

Mathematics: applications and interpretation
Standard level
Paper 1

Friday 6 May 2022 (afternoon)

Candidate session number

1 hour 30 minutes

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Instructions to candidates

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- A graphic display calculator is required for this paper.
- Answer all questions.
- Answers must be written within the answer boxes provided.
- Unless otherwise stated in the question, all numerical answers should be given exactly or correct to three significant figures.
- A clean copy of the **mathematics: applications and interpretation formula booklet** is required for this paper.
- The maximum mark for this examination paper is **[80 marks]**.

Please **do not** write on this page.

Answers written on this page
will not be marked.

21 pages

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will not be marked.



24EP22

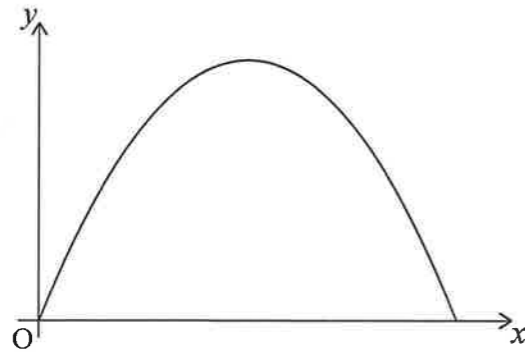


24EP03

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12. [Maximum mark: 5]

The cross-section of an arched entrance into the ballroom of a hotel is in the shape of a parabola. This cross-section can be modelled by part of the graph $y = -1.6x^2 + 4.48x$, where y is the height of the archway, in metres, at a horizontal distance, x metres, from the point O, in the bottom corner of the archway.



- (a) Determine an equation for the axis of symmetry of the parabola that models the archway. [2]

To prepare for an event, a square-based crate that is 1.6 m wide and 2.0 m high is to be moved through the archway into the ballroom. The crate must remain upright while it is being moved.

- (b) Determine whether the crate will fit through the archway. Justify your answer. [3]

(Question 2 continued)

10. [Maximum mark: 5]

The masses of Fuji apples are normally distributed with a mean of 163 g and a standard deviation of 6.83 g.

When Fuji apples are picked, they are classified as small, medium, large or extra large depending on their mass. Large apples have a mass of between 172 g and 183 g.

(a) Determine the probability that a Fuji apple selected at random will be a large apple. [2]

Approximately 68% of Fuji apples have a mass within the medium-sized category, which is between k and 172 g.

(b) Find the value of k . [3]

Handwriting practice area for question 10(b).



24EP18

(Question 3 continued)

Handwriting practice area for question 3 continued.

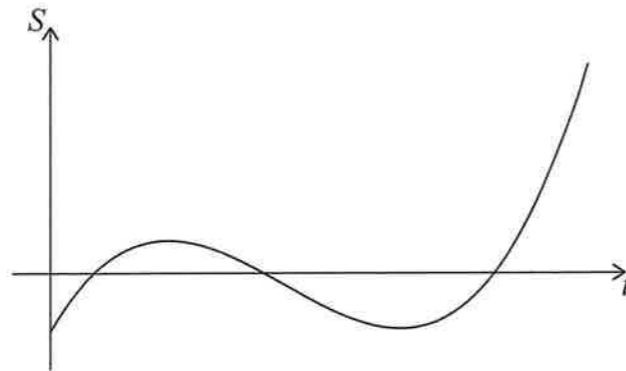


24EP07

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9. [Maximum mark: 8]

The graph below shows the average savings, S thousand dollars, of a group of university graduates as a function of t , the number of years after graduating from university.



- (a) Write down one feature of this graph which suggests a cubic function might be appropriate to model this scenario.

[1]

The equation of the model can be expressed in the form $S = at^3 + bt^2 + ct + d$, where a , b , c and d are real constants.

The graph of the model must pass through the following four points.

t	0	1	2	3
S	-5	3	-1	-5

- (b) (i) Write down the value of d .
- (ii) Write down three simultaneous equations for a , b and c .
- (iii) Hence, or otherwise, find the values of a , b and c .

[4]

A negative value of S indicates that a graduate is expected to be in debt.

- (c) Use the model to determine the total length of time, in years, for which a graduate is expected to be in debt after graduating from university.

[3]

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5. [Maximum mark: 7]

A polygraph test is used to determine whether people are telling the truth or not, but it is not completely accurate. When a person tells the truth, they have a 20% chance of failing the test. Each test outcome is independent of any previous test outcome.

10 people take a polygraph test and all 10 tell the truth.

- (a) Calculate the expected number of people who will pass this polygraph test. [2]
- (b) Calculate the probability that exactly 4 people will fail this polygraph test. [2]
- (c) Determine the probability that fewer than 7 people will pass this polygraph test. [3]

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24EP16



24EP09

Turn over

8. [Maximum mark: 6]

A study was conducted to investigate whether the mean reaction time of drivers who are talking on mobile phones is the same as the mean reaction time of drivers who are talking to passengers in the vehicle. Two independent groups were randomly selected for the study.

To gather data, each driver was put in a car simulator and asked to either talk on a mobile phone or talk to a passenger. Each driver was instructed to apply the brakes as soon as they saw a red light appear in front of the car. The reaction times of the drivers, in seconds, were recorded, as shown in the following table.

Talking on mobile phone	Talking to passenger
0.69	0.67
0.87	0.86
0.98	0.60
1.04	0.81
0.79	0.76
0.87	0.71
0.71	0.74

At the 10% level of significance, a t -test was used to compare the mean reaction times of the two groups. Each data set is assumed to be normally distributed, and the population variances are assumed to be the same.

Let μ_1 and μ_2 be the population means for the two groups. The null hypothesis for this test is $H_0: \mu_1 - \mu_2 = 0$.

- (a) State the alternative hypothesis. [1]
- (b) Calculate the p -value for this test. [2]
- (c) (i) State the conclusion of the test. Justify your answer.
- (ii) State what your conclusion means in context. [3]

(This question continues on the following page)

(Question 6 continued)



24EP14



24EP11

Turn over