\frac{dy}{dt} &= v\\

\frac{dv}{dt} &= -\frac{k}{m}y&Q1

equation (2) is simply rewriting equation (1), by replacing F as ma, where a is the acceleration.

Y is the distance relative to equilibrium position, which is approximately 24cm above the sensor

Q2

equations (8) is just the discrete version of equations (7) and equations (7) is exactly the same as equations (2), just renaming some variables.

\frac{dy}{dt} &= v\\

\frac{dv}{dt} &= -\frac{k}{m}y&

Q3

Mass: 200g

From the first highest point

0.017 32.672 0.239

The next highest point

0.750 32.674 0.239

Time lapse 0.733

Measured Angular frequency = 2\*pi/0.733

Angular frequency = sqrt(k/m)

K= (2\*pi/0.733 rad/s)\*\*2\*0.2kg = 14.70 kg/s^2

Q10

Disk mass 16.7g

Weight 200g

Total 216.7 g

K = 14.70 kg/s^2

4\*k\*m