PHYS 1125 Lab 00 Worksheet: Uncertainty Propagation

1. Using the rules for uncertainty propagation, determine either the absolute or relative uncertainty (use your judgement) of the left-hand-side quantity of each expression. Only explicit numbers are assumed to have zero uncertainty. [Think if any reformatting of the expression is necessary before applying a rule.]

(a) $F = ma$	
(b) $P = M - m$	
(c) $V = \frac{1}{6}\pi D^3$	
(d) $q = \sqrt{xy}$	
(e) $T = 2\pi\sqrt{\frac{L}{g}}$	
(f) $a = \frac{F_1 + F_2}{m}$	
(g) $F = \frac{Gm_1m_2}{r^2}$	

2. Calculate the value of $q \pm \delta q$, where $q = \dfrac{3AB}{C}$, $A = (3.3 \pm 0.5)\,\mathrm{m}^2$, $B = (2.5 \pm 0.1)\,\mathrm{m}$ and $C = (4.1 \pm 0.2)\,\mathrm{m}$.

3. For the same values in question 2, calculate $Q \pm \delta Q$, where $Q = A + BC$. [Hint: Let $D = BC$ and find its (absolute) uncertainty. Use your result to find the uncertainty of the given sum, Q.]

4. A kinematics equation that, if not familiar to you already will become soon, is: $x = x_0 + v_{0x}t + \frac{1}{2}a_x t^2$.

   For $x_0 = (5.3 \pm 0.1)\,\text{m}$, $v_{0x} = (8.4 \pm 0.2)\,\text{m/s}$, $t = (4.15 \pm 0.21)\,\text{s}$ and $a_x = (1.1 \pm 0.2)\,\text{m/s}^2$, calculate $x \pm \delta x$. [Again, it is recommended that you find the uncertainty of $x_1 = v_{0x}t$ and $x_2 = \frac{1}{2}a_x t^2$ first.]