

Homework 17

1) A car starts at position $20\mathbf{i} + 50\mathbf{j}$ and is moving with a constant velocity of $10\mathbf{i} - 15\mathbf{j}$ km/h .

A lorry starts at position $90\mathbf{i} + 10\mathbf{j}$ and is moving with a constant velocity of $-5\mathbf{i} + 30\mathbf{j}$ km/h .

a) Show that the car and the lorry will not collide. **4**

b) Determine the minimum distance they will be apart during their motion. **4**

2) An object is projected into the air from horizontal ground at the origin. Its velocity is $10\mathbf{i} + 8\mathbf{j}$ ms⁻¹, where \mathbf{i} is defined as the horizontal component, and \mathbf{j} is the vertical component of the motion.

a) Calculate the maximum height the object will reach. **2**

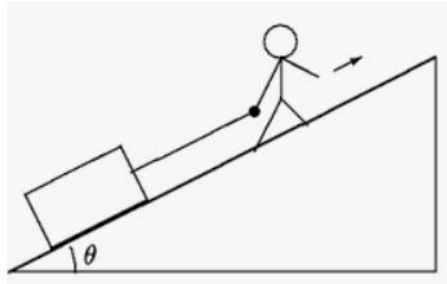
b) Calculate the range of the object. **3**

3) A function is defined over a given domain by the equation

$$x \sin y + y \cos x = 2 .$$

Determine the exact value for $\frac{dy}{dx}$, when $x = 0$. **4**

- 4) An object of mass 5kg is placed on a slope which is at an angle $\theta = 20^\circ$ to the horizontal. The minimum force required to hold the object in place and prevent it sliding down the slope is 4 newtons.



- a) Calculate the coefficient of friction between the object and the slope. **3**

When the force is removed the object slides down the slope.

- b) Determine the speed of the object when it has travelled 2 metres down the slope. **4**