Godalming College

Mechanics 11 – Projectiles 1

Please **complete** this homework by _____. Start it early. If you can't do a question you will then have time to ask your teacher for help or go to a drop in session.

Section 1 – Review of previous topics. Please complete all questions.

1. Find the magnitude of the vectors (a) 5**i** – 12**j** (b) -3**i** – 5**j**

2. A train starts from rest and after 20 seconds is travelling at 39 ms^{-1}. It travels at this speed for 1 minute. Find the acceleration over the first 20 seconds and the total distance travelled.

3. A stone is thrown vertically upwards from a bridge at 6 ms^{-1}. It hits the water below the bridge 2 seconds later. Find the speed with which the stone hits the water and the initial height of the stone above the water.

4. A ball is thrown vertically upwards at 25ms^{-1}. Find the length of time for which it is more than 3 metres above the point of projection.

5. Jemima is investigating the daily sunshine hours in Camborne in 1987. She numbers each day in date order from x=1 (on January 1st) to x=184 and plots a scatter graph of x against y, the number of hours of sunshine on this day. She calculates the equation of the line of best fit to be $y = 6.6277 - 0.0153x$
   (a) Interpret the meaning each of the numbers in this equation in this context
   (b) Using this model, find the number of hours daylight predicted for February 1st.
   (c) Using your knowledge of the large data set, comment on the reliability of this prediction.

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Section 2 – Consolidation of this week's topic. Please complete all questions.

1. Find the speed of projection and the angle of projection if a particle is projected with initial velocity of (a) 4**i** + 3**j** (b) 2**i** – **j**

(4 marks)

2. A particle is projected from ground level at an angle of θ degrees, where $\tan\theta = \frac{12}{5}$. If the particle is projected with an initial speed of 39ms^{-1}, write the initial velocity as a vector in terms of **I** and **j**.

(4 marks)

3. A particle is projected horizontally from the top of a vertical cliff. It is projected out to sea horizontally at a speed of 15ms^{-1} from a point 25m above sea level.
   (a) Find the time taken for the particle to reach the sea (3)
   (b) Find the horizontal distance from the point it lands to the foot of the cliff (2)
   (c) In reality which of your answers is likely to be an overestimate? Explain your answer. (1)

(6 marks)

4. In the situation described in question 3, how far will the particle be from the point of projection after 1 second?

(6 marks)

5. A bullet is fired at a target area placed 80 metres away. The bullet is fired horizontally and from the same vertical height as the bullseye, but strikes the target area 4cm below the bullseye. Find the speed with which the bullet was fired.

(6 marks)

6. A particle is projected with initial speed $\frac{7\sqrt{3}}{5}$ ms^{-1} across a rough horizontal table whose surface is 1.2 metres above the floor. The coefficient of friction between the particle and the table is ¼ and the path of the particle is initially 0.8 metres from the edge of the table.
   Calculate:
   (a) The speed of the particle as it reaches the edge of the table (5)
   (b) The **total horizontal** distance travelled before the particle hits the floor (5)
   (c) The **total** time taken until the particle hits the floor. (4)

(14 marks)

Total: 40 Marks