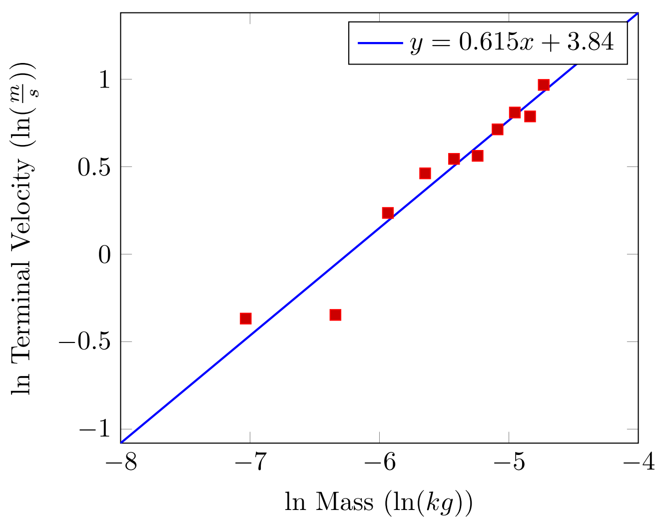
1 • Derivation

At terminal velocity, $a = 0$, therefore:

$$mg = k{v_T}^n$$
$${v_T}^n = \frac{mg}{k}$$
$$\ln({v_T}^n) = \ln(\frac{mg}{k})$$
$$n\ln(v_T) = \ln(m) + \ln(g) - \ln(k)$$
$$\ln(v_T) = \frac{1}{n}\ln(m) + \frac{1}{n}\ln(g) - \frac{1}{n}\ln(k)$$

2 • Data

Mass (kg)	Distance (m)	Time (s)	Terminal Velocity (m/s)
$8.82 \cdot 10^{-4}$	2	2.89	0.692
$1.764 \cdot 10^{-3}$	2	2.83	0.707
$2.646 \cdot 10^{-3}$	2	1.58	1.266
$3.528 \cdot 10^{-3}$	2	1.26	1.587
$4.41 \cdot 10^{-3}$	2	1.16	1.724
$5.292 \cdot 10^{-3}$	2	1.14	1.754
$6.174 \cdot 10^{-3}$	2	0.98	2.041
$7.056 \cdot 10^{-3}$	2	0.89	2.247
$7.938 \cdot 10^{-3}$	2	0.91	2.198
$8.82 \cdot 10^{-3}$	2	0.76	2.632



3 • Analysis

3.1 Coefficient of Velocity

n is 2, because the slope of Figure 2 is 0.615, which is close to 0.5, which is $\frac{1}{2}$. Therefore, the drag force is proportional to v^2.

3.2 Graph y-intercept

The y-intercept, which is b, which is $\frac{1}{2}\ln(g) - \frac{1}{2}\ln(k)$, is 3.84.

3.3 Drag Coefficient

Drag Coefficient (kg/m)
$1.805 \cdot 10^{-2}$
$3.461 \cdot 10^{-2}$
$1.618 \cdot 10^{-2}$
$1.372 \cdot 10^{-2}$
$1.454 \cdot 10^{-2}$
$1.685 \cdot 10^{-2}$
$1.453 \cdot 10^{-2}$
$1.369 \cdot 10^{-2}$
$1.61 \cdot 10^{-2}$
$1.248 \cdot 10^{-2}$

The drag coefficient $k = \frac{mg}{{v_T}^2}$ was calculated for each trial, with an average value of $0.017\frac{kg}{m}$.

4 • Assumptions

We assumed that the coffee filters had a constant velocity after being dropped, which we assumed was equal to the terminal velocity.