Pearson Edexcel A Level Mathematics 9MA0

Mechanics – Application of Forces

Time allowed: 45 **minutes**

School: www.CasperYC.club

Name:

Teacher:

Question	Points	Score
1	17	
2	6	
3	14	
4	13	
Total:	50	

How I can achieve better:

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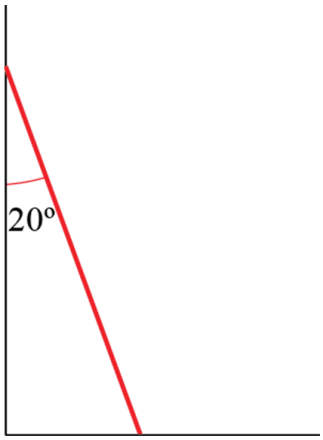
1. A 10 m long, uniform ladder has a mass of 6 kg and makes an angle of 20° with a smooth vertical wall. It stands on a rough horiztonal floor, which has coefficient of friction 0.3 with the bottom of the ladder.



(a) Draw a diagram showing all the forces acting on the ladder. Describe the origin of each force using words. [4]

(b) Calculate the magnitude of each force and hence determine whether or not the ladder slips. [13]

Total: 17

2. Three forces, F_1, F_2 and F_3, act on a circular lamina of radius 5 cm. The origin is at the centre of the lamina.

$$\mathbf{F}_1 = \begin{pmatrix} 2 \\ 0 \end{pmatrix} \text{ N acts at the point } \begin{pmatrix} 1 \\ 1 \end{pmatrix} \text{ cm} \quad (1)$$

$$\mathbf{F}_2 = \begin{pmatrix} 3 \\ 0 \end{pmatrix} \text{ N acts at the point } \begin{pmatrix} -2 \\ 3 \end{pmatrix} \text{ cm} \quad (2)$$

$$\mathbf{F}_3 = \begin{pmatrix} f \\ 0 \end{pmatrix} \text{ N acts at the point } \begin{pmatrix} -3 \\ -3 \end{pmatrix} \text{ cm} \quad (3)$$

The net force on the lamina is zero.

(a) Find the value of f. [2]

(b) Find the total moment about the origin. Give your answer in N m. [4]

Total: 6

3. A 0.1 kg inflatable ball floats on the surface of the sea. The current from the water underneath the ball exerts a force $\mathbf{C} = \begin{pmatrix} 2 \\ 1 \end{pmatrix}$ N and the wind exerts a force of $\mathbf{W} = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$ N on the ball.

   (a) Find the resultant force exerted on the ball. [2]

   (b) Calculate the acceleration of the ball. [3]

   Initially, the ball is at the origin and has velocity $\begin{pmatrix} 1 \\ 1 \end{pmatrix}$ m/s.

   (c) Find the x and y coordinates of the ball t s later. [4]

   (d) Find the distance travelled by the ball when $t = 10$ s. [5]

Total: 14

4. A 0.5 kg particle experiences two forces $\mathbf{A} = (2\mathbf{i} - \mathbf{j})$ N, and $\mathbf{B} = \mathbf{i}$ N.

   Initially, the particle is at rest and has position vector $(3\mathbf{i} + 4\mathbf{j})$ m

   (a) Find the x and y coordinates of the particle t seconds later. [9]

   (b) Explain why the particle never returns to its starting point. [2]

   (c) Describe a physical situation which this mathematical model could represent and give physical meanings to $\mathbf{A}$ and $\mathbf{B}$. [2]

Total: 13