

AS Level Mathematics A

H230/02 Pure Mathematics and Mechanics

Question Set 6

- 1 A particle is in equilibrium under the action of the following three forces:
 $(2\mathbf{p}\mathbf{i} - 4\mathbf{j})\text{ N}$, $(-3\mathbf{q}\mathbf{i} + 5\mathbf{p}\mathbf{j})\text{ N}$ and $(-13\mathbf{i} - 6\mathbf{j})\text{ N}$.
 Find the values of p and q . [3]
- 2 A crane lifts a car vertically. The car is inside a crate which is raised by the crane by means of a strong cable. The cable can withstand a maximum tension of 9500 N without breaking. The crate has a mass of 55 kg and the car has a mass of 830 kg .
- (a) Find the maximum acceleration with which the crate and car can be raised. [2]
- (b) Show on a clearly labelled diagram the forces acting on the crate while it is in motion. [1]
- (c) Determine the magnitude of the reaction force between the crate and the car when they are ascending with maximum acceleration. [3]
- 3 A particle P is moving in a straight line. At time t seconds P has velocity $v\text{ ms}^{-1}$ where $v = (2t + 1)(3 - t)$.
- (a) Find the deceleration of P when $t = 4$. [2]
- (b) State the positive value of t for which P is instantaneously at rest. [1]
- (c) Find the total distance that P travels between times $t = 0$ and $t = 4$. [3]
- 4 A car starts from rest at a set of traffic lights and moves along a straight road with constant acceleration 4 ms^{-2} . A motorcycle, travelling parallel to the car with constant speed 16 ms^{-1} , passes the same traffic lights exactly 1.5 seconds after the car starts to move. The time after the car starts to move is denoted by t seconds.
- (a) Determine the two values of t at which the car and motorcycle are the same distance from the traffic lights. [6]
- These two values of t are denoted by t_1 and t_2 , where $t_1 < t_2$.
- (b) Describe the relative positions of the car and the motorcycle when $t_1 < t < t_2$. [1]
- (c) Determine the maximum distance between the car and the motorcycle when $t_1 < t < t_2$. [3]

Total Marks for Question Set 6: 25

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