Experiment 1: Projectile Motion

Table and Group: _______  Participants: ________________________________
Each group will turn in one common report. ________________________________

For downward and upward launches of the projectile, enter your results in the table below.

Note that you will fill in the first 4 columns from your measurements, then calculate the 5th column (Flight Time) and use that number to calculate the 6th column (Range Predicted), then do the range measurement. Do at least one upward and one downward shot.

Launch Height Down:__________________  Up:_____________________

<table>
<thead>
<tr>
<th>θ (deg)</th>
<th>V₀ up</th>
<th>V₀ sin(θ)</th>
<th>V₀ cos(θ)</th>
<th>Flight Time</th>
<th>Range Predicted</th>
<th>Range Measured</th>
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</thead>
<tbody>
<tr>
<td>Up/down?</td>
<td>m/s</td>
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1. The writeup gives the formula for the time for an upward shot. How would the formula change for a downward shot? Give your formula here and use it to calculate the predicted range for your downward shot(s) when you do that part of the experiment.

(More questions on back)
2. Given your results in the table, do you believe that your experimental data support the theoretical equations of projectile motion? Justify your answer.

3. For the downward launches, estimate how accurately you think you can measure the range (i.e. within $\frac{1}{2}$ mm, within 5 cm, etc.). Consider both an estimate of your accuracy in measuring the distances and also the variation from shot to shot.

4. The formula in the writeup shows one solution to the quadratic equation for the flight time. Use the numbers you found for one launch in this experiment to find the second solution to this equation (the one with a “−” before the square root). The writeup claims that the solution with a “+” in front of the square root is the right one. What do you think the other solution means?