



Rewarding Learning

ADVANCED
General Certificate of Education
2022

Centre Number

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Candidate Number

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Mathematics

Assessment Unit A2 2

assessing

Applied Mathematics



[AMT21]

AMT21

TUESDAY 14 JUNE, AFTERNOON

TIME

1 hour 30 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.

Do not write outside the boxed area on each page or on blank pages.

Complete in black ink only. Questions which require drawing or sketching should be completed using an HB pencil. **Do not write with a gel pen.**

Candidates must answer **all** questions from sections A and B.

Equal time should be spent on each section. Show clearly the full development of your answers.

Answers without working may not gain full credit.

Answers should be given to three significant figures unless otherwise stated.

You are permitted to use a graphic or scientific calculator in this paper.

INFORMATION FOR CANDIDATES

The total mark for this paper is 100. The total available mark for each section of this paper is 50.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

Answers should include diagrams where appropriate and marks may be awarded for them.

Take $g = 9.8 \text{ m s}^{-2}$, unless specified otherwise.

A copy of the **Mathematical Formulae and Tables booklet** is provided.

Throughout the paper the logarithmic notation used is $\ln z$ where it is noted that $\ln z \equiv \log_e z$

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32AMT2101

Answer all questions.

SECTION A

Mechanics

1 Bodies P and Q are travelling in the same direction along the same straight line.

P has a mass of 3 kg and a speed of 5 m s^{-1}
Q has a mass of 2 kg and a speed of 2 m s^{-1}

P collides directly with Q.

(i) If P and Q coalesce, find the velocity of the combined body after the collision. [4]

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(ii) Find the impulse exerted on P by Q.

[2]

A series of horizontal dotted lines for writing the answer.



(ii) Find the value of t when the acceleration of the rocket is parallel to the \mathbf{i} vector.

[4]

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- 3 A particle moves in a straight line through a fixed point O.
At time t seconds the velocity $v \text{ m s}^{-1}$ is given by

$$v = 5t^2 + 2t - 3$$

Initially, the displacement of the particle is 0.5 m from O.

- (i) Find an expression for the displacement of the particle from O at time t . [4]

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- (ii) Find the distance travelled by the particle in the first 3 seconds. [8]

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32AMT2107

- 4 Fig. 1 below shows a golfer striking a golf ball.
The golf ball is projected from a point O on horizontal ground.

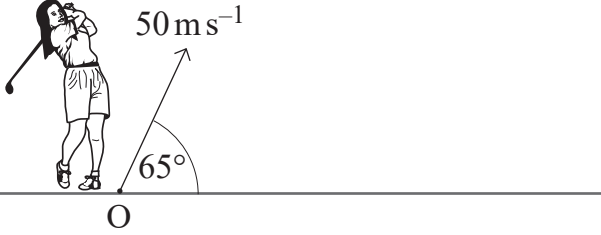


Fig. 1

It has an initial velocity of 50 m s^{-1} at an angle of 65° to the horizontal.

- (i) Find the magnitude and direction of its velocity after 4 seconds. [6]

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Fig. 2 below shows a tree in the plane of projection which is 180 m from O and 25 m tall.

