

## Unit 1 Practice NAB

### Outcome 1

1. A cyclist starts from rest at traffic lights and travels along a straight road to come to rest at a T-junction. In moving from the traffic lights to the junction, the cyclist accelerates uniformly at  $0.4\text{ms}^{-2}$  for 20 seconds, moves with a constant speed for 2 minutes and then decelerates uniformly to rest in 30 seconds.

- a) Draw a velocity-time graph for the journey from lights, L, to junction, J. (2)
- b) Using your graph, find the total distance travelled by the cyclist. (2)

2. A brick falls from scaffolding 18 metres above the ground under the constant acceleration due to gravity of  $9.8\text{ms}^{-2}$ .

Given that it was initially at rest, calculate the time it will take to reach the ground. (3)

3. It was found that the displacement, in metres, of Tiger Woods tee-shot,  $t$  seconds after he hit it, was given by:

$$S = 230t^2 + 45t - 16t^4$$

Obtain a formulae for

- a) its speed  $t$  seconds after it was hit. (1)
- b) its acceleration  $t$  seconds after being hit. (1)

### Outcome 2

4. Two planes A and B are flying at the same altitude, with velocities of  $350\text{kmh}^{-1}$  due north and  $420\text{kmh}^{-1}$  due east respectively.

Find the magnitude and direction of the velocity of A relative to B. (4)

5. Two ships S and T are observed at positions  $5\mathbf{i} + 2\mathbf{j}$  and  $7\mathbf{i} + 7\mathbf{j}$  respectively, referred to rectangular axes Ox and Oy having unit vectors  $\mathbf{i}$  and  $\mathbf{j}$  respectively.  
Relative to the origin O, S has a constant velocity  $15\mathbf{i} + 10\mathbf{j}$  and T has constant velocity  $9\mathbf{i} - 5\mathbf{j}$ .

Show that the ships will collide. (Distances in km and times are in hours) (4)

### Outcome 3

6. A bullet is fired directly from point P on horizontal ground at an angle of elevation of  $30^\circ$  with speed  $56\text{ms}^{-1}$ . It hits the ground at Q, T seconds later.

- Find
- i) the value of T (2)
  - ii) the distance between P and Q. (2)
  - iii) the greatest height reached by the bullet. (2)

### Outcome 4

7. A body is acted upon by two forces  $F_1$  and  $F_2$  newtons.  
 $F_1 = 4\mathbf{i} + 3\mathbf{j}$  and  $F_2 = -\mathbf{i} - 5\mathbf{j}$  where  $\mathbf{i}$  and  $\mathbf{j}$  are unit vectors.

Determine the magnitude and direction of the resultant force acting on the body. (3)

8. A body of mass 2kg is suspended by two wires, one making an angle of  $30^\circ$  with the horizontal and the other  $60^\circ$  with the horizontal.

Calculate the weight, W newtons, of the body and the magnitude of the tensions in each of the two wires. (5)

9. A body of mass M kg is on a ramp inclined at  $25^\circ$  to the horizontal. If the body is on the point of slipping down the ramp, calculate the coefficient of friction between the body and the ramp. (2)