

Soddy Daisy Middle School Field Trip
May 7, 2009, 9:30 am – 12 pm

Tentative Schedule

9:30 – 10:30 am

- Students arrive at EMCS building, if it is good weather. If not, students arrive at the SimCenter, 701 E MLK Blvd.

Once at the SimCenter (whether we walk through EMCS/Campus or not):

- Brief facility tour: results, student area, cluster info from Wally, fuel cell
- Discussion and Q&A with students about use of math/engineering in real-world problems and what you want to do as a career
- Presentation of animations/what we do with explanation by Vince

10:30 – 11:30 am (this time is negotiable depending on length part I takes)

Students split into mechanical and aerospace groups, switch after 30 minutes

Mechanical Group

Drop and throw balls, measure the time it takes from throw/drop to landing, and figure out the missing piece in one of two ways:

(Groups of Three: Throw, Catch, Measure)

1) Throw: use $h(t) = -.5gt^2 + v_0 t + h_0$

you will be able to measure h_0 , g , final height (0), and time
determine initial velocity

gives perspective on knowns and unknowns

Supplies: worksheet, tape measure, watch, balls

2) Drop: use $h(t) = -.5gt^2 + h_0$

all measurements will be available

solve simple quadratic with square roots to determine if the time you measured
was close to the mathematical model

gives perspective on mathematical model

Supplies: worksheet, tape measure, watch, balls

All students should do each option (15 minutes at each task)

Aerospace Group

Goes with Vince and crew to throw and make paper planes and see if NACA0012 gave accurate information, and if not, why?

(Groups of Three: Throw, Catch, Measure)

Try three flights of your plane with different angles of attack at 10° , 0° , -10° to see which flies higher and/or farther.

Look at results on NACA0012 to determine which should have flown further and see if our computational models held.

Supplies: Planes, Worksheet, Tape Measure

11:30 am – 12:00 pm

Paper airplane contest, debriefing.

If the weather has changed and we have time:

Walk/ride to EMCS, see campus and engineering building, head to UC for lunch.

Student Names _____

Activity One: What Goes Up Must Come Down!
PART ONE

We will be using the formula:

$H = -16t^2 + v_0t + h_0$, where H is the height of an object, t is the time an object is in the air, v_0 is the initial velocity, and h_0 is the initial height.

Each student will throw a ball to another student while the third one times. Who will have the highest initial velocity throw?

First, measure the height from the floor to your shoulders (where you will release the ball). Write this down under h_0 for each group member, and be sure to measure in FEET.

Now, each of you will throw the ball and will need to write the time down that it took from when you released it to when it hit the ground, where $H = 0$.

Finally, solve the equation for v_0 , and see who threw the fastest!

Name			
h_0 (feet)			
t (seconds)			
v_0 (ft/sec)			

PART TWO

We will be using the formula $H = -16t^2 + h_0$, where H is the height of an object, t is the time an object is in the air, and h_0 is the initial height.

Each student will drop a ball from the top of the foyer railing while a partner times. Does the time we get from our watch agree with the time we get from the equation, and if not, why?

First, measure the height from the floor to the tips of your fingers with your arm extended upwards (where you will release the ball), and be sure to measure in FEET. Add 20 feet to this and write this down under h_0 for each group member.

Now, each of you will drop the ball and will need to write the time down that it took from when you released it to when it hit the ground, where $H = 0$.

Finally, plug your answers into $t = \sqrt{\frac{h_0}{16}}$ to see if the time you got on the watch matched the time you got with the equation!

Name			
h_0 (feet)			
t (seconds)			
v_0 (ft/sec)			

Student Names _____

Activity Two: The Lift Sure Can Be A Drag

We will be making a paper airplane using the design at <http://www.josephpalmer.com/planes/PL1/PL1.shtml>.

You will need to pick one student in the group to throw so that the initial velocity is as close to constant as possible in order to keep the experiment fair. Another student needs to mark where the glider lands and time the flight, and the third student needs to measure how far it flew.

First, throw the glider with the wings in the 0° position. Measure the time in the air (seconds) and the distance flown (feet).

Time in air: _____ Distance flown: _____

Now, throw the glider with the wings in the 10° position. Repeat the above procedure of measuring and timing.

Time in air: _____ Distance flown: _____

Now, throw the glider with the wings in the -10° position. Repeat the above procedure of measuring and timing.

Time in air: _____ Distance flown: _____

Which gave us the highest flight? _____

Which gave us the longest timed flight? _____

Which gave us the longest distance flight? _____

Finally, we will look at some computer models on a NACA 0012 airfoil to verify if our models gave us the same results as the gliders did. This decision will be based on pressure force that counteracts gravity to generate lift. If the results were not the same, list some reasons for the differences.
