



IB Demystified

Examiners. Moderators. Mentors.

Mathematics: Applications and Interpretation

Standard Level

Paper 2

Mock Examination

Question Paper

Mock Exam 1

Calculator: Graphic display calculator required

Time allowed: 1 hour 30 minutes

Maximum mark: 80 marks

Instructions to Candidates

- A graphic display calculator (GDC) is required throughout this paper.
- A clean copy of the *Mathematics: Applications and Interpretation SL* formula booklet may be used.
- Answer **all** questions in the answer booklet or on the continuation pages provided.
- Begin each question on a new page of your answer booklet.
- Unless a question states otherwise, give numerical answers exactly or correct to three significant figures.
- Solutions obtained from a calculator must be supported by suitable working, such as a clear setup, a sketch, or a description of the method used.
- Where a graph is used to reach an answer, include a sketch or a clear description of the graphing method.
- Unsupported answers may not receive full marks, so you are advised to show all working.
- The maximum mark for this paper is **80 marks**.
- The time allowed for this paper is **1 hour 30 minutes**.

Candidate Information

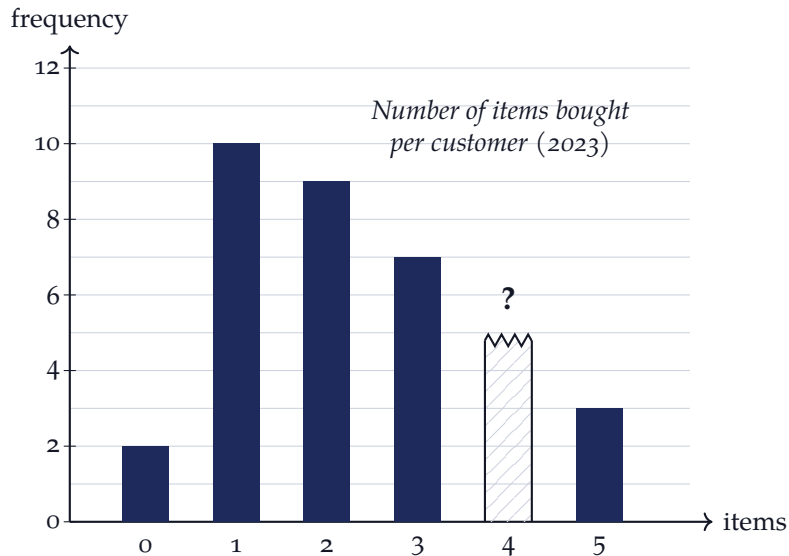
Candidate name: _____

Session number: _____

Date: _____

1. [Maximum mark: 15]

A neighbourhood bakery records the number of items bought by each customer during one busy morning in 2023. The results are displayed in the bar chart below. Unfortunately the height of the bar for customers who bought **4 items** has become unreadable.



Paul, the owner, uses the bar chart to construct the frequency table below. The frequency for 4 items is denoted by p , and the frequency for 3 items is denoted by k .

Items bought	0	1	2	3	4	5
Frequency	2	10	9	k	p	3

(a) Write down the value of k . [1]

Paul finds that the mean number of items bought per customer that morning was 2.5.

(b) (i) Write down an equation for the mean number of items in terms of p .

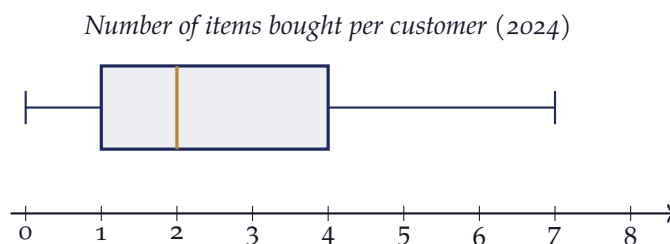
(ii) Hence determine the value of p . [3]

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(Question 1 continued)

The number of items bought per customer during a comparable morning in **2024** is summarised in the box-and-whisker diagram below.



After comparing the 2024 box-and-whisker diagram with the 2023 frequency table, Paul concludes that the spread of purchases is *consistent* across the two years.

- (c) State **two** observations that support Paul's conclusion. In each observation use values from the data to compare any two of: *range*, *symmetry*, *median* and *interquartile range*. [3]

Paul selects customer receipts from the 2023 morning at random, without replacement, and inspects them one at a time. For the first receipt he selects, he defines event F as:

“the customer bought **at most 2** items”.

- (d) From the table below, write down the event(s) equivalent to F' . There may be more than one correct event. [2]

Event	Description
A	The customer bought exactly 3 items
B	The customer bought more than 2 items
C	The customer bought at least 3 items
D	The customer bought fewer than 3 items
E	No customer in the morning bought 2 items or fewer

- (e) The first receipt selected showed that the customer bought exactly 4 items. Write down the probability that the second receipt selected also shows exactly 4 items. Give your answer as a fraction. [2]
- (f) Calculate the probability that the first receipt selected shows 5 items bought **and** the second receipt selected shows 0 items bought. [4]

Turn over ►

2. [Maximum mark: 15]

Give all answers in this question correct to the nearest dollar, unless stated otherwise.

