Lab Write-up

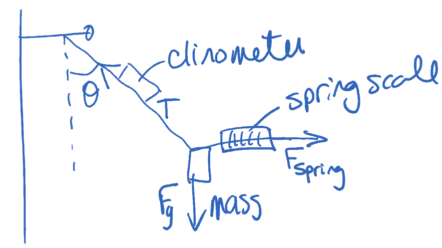
Equilibrium Lab

Purpose: . . . .

Materials: . . . .

Procedure; Data, Observations:

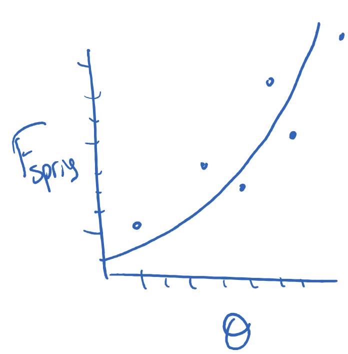
Set up materials as in diagram below



Measured F_{spring} at 5 different angles, see table

θ	F_{spring}

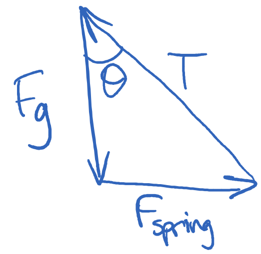
Plotted graph of F_{spring} vs θ



← draw in the curved line (best fit, not connect the dots)

To show that a plot of F_{spring} vs $\tan\theta$ should be a straight line:

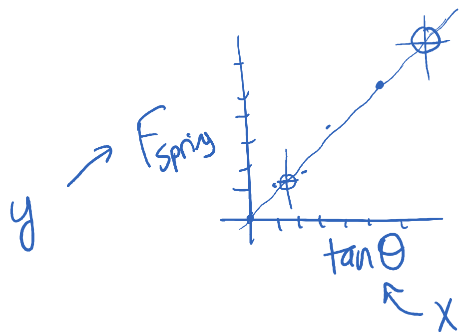
F.B.D.



$$\tan\theta = \frac{F_{spring}}{F_g}$$

$$F_{spring} = F_g \tan\theta + 0$$

$$y = m\,x + b$$



↑ ignore a point that is way off

← draw the best fit line so that we can calculate a slope.

slope – do not just use points from data table!
– is the average of all points/data

do use locations on line where it crosses cross-hairs of the grid.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Calculate mass: we know that $F_{spring} = F_g \tan\theta$ (see above), so slope $= F_g$

$$F_g = mg$$

$$m = \frac{F_g}{g} = \frac{\text{slope}}{g} = \frac{\quad}{9.81\,\frac{N}{kg}}$$

We know the actual mass was 0.500kg so

We know the actual mass was 0.500kg so the % diff

$$= \frac{|\quad 0.5kg|}{0.5kg} \times 100\%$$

$=$

Analysis + Conclusions:

- Using this equilibrium method we calculated the mass to be ___ kg; which is ___% different than the actual 0.5kg.
- Using an equilibrium Δ we could see that $\tan\theta = \frac{F_{spring}}{F_g}$. When rearranged into $y = mx + b$ form (linear) $F_{spring} = F_g \tan\theta$ where F_g is the slope. In Δ the 3 vectors add to zero, since $\Sigma F_{up} = \Sigma F_{down}$ and $\Sigma F_{left} = \Sigma F_{rt}$.
- creatively think of better way...
- Errors: - not holding spring scale perfectly horizontal
  - stretching of string
  - clinometer app accuracy + difficulty holding at an angle
  - spring scale - friction
    - spring could be at limit
    - zeroing became unzeroed
  - mass wasn't exactly 500g