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W25 201-8 lab 1 lecture summary doc

For all three parts to turn in the first few steps are the same:

1) Title the graph and label the axes
2) Determine the scale for the axes
3) Plot the points from the tables given in the handout
4) Draw a best fit line that has half the points above and half below
5) Pick one point on the best fit line near the bottom of the graph (q_1) and one near the top of the graph (q_2)

The first two calculations (slope and y-intercept) also have the same starting place for all three:

Slope:

$$m_s = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

y-intercept (b in this equation):

$$y = m_s x + b$$

Where $q_1 \equiv (x_1, y_1) \& q_2 \equiv (x_2 . y_2)$

This is all that is needed for $R\ vs\ v$, however there is another value,q, you are asked to calculate for graphs 2 and 3.

We are given the nominal equation $m = \frac{1}{2}qt^2$ and we discussed in class how if we want to be able to draw a best fit curve that is a strait line we will have to either square the time data or take the square root of the mass data.

In order to calculate q we take the equation that we plotted and assume that the parts of it match up with our equation for the best fit line:

$$\begin{matrix} m = & \frac{1}{2}q & t^2 & + 0 \\ y = & m_s & x & + b \end{matrix}$$

Below I have written the same equation but I have isolated the parts that we assume match up with each other with parentheses and the part we most care about with square brackets.

$$\binom{m}{y} \begin{matrix} = \\ = \end{matrix} \begin{bmatrix} \frac{1}{2}q \\ m_s \end{bmatrix} \binom{t^2}{x} \begin{matrix} + \\ + \end{matrix} \binom{0}{b}$$

For #2 we looked at $m\ vs\ t^2$. In the given equation t^2 already appears the way that we graphed it (i.e. raised to the 2nd power) and so we don't need to make any modifications to the equation before we set $m_s = \frac{1}{2}q$ and find our q value by solving for q and plugging in our value for m_s.

This is not the case for #3. We need a $\sqrt{m}$ term to be in the equation. We still start with $m = \frac{1}{2}qt^2$ and modify it until the term we need is present.

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Things to remember when doing the math for this lab and on the upcoming quiz:

- All the values that we plot on our graphs or read off our graphs have units attached to them.
    - This means that the ordered pairs for our points q_1& q_2 will have units.
        - The 1st value has the same units as the horizontal axis
        - the 2nd value has the same units as the vertical axis
    - It helps to always write them as we do our math so that we remember any operations that we perform on them along the way to getting our answers.
    - This also helps me give you as much partial credit as I can justify giving.
- Whatever you do to one side of an equation you do to the other also
    - This applies to constants(numbers), variables and units
- When distributing exponents to fractions they affect both the top and the bottom in the same way
    - This applies to units too:

$$\left(\frac{miles}{hour^3}\right)^2 \equiv \frac{miles^{1\cdot 2}}{hours^{3\cdot 2}} \equiv \frac{miles^2}{hours^6}$$

- Square roots are canceled by squaring them and vise versa both for numbers and units:
$$\left(\sqrt{x}\right)^2 = \sqrt{x^2} = x$$
- Both sides of every equation must always have the same units.
    - If there is a value whose units we don't know (like our m_s & q values) we often use this fact to deduce what they should be.
    - If the units of a particular value that you plug in does not match the others they should do so after partially or fully canceling with those of another after any multiplication or division steps
- Please make sure that your final answers are clearly indicated by being circled/boxed and that it includes correct units and sig figs. For example, if a final answer that a velocity, $\vec{v}$, was 45 meters per second it would look like:

$$\boxed{\vec{v} = 45\frac{m}{s}}$$