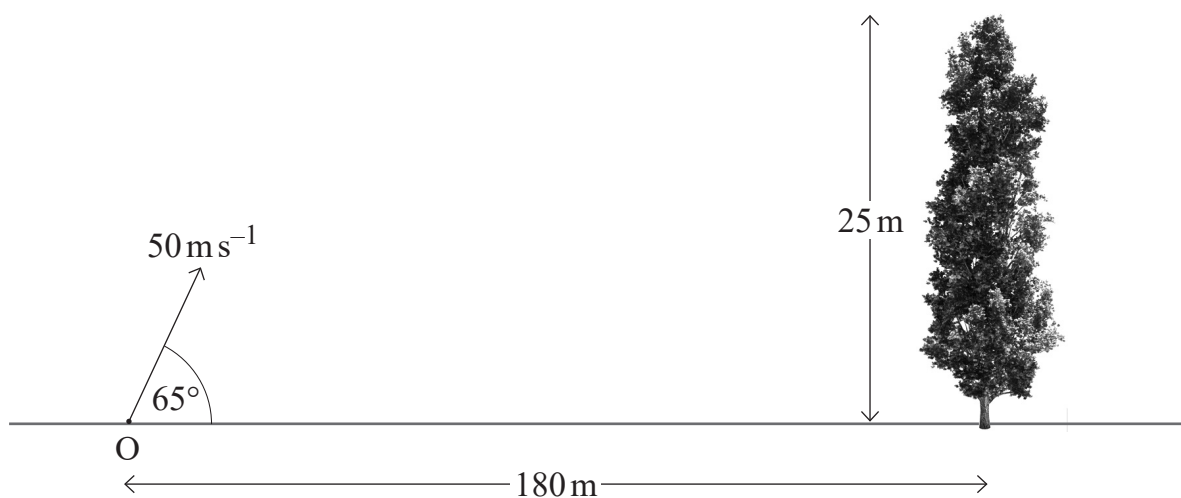


Fig. 2

(ii) Determine whether the ball will clear the tree.

[5]

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32AMT2111

- 5 **Fig. 3** below shows a uniform rod AB of length 4 m and mass 8 kg. The rod is smoothly hinged at end A to a vertical wall.

One end of a light inextensible string of length 5 m is attached to the rod at a point C, where C is 1 m from B.

The other end of the string is attached to the wall at a point D vertically above A.

The rod rests in equilibrium in a horizontal position.

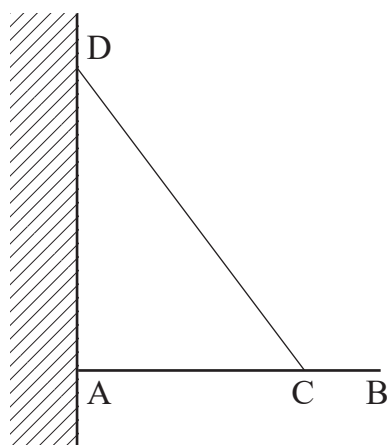
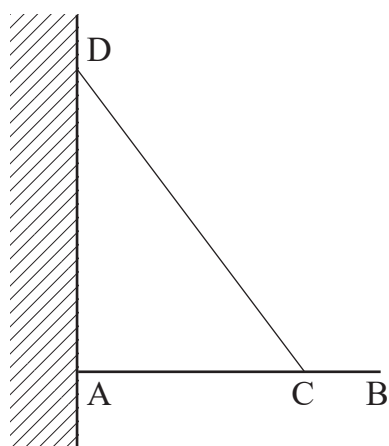


Fig. 3

- (i) Complete the diagram below showing all the external forces acting on the rod. [3]



(ii) Find the magnitude and direction of the reaction on the rod at the hinge. [11]

Ruled lines for writing the answer to the physics problem.

[Turn over]



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32AMT2114



Over time, a mechanic has noticed that cars with smaller depths of tyre tread seem to consume more fuel per mile.

He wishes to use a sample of 10 cars to test this observation.

For the sample, the mechanic calculates the product–moment correlation coefficient between the depth of tyre tread and fuel consumption per mile to be $r = -0.6172$

(ii) Explain why a one-tailed test is appropriate in this context. [2]

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At the 5% level of significance, the critical value of r is -0.5494

(iii) State the critical region for the test. [1]

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(iv) What conclusion can the mechanic draw from this information? [2]

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A clinical trial is to be carried out involving healthy adults whose systolic blood pressure is below 104 mmHg or above 130 mmHg.

(iii) Estimate the percentage of healthy adults who are eligible for the trial. [6]

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32AMT2121

9 Events A and B are such that

$$P(A|B) = 0.45 \quad P(A \cap B) = 0.18 \quad \text{and} \quad P(B|A) = 0.72$$

(i) Find the values of $P(A)$ and $P(B)$. [5]

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32AMT2125

(ii) Hence determine whether or not A and B are independent.

[2]

A series of horizontal dotted lines provided for the student to write their solution.



(iii) Using a Venn diagram, or otherwise, calculate $P(\bar{A} \cap \bar{B})$.

[3]

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32AMT2129

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32AMT2130





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32AMT2131

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Question Number	Marks
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Examiner Number

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