PHYS 1140, Fall 2013
Homework 2

Due Wednesday Sept. 26, 4pm
Duane G2B66

1) In lab 1, you used the equation $\frac{\delta g}{g} = \sqrt{\left(\frac{\delta L}{L}\right)^2 + \left(\frac{2\delta T}{T}\right)^2}$ for the fractional uncertainty in g given an uncertainty in the period δT and the length δL. Derive this equation from the master rule of error propagation, using the equation for the period $T = 2\pi\sqrt{L/g}$.

2) $K = \frac{1}{2}mv^2$. You measure $m \pm \delta m$ = (0.125 ± 0.005) kg, and $v \pm dv$ = (0.87 ± 0.01) m/s.
   a) What is the derived quantity K?
   b) What is the error in K?
   c) What is the percentage error in K?

3) $f(x) = 30\sin\phi$ V
   $\phi = 35 \pm 5°$
   $\delta f = ?$
   (Remember to convert to radians.)

4) You are trying to measure a velocity. You measure the distance with a precision of 13%, and time with a precision of 8%. What is the fractional uncertainty on the velocity?

5) You measure the width, a, of an optical slit in two different ways, with associated estimated errors. Based on a measurement of a diffraction pattern, you get $a_{diff} = 0.250 \pm 0.005$ mm. Measuring it directly with a microscope, you get $a_{slit} = 0.271 \pm 0.008$ mm.
   a) What is the precision of the two measurements?
   b) What is the discrepancy between the two measurements?
   c) Is the discrepancy significant? Why/why not?