Mia invests 8000 Australian dollars (AUD) in a savings account. The account pays a nominal annual interest rate of 4.2%, compounded quarterly.

- (a) Calculate the value of Mia's investment after 5 years. [3]

Mia wishes to buy professional camera equipment costing 26 000 AUD. She uses the full value obtained in part (a) as an initial payment and borrows the remaining amount as a loan.

- (b) Determine the amount of Mia's loan. [1]

Mia repays the loan over 8 years, making a repayment at the end of each month. The loan has a nominal annual interest rate of 7.2%, compounded monthly.

- (c) Determine Mia's monthly loan repayment. [5]

After 3 complete years of repayments, the amount still owing on the loan is 11 129 AUD. At this point Mia increases her repayment to 280 AUD at the end of each month.

- (d) (i) Calculate the amount by which the loan will decrease during the next 2 complete years. [4]

- (ii) Hence determine the total interest Mia pays during this 2-year period. [2]

Turn over ►

3. [Maximum mark: 17]

Hana is following a 12-week programme to prepare for a 10 km road race.

Each week of the programme includes one **long run**. In week 1 her long run is 6 km. In each subsequent week she increases the distance of her long run by 8%.

- (a) Explain why the distances of Hana's long runs form a geometric sequence, and state the common ratio. [2]
- (b) Find the total distance of Hana's first 10 long runs. [2]

A coaching guideline recommends that, by the final week of a programme, the long run should be at least 1.3 times the race distance.

- (c) Show that the long run in week 12 of Hana's programme satisfies this guideline. [3]

The programme also includes a strength routine. In each session Hana performs a number of squats. In session 1 she performs 30 squats, and in each later session she increases the number of squats by the same fixed amount. In session 9 she performs 70 squats.

The numbers of squats performed each session form an arithmetic sequence, where u_n is the number of squats performed in session n .

- (d) (i) Determine the common difference of the sequence. [2]
- (ii) Find the number of squats Hana performs in session 12. [2]
- (iii) Find the total number of squats Hana performs in her first 12 sessions. [3]
- (e) Determine the first session in which Hana performs more than 100 squats. [3]

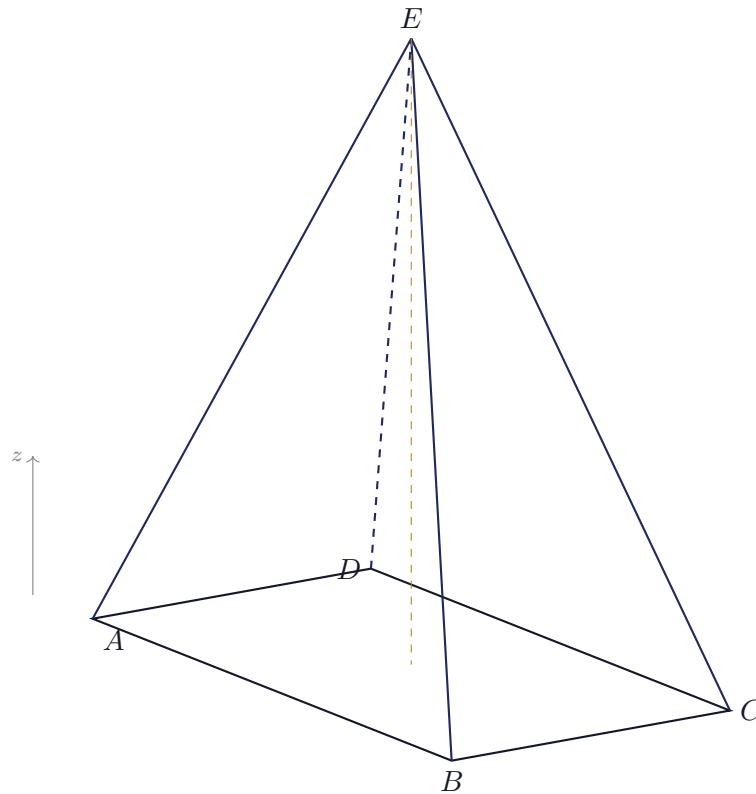
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4. [Maximum mark: 14]

A company manufactures a solid glass paperweight in the shape of a right pyramid on a rectangular base $ABCD$ with apex E . Relative to a set of axes, with all lengths in centimetres, the vertices are

$$A(0, 0, 0), \quad B(6, 0, 0), \quad C(6, 4, 0), \quad D(0, 4, 0), \quad E(3, 2, 9).$$

diagram not to scale



- (a) Find the length of the base diagonal AC . [2]
- (b) Find the length of the edge AE . [2]
- (c) Show that the volume of the paperweight is 72 cm^3 . [3]

The glass used costs 0.04 US dollars (USD) per cubic centimetre. Manufacturing each paperweight