OCR
Oxford Cambridge and RSA

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:

$(2p\mathbf{i} - 4\mathbf{j})$ N, $(-3q\mathbf{i} + 5p\mathbf{j})$ N and $(-13\mathbf{i} - 6\mathbf{j})$ 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 $v\,\text{m s}^{-1}$ 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 $4\,\text{m s}^{-2}$. A motorcycle, travelling parallel to the car with constant speed $16\,\text{m s}^{-1}$, 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