**PROJECTILE MOTION VIDEO ANALYSIS**

**Purpose:** use a digital camera to record a video of a projectile being thrown though the air.

**Materials:** Digital Camera\* Meterstick(s)\* Logger Pro 3.6

**Procedure:**

1. Record a video of a projectile traveling through the air.

Camera should be perpendicular to the motion of the projectile.

Camera should remain still and NOT follow the motion.

Set the meterstick or another object of a known length in the background of the video so you can set the scale.

1. Upload the video to a computer with LoggerPro 3.8.7 or newer.
2. Open LoggerPro. Click: **Insert---Movie--- (movie file location and choose your movie.)—ok**
3. Click the Three Red dots on the bottom left corner of the Movie Screen. A menu on the right side of the screen should appear.
4. Let the video play once. You may adjust the size of the movie screen by dragging a corner of the screen.
5. Click the Horizontal yellow ruler button **(SET SCALE).** Move the pointer to one end of the meterstick or object in the background. Left click one end of the object and drag to the other end of the object. Enter the length of the objects in the box that appears.
6. Let the video play until the projectile begins in flight, then Stop the movie. Or the block on the progress bar to point in the movie where the object is in flight.
7. Stop the video when the ball leaves the hand of the person throwing the ball. Set the origin at this position. **(SET ORIGIN)**
8. Click the Red Dot **(ADD POINT)** in the Menu Bar on the Right side of the screen. Move the curser to the center of the object. Click the mouse, a dot will appear on the screen and video will advance.
9. Keep clicking the center of the object until a smooth parabola is show on the movie screen. Two separate set of red and blue dots will appear on the graph a displacement time graph.

PART II

1. Drag the cursor over the Parabola to shade the most consistent portion of the **X, Y/t** graph. Click **ANALYZE---Curve Fit—VideoAnalysisY--- (choose the equation that best describes the equation)—Try Fit—ok.** Let the Equation box remain on the Graph. You can drag it to one side to see the other line.
2. Click **ANALYZE---LinearFit—VideoAnalysisX--—ok.** Let the Equation box remain on the Graph. You can drag it to one side to see the other graphs.
3. To Print Graph Click: **FILE—Print Graph…—Print Footer—(enter team member names in the Name box, type** *Displacement/Time* **in the Comment Box)** Print the graph to a local Printer.
4. Change the graph to a **Vx, Vy/t**. Right Click the Y-axis of the graph. Choose **Graph Options—Axes Options—**check **X velocity, Y velocity. ---**Uncheck—**X, Y--- Done.** Only two set of points should appear on the graph.
5. Drag the cursor over the line to shade the most consistent portion of the Vx,Yy**/t** graph. Right Click on the graph choose **Zoom Graph In.**
6. Click **ANALYZE---LinearFit—check both - *X velocity, Y velocity* —ok.** Let the Equations boxes remain on the Graph. You can drag the boxes to the sides to keep the lines visible.
7. To Print Graph Click: **FILE—Print Graph…—Print Footer—(enter team member names in the Name box, type** *Velocity /Time* **in the Comment Box)** Print the graph to a local Printer.

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| --- |
| X(m)Y(m) |
| X equation : |
| Y equation: |

**Use the Displacement Graphs to Answer the Following Questions.**

 **(*Types of Motion:* +acc, -acc, +constant velocity, constant -velocity)**

1) What type of motion does the shape of the **X** displacement graph demonstrate? Explain why.

2) Using the equationof the X displacement graph, determine the Horizontal Velocity of the object. Explain the process.

3) What type of motion does the shape of the **Y** displacement graph demonstrate? Explain why.

4) Using the equationof the Y displacement graph, determine the Initial Vertical Velocity of the object. Explain the process.

5) Using the equationof the Y displacement graph, determine the vertical acceleration. Explain the process.

6) Determine the initial velocity (magnitude and direction) of the projectile using the vertical and horizontal components of velocity. Show your work.

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| --- |
| VX (m/s)VY (m/s) |
| VX equation : |
| VY equation: |

Use the ***Velocity vs. Time*** graphs to answer the following Questions.

 **(*Types of Motion:* +acc, -acc, +constant velocity, constant -velocity)**

7) What type of motion does shape of the **X** Velocity graph demonstrate? Explain why.

8) Using the equationof the X Velocity, determine the initial Horizontal Velocity of the object. Explain the process.

9) What type of motion of does the shape of the **Y** Velocity graph demonstrate? Explain why.

10) Using the equationof the Y Velocity, determine the initial Vertical Velocity of the object. Explain the process.

11) Using the equationof the Y Velocity, determine the acceleration of gravity. Explain the process.

12) Determine the initial velocity (magnitude and direction) of the projectile using the vertical and horizontal components of velocity. Show your work.