



A-LEVEL MATHS QUESTIONS

Mechanics and Statistics - Day 6

COMPLETE ALL QUESTIONS



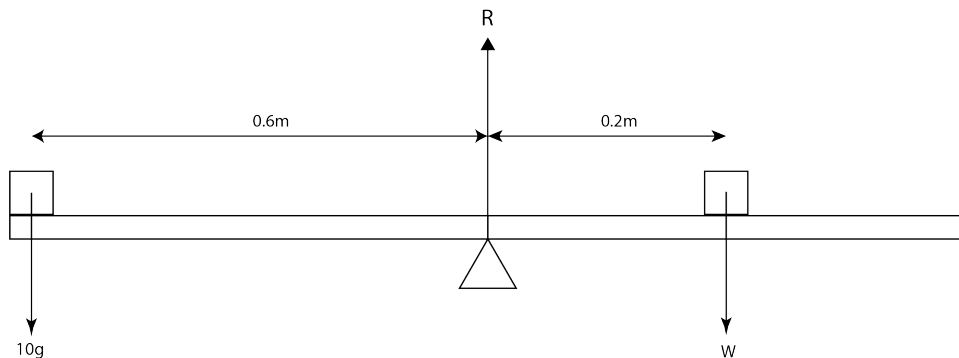
1. A series of measurements are made of the leaves of a species of plant. It is found that the product moment correlation coefficient is 0.58. Given that the sample size is 50, perform a hypothesis test on the correlation coefficient at a 1% level stating your null and alternate hypotheses carefully.

2. A particle of mass m experiences a continuous force of magnitude 10 in a constant direction. The particle experiences a non-constant resistive force of magnitude $0.4v^2$ in the direction opposite to the motion of the particle, where v is the velocity of the particle. Show that this information gives rise to the differential equation

$$10m \frac{dv}{dt} = 100 - 4v^2$$

3. A particle experiences a force of magnitude equal to its displacement, but in the opposite direction. Given that the particle has a mass of 5kg, determine the differential equation linking the displacement, x , and the acceleration $\frac{d^2x}{dt^2}$

4. A beam is at rest on a support, as shown in the diagram.



Determine W and hence find the reaction force at the pivot.



5. A light beam of length 2m rests on two pivots, each positioned 50cm from the respective ends of the beam. masses of 3kg and 4kg rest at each endpoint. Determine the reaction forces from both pivots.

6. A particle has position vector

$$\underline{x}(t) = \begin{pmatrix} 10 + \sin(6t) \\ 5 - \cos(6t) \end{pmatrix}$$

Show that the particle's motion satisfies the differential equation

$$\frac{d^2 \underline{x}}{dt^2} = k\underline{x} + \underline{c}$$

where k is a scalar and \underline{c} a constant vector, to be determined.