Old Capital Building dome. Then, use the Percent Error Formula to determine the accuracy of your result from Question 1. What are some sources of error in your measurement? Before leaving lab today, please fully deconstruct your angular size measurement tool.