

AS Level Mathematics B (MEI)

H630/01 Pure Mathematics and Mechanics

Question Set 6

1. In this question, the x and y directions are horizontal and vertically upwards respectively.
- A particle of mass 1.5 kg is in equilibrium under the action of its weight and forces $\mathbf{F}_1 = \begin{pmatrix} 4 \\ -2 \end{pmatrix}\text{N}$ and \mathbf{F}_2 .
- (a) Find the force \mathbf{F}_2 . [3]
- The force \mathbf{F}_2 is changed to $\begin{pmatrix} 2 \\ 20 \end{pmatrix}\text{N}$.
- (b) Find the acceleration of the particle. [2]
- 2 In this question you must show detailed reasoning.
- A particle moves in a straight line. Its velocity $v\text{ ms}^{-1}$ after $t\text{ s}$ is given by $v = t^3 - 5t^2$.
- (a) Find the times at which the particle is stationary. [2]
- (b) Find the total distance travelled by the particle in the first 6 seconds. [3]
- 3 A car travelling in a straight line accelerates uniformly from rest to $V\text{ ms}^{-1}$ in $T\text{ s}$. It then slows down uniformly, coming to rest after a further $2T\text{ s}$.
- (a) Sketch a velocity-time graph for the car. [2]
- The acceleration in the first stage of the motion is 2.5 ms^{-2} and the total distance travelled is 240 m .
- (b) Calculate the values of V and T . [4]
- 4 An astronaut on the surface of the moon drops a ball from a point 2 m above the surface.
- (a) Without any calculations, explain why a standard model using $g = 9.8\text{ ms}^{-2}$ will not be appropriate to model the fall of the ball. [1]
- The ball takes 1.6 s to hit the surface.
- (b) Find the acceleration of the ball which best models its motion. Give your answer correct to 2 significant figures. [2]
- (c) Use this value to predict the maximum height of the ball above the point of projection when thrown vertically upwards with an initial velocity of 15 ms^{-1} . [2]

Total Marks for Question Set 6: 21 marks



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