

Surname	Centre Number	Candidate Number
First name(s)		2



GCE AS/A LEVEL

2300U20-1



S25-2300U20-1

FRIDAY, 23 MAY 2025 – AFTERNOON

MATHEMATICS – AS unit 2
APPLIED MATHEMATICS A

1 hour 45 minutes

ADDITIONAL MATERIALS

In addition to this examination paper, you will need:

- a Formula Booklet;
- a calculator;
- statistical tables (RND/WJEC Publications).

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

You may use a pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Take g as 9.8 ms^{-2} .

Write your answers in the spaces provided in this booklet. If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

The maximum mark for this paper is 75.

The number of marks is given in brackets at the end of each question or part-question.

Sufficient working must be shown to demonstrate the **mathematical** method employed.

Answers without working may not gain full credit.

Unless the degree of accuracy is stated in the question, answers should be rounded appropriately.

You are reminded of the necessity for good English and orderly presentation in your answers.

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1	6	
2	4	
3	11	
4	8	
5	11	
6	6	
7	6	
8	8	
9	4	
10	11	
Total	75	

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Reminder: Sufficient working must be shown to demonstrate the **mathematical** method employed.

Section A: Statistics

1. Financial transactions on a network occur at an average rate of one every 10 minutes. Transactions occur singly, randomly and independently.

- (a) Stating an appropriate model, calculate the probability that there will be exactly 5 transactions in a randomly selected one-hour period. [3]

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During a busy period, the average rate of transactions is 10 per hour. The cost per transaction is \$30.

- (b) For this busy period, calculate the probability that the total cost of the transactions will be at least \$360 in a randomly selected hour. [3]

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2. The probability distribution of a discrete random variable X is given below.

x	2	3	4	5
$P(X = x)$	0.1	0.4	0.3	0.2

Given that X_1 and X_2 are two independent observations of X , calculate the probability that $X_1 + X_2 = 6$.

[4]



- (a) Write suitable hypotheses to test Martin's claim.

[1]

(b) (i) Calculate the p -value for Martin's data.

- (ii) Complete the hypothesis test at the 5% level of significance and make a conclusion in context.

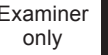
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- (c) Now suppose that Martin's new question is such that the true probability that the question is answered correctly is 0.2. Calculate the probability of a Type II error in a random sample of size 63. Interpret your answer in context. [5]



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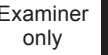


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- [6]



5. The World Health Organisation (WHO) compiles data on life expectancy and other factors.

A hobbyist statistician is exploring the data he collects from the WHO. The following screenshot shows part of his work.

Country	Life expectancy	Adult mortality	Hepatitis B	Polio	GDP	Population	Years of schooling	Life expectancy
Benin	60	249	82	78	784	13 958 086	10.7	60
Botswana	65.7	256	95	96	6533	2 705 113	12.6	65.7
Comoros	63.5	227	91	92	728	777 424	11.1	63.5
Costa Rica	79.6	AB	92	92	1146	5 235 470	14.2	79.6
Saudi Arabia	74.5	88	98	97	2733		16.1	74.5
Seychelles	73.2	168	98	97	1539	93 419	14.1	73.2

(a) Give **two** ways in which the data could be cleaned.

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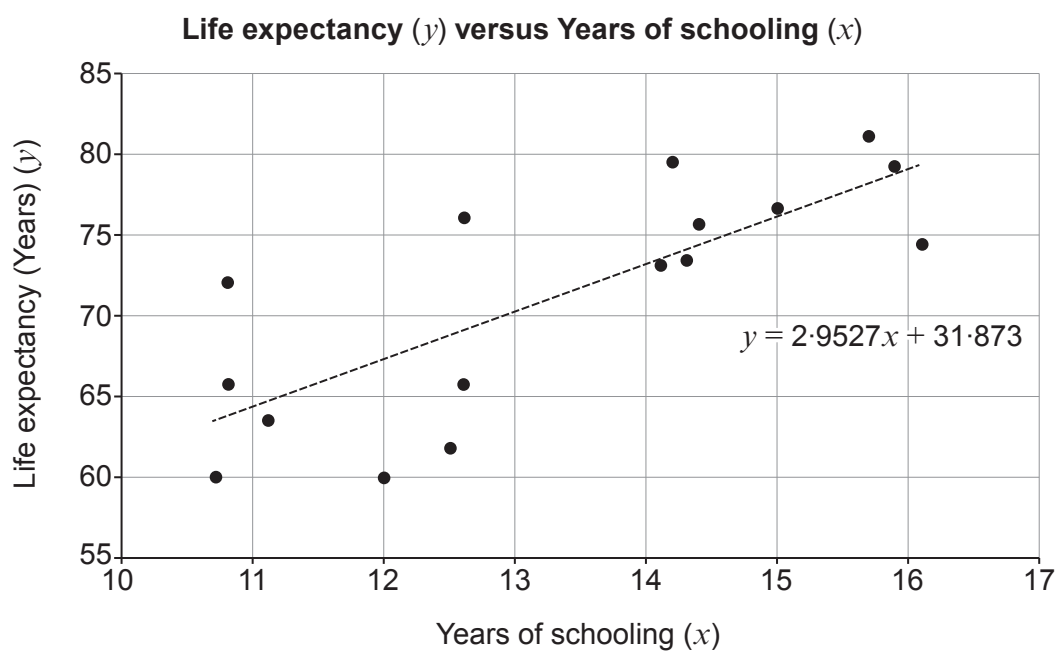
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The graph below shows the life expectancy and years of schooling for 16 randomly selected countries.



- (b) Interpret the gradient of the regression line in context.

