**Vernier Trajectories**

**IB Physics**

On the desktop of the computer you will find a folder called NewVernier – open it and you will see a series of Interactive physics files called Vernier1, Vernier2 etc. Do not save any changes you have made in the course of this lab in these files.

**Every man, woman and child should turn in their own calculations**

# Vernier 1

* Have each person in the group choose a different horizontal distance to aim for. Set up your H | V table, and solve for the horizontal velocity that each person needs to hit the target, and try it. Show your calculations of this.
* Once each person in the group has had a chance to hit the target by calculating, not by trial and error, as a group derive an equation for the launch velocity - **v** in terms of **g** – the acceleration of gravity, **h** – the height of the cliff, and **x** – the distance of the target from the base of the cliff. (hint **v** = s/t = **x**/t, solve for t from the vertical: **h** = 1/2**g**t2, t will equal √something. Solve the variables without putting in any numbers)

# Vernier 2 - A moving target!!

Here you will need to read the directions and figure out your launch speed. There are two ways to do this: figure out where the target will be when the ball gets there, or simply calculate the velocity needed to hit the target at its initial position, and add the target velocity to the velocity you just calculated. Figure this out as a group, and try a different speed to make sure your success wasn’t an accident. Remember – no trial and error. Whatever you do explain it on your lab.

Show your calculations.

**Vernier 3**

Use the range equation to hit the target. You could either pick any velocity and angle, and calculate the range, and then put the target there, or pick a certain velocity, and use the formula for the angle to calculate the launch angle (typically you will have to use the complement (90 – angle) of the angle you get from the angle equation) Alternately – you could pick a particular angle, and calculate the velocity needed to hit the target. Make sure everyone in the group gets a chance to hit the target their very own way.

 OR , 

**Vernier 4 (10 pts extra credit!!!)**

This is a moving target with an arc trajectory. To get extra credit you will need to have me set it up for you, and wait until I am there to type in your values and try to hit the target. You will have to explain how you did it. Trial and error is not acceptable. This is non-trivial. Use algebra without numbers to receive full extra credit. (That is derive a formula) (Hint – you will need to also specify either when or where you are going to hit the target)

**Vernier ? (10 pts extra credit!!!)**

Make your own challenge for people to solve. This will require some knowledge of interactive physics. We will make a shared folder of these. Have fun! (You can do these at any time after this chapter for extra credit)

**Before you turn in your lab - make sure you have derived the equation I asked you to in Vernier1!!!**

**(If you don't understand, ask for help)**