Free fall with Video Analysis

This demonstration requires a video (best taken with a tripod or steady hand) showing some object of known dimension thrown upward and returning in a plane perpendicular to the line of sight. The more real and apparently messy the better. We shall use a clip of my daughter hurled aloft by her swimming teacher at 30 fps.

On the way down.

Analysis

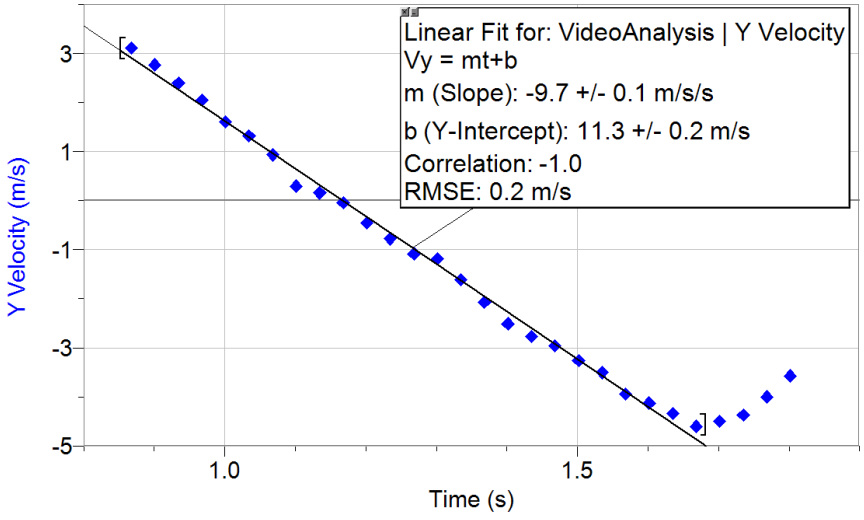
1 Open the video clip [Real Time] and save it to the desktop. Open Logger Pro.

2 Go to *Insert – Movie* in Logger pro and select the movie.

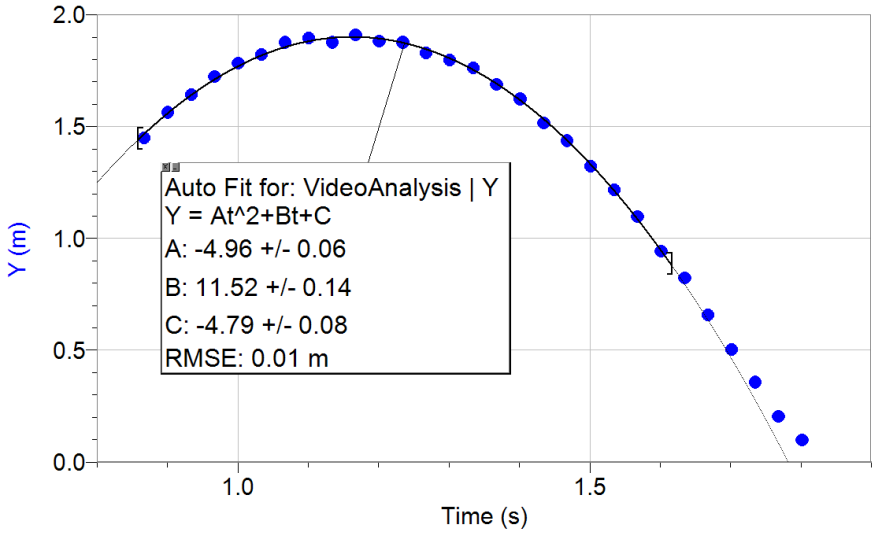
3 Open the movie controls by clicking the button with three dots and an arrow (lower right) and set the frame advance to 3 (optional).

4 Add axes. Set the scale in meters by dragging along a known dimension of the object, (in this case her leg-length, hip to heel, was measured as 55 cm.). Plot Y (vertical position data) by clicking frame by frame. Click on the vertical axis label on the Position graph in Logger pro and change it to Velocity.

Graph 1: vertical velocity *plotted using the real time clip.* On the way up and back down. A straight line is fitted to the data. From the fit, *g* is given as - 9.7 m/s/s.



Graph 2: vertical position against time. A parabola is fitted to the points that correspond to the straight line section of the velocity-time graph. From the fit *g* is given as -2x4.96.



Everyone is a little surprised to find the measured acceleration (allowing for errors due to inaccurate scale setting) to be close to -10 m/s/s. The equations don't just apply in the physics classroom.

Note: The exact result depends mostly on the scale setting. The video shown returned values for *g* between 9.6 and 10.0 m/s/s over several attempts, setting the length scale each time.