Write your name here

Surname		Other Names

AS/A Level Mathematics

Projectiles

Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

• Use **black** ink or ball-point pen.
• If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
• **Fill in the boxes** at the top of this page with your name.
• Answer **all** questions and ensure that your answers to parts of questions are clearly labelled..
• Answer the questions in the spaces provided
– there may be more space than you need.
• You should show sufficient working to make your methods clear.
Answers without working may not gain full credit.
• Answers should be given to three significant figures unless otherwise stated.

Information

• The marks for **each** question are shown in brackets
– use this as a guide as to how much time to spend on each question.

Advice

• Read each question carefully before you start to answer it.
• Try to answer every question.
• Check your answers if you have time at the end.

1 A particle P is projected from the ground with velocity 25ms^{-1} at an angle of 40° to the horizontal.

(a) Find the greatest height of P **(3)**

(b) Find the horizontal distance travelled by P before it hits the ground. **(4)**

(Total for question 1 is 7 marks)

2 A particle P is projected with a velocity $(3\mathbf{i} + 4\mathbf{j})$ms^{-1} from a point 20m above the ground.

(a) Find the speed of the particle after 2 seconds. **(4)**

(b) Find the greatest height of P **(3)**

(c) Find the horizontal distance travelled by P before it hits the ground. **(4)**

(Total for question 2 is 11 marks)

3 A particle P is projected from the ground with velocity 25ms^{-1} at an angle of $\theta°$ to the horizontal.
P lands after 5 seconds.

(a) Find value of θ **(4)**

(b) Find the horizontal distance travelled by P before it lands on the ground **(4)**

(Total for question 3 is 8 marks)

4 A particle P is projected with speed Ums^{-1} from the point A, 20m above the ground.
P is projected at an angle of 60° to the horizontal. B is the greatest height of P, 16m above A.

(a) Find the value of U. **(3)**

(b) Find the horizontal distance travelled. **(6)**

(c) Find the speed of the ball when it hits the ground. **(3)**

(Total for question 4 is 12 marks)

5 A particle P is projected from the ground with velocity $k(3\mathbf{i} + 4\mathbf{j})$ ms^{-1}, where k is a constant.
Given the greatest height reached by P is 24m above the ground.

(a) Find the exact value of k. **(3)**

(b) Find the horizontal distance travelled. **(6)**

(Total for question 5 is 9 marks)

6 A particle P is projected from a point O with velocity Ums^{-1} at an angle of $\theta°$ to the horizontal.
When P has moved a horizontal distance x, it's height above O is y.

(a) Show that

$$y = x\tan\theta - \frac{g x^2}{2 u^2 \cos^2\theta}$$

(4)

Given that θ = 45° and that when $x = 6$, $y = 2$

(b) Find the speed of P at the point where $x = 6$. and $y = 2$

(6)

(Total for question 6 is 10 marks)