[1]

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- (c) Comment on the causal nature or otherwise of the correlation.

[1]

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TURN OVER FOR QUESTIONS 5(d)–5(f)



- (d) (i) Calculate an estimate of the life expectancy for a country that has 14.6 years of schooling. [1]
- (ii) Comment on the reliability of your answer. [1]

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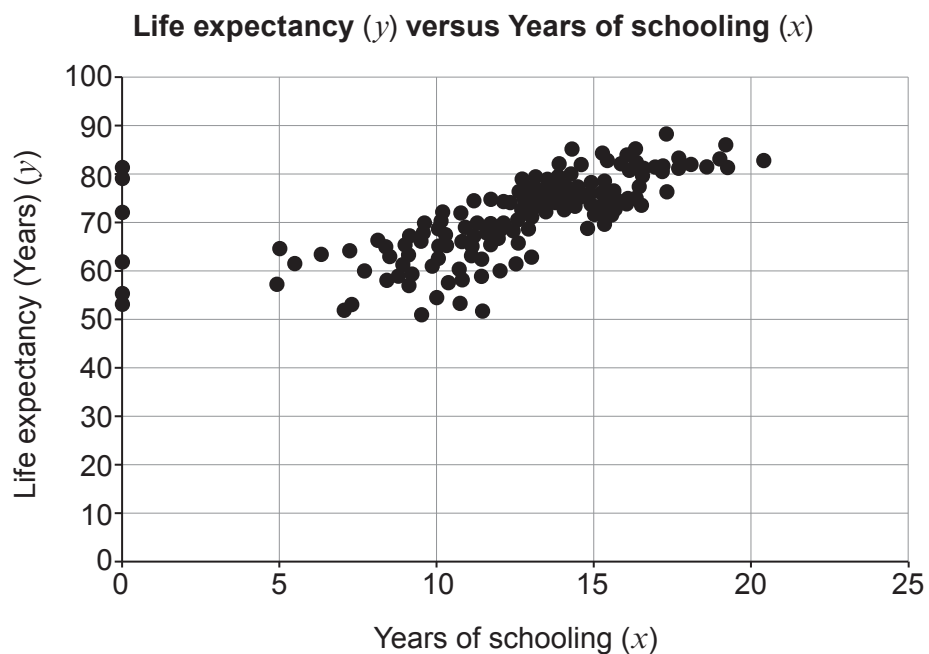
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The entire data set was used to produce the following scatter diagram.



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- $$\sum y = 13105.9 \quad \sum y^2 = 950615.47 \quad n = 183$$

- (ii) The hobbyist statistician claims that 71.6 years represents average global life expectancy. Comment on this claim. [1]



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- (b) The force $\mathbf{G} + \mathbf{H}$ acts on the particle. Determine the acceleration vector of the particle. [3]

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7. (a) Using the equations $v = u + at$ and $s = \frac{1}{2}(u + v)t$, show that

$$s = ut + \frac{1}{2}at^2. \quad [2]$$

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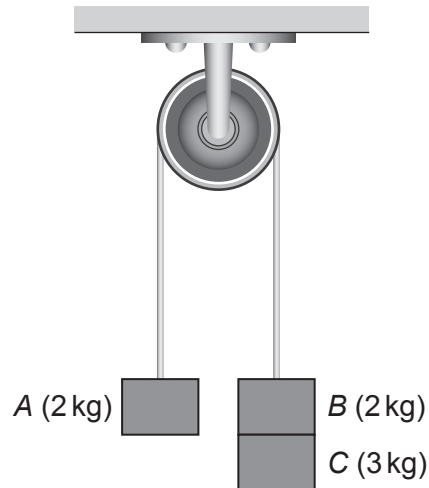
- (ii) State **one** assumption that you have made in your solution. [1]



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8. Two objects A and B are connected by a light inextensible string passing over a smooth fixed pulley. Object A has mass 2 kg and object B has mass 2 kg . Another object C , of mass 3 kg , is attached to object B as shown in the diagram below.

Initially, the system is held at rest with the string just taut and the hanging parts of the string vertical.



The system is then released from rest.

- (a) (i) Find the magnitude of the acceleration of A and the tension in the string. [6]
(ii) Hence, find the force exerted by the string on the pulley. [1]



- (b) Object *C* separates from *B* and falls away. Without carrying out any further calculations, write down the acceleration of *A* after the separation. [1]



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- A diagram showing a car on a horizontal road. The road is represented by a thick grey line. Two vertical grey lines are positioned on the road, labeled 'A' and 'B' below them. The car is located on the road to the left of line A.

$$v = 50t - 2t^3 \quad \text{for} \quad 0 \leq t \leq 5.$$

(a) Find an expression for the displacement of the car from A at time t s.

[3]



- (b) When $t = 4$, the car passes the point B . Determine the length of the track between A and B . [1]

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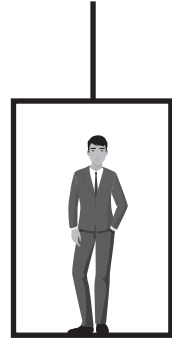
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- A velocity-time graph for a car. The vertical axis is labeled 'Velocity (ms^{-1})' and has markings at 0 and 5. The horizontal axis is labeled 'Time (s)' and has markings at 0, 4, 10, and t . The graph consists of three segments: a straight line from (0, 0) to (4, 5), a horizontal line from (4, 5) to (10, 5), and a straight line from (10, 5) to (t , 0). Dashed lines connect the points (4, 5) and (10, 5) to their respective coordinates on the axes.



- [4]





(c) Calculate the distance travelled by the lift during the entire 15 s journey.

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