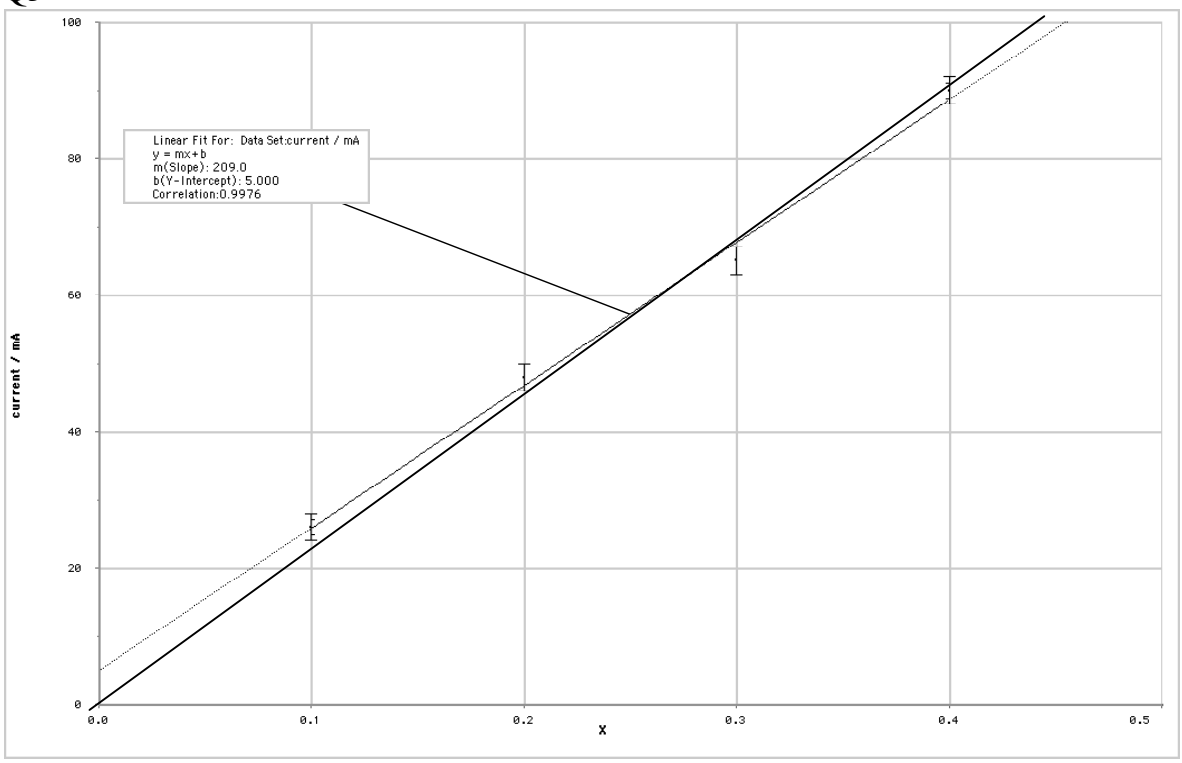
Chapter 1.2

Q1 No since there appears to be a large systematic error and a systematic error will not be reduced by repeated measurements.

Q2 Systematic.

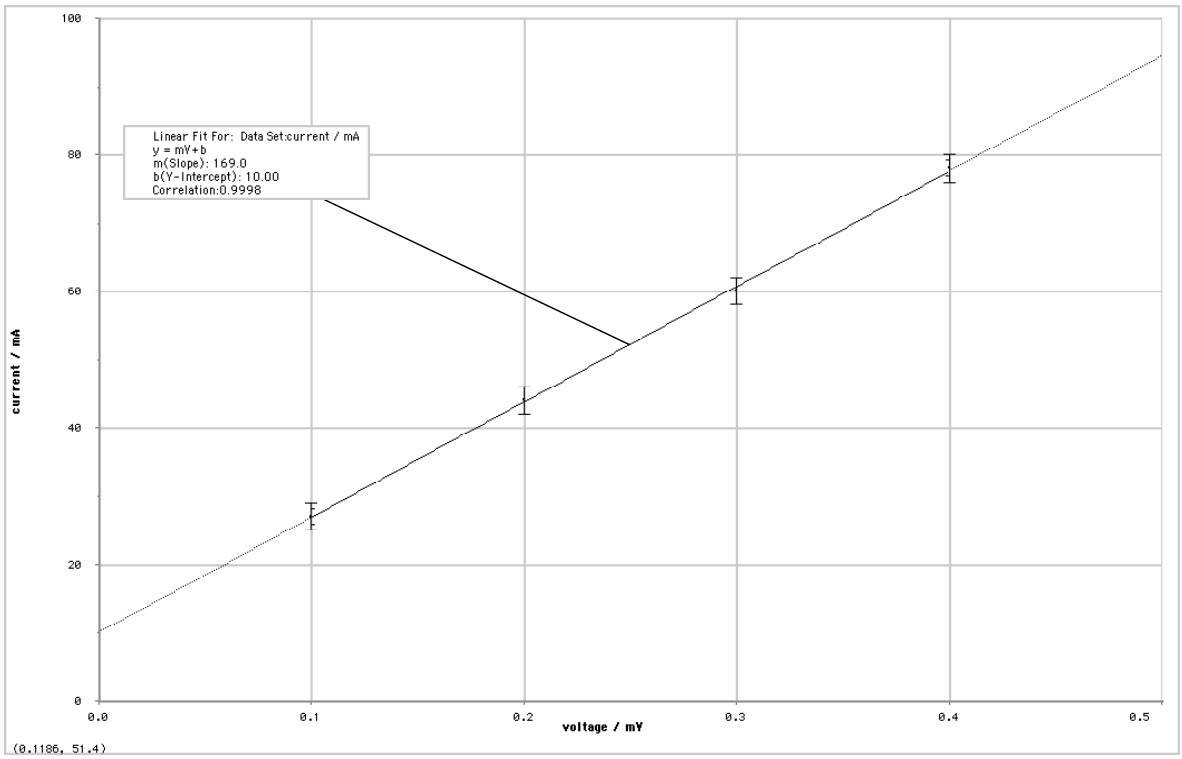
Q3



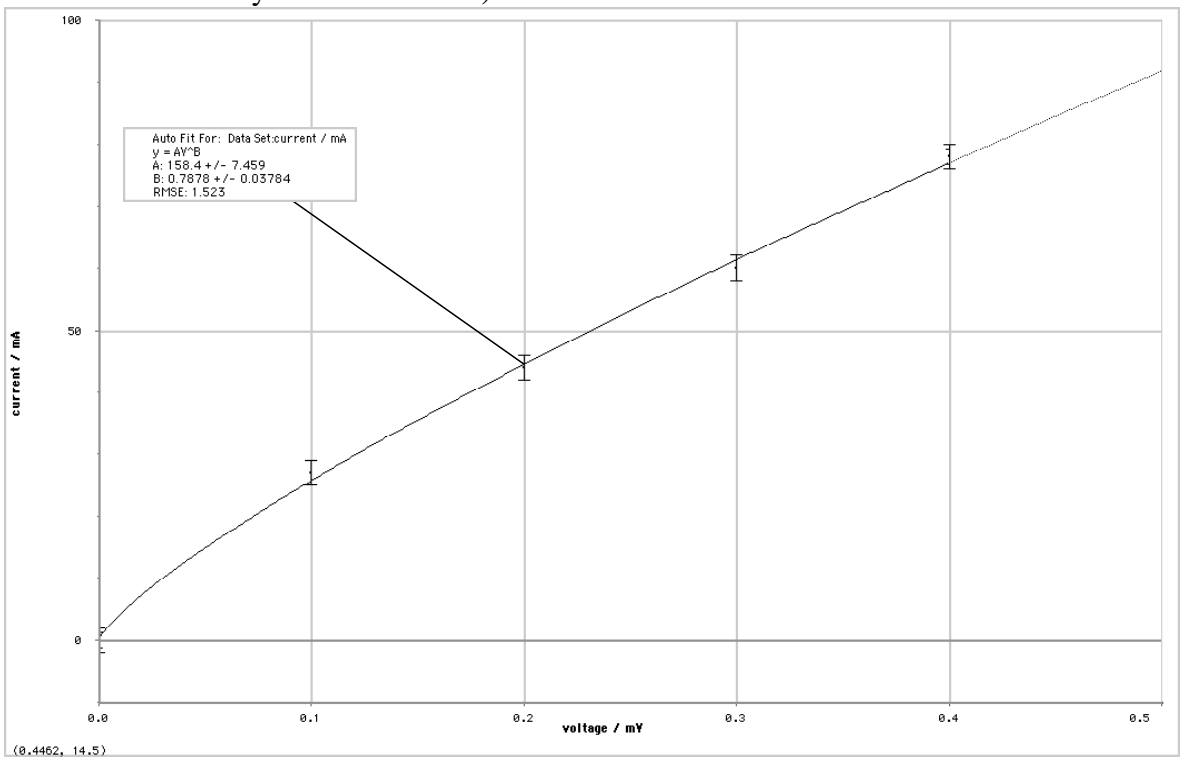
The line of best fit does not go through the origin. There is a vertical intercept of 5 mA. However, an extreme line can be made to go through the origin and all the error bars.

Q4

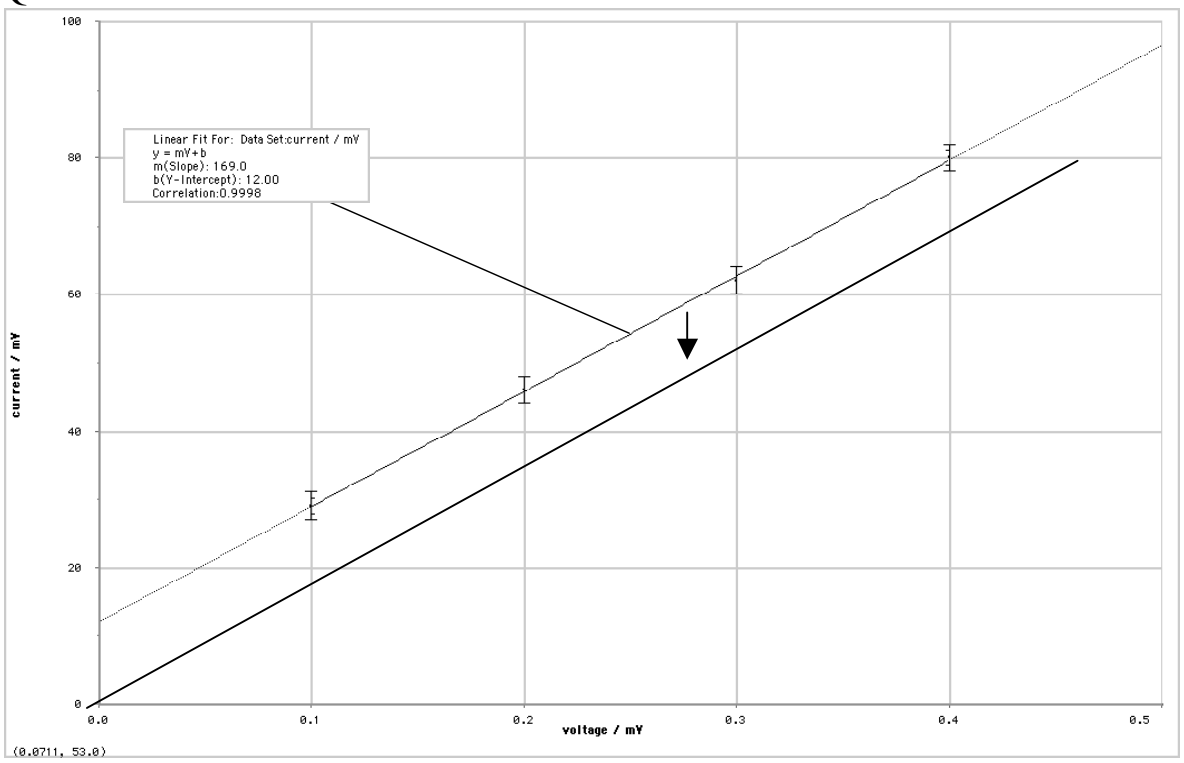
The vertical intercept is about 10 mA. No straight line can be made to pass through the origin and the error bars unless a systematic error of about 10 mA in the current is invoked.



However, a line of best fit that is a curve can also be fitted through the data and that does go through the origin. (However, it may be objected that this particular functional form is chosen – at low voltages we might expect a straight line (Ohm's law). So a different functional form may have to be tried.)

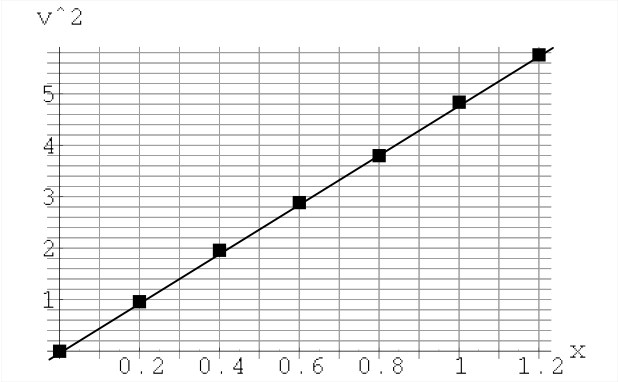


Q5



The straight line of best fit does not go through the origin. A large systematic error may be present.

Q6 Since we expect $v^2 = 2ax$ we use the given data to plot v^2 versus x: the data are read as $(0.2, 0.98)$, $(0.4, 1.40)$, $(0.6, 1.70)$, $(0.8, 1.95)$, $(1.0, 2.20)$ and $(1.2, 2.40)$. Hence we plot:



The slope is $2a$. Measuring the slope gives $2a = 4.8 \Rightarrow a = 2.4\ \text{m s}^{-2}$. Hence the equation is $v^2 = 2ax = 4.8x$. When $x = 2.0\ \text{m}$, $v = \sqrt{4.8 \times 2.0} = \sqrt{9.6} = 3.1\ \text{m s}^{-1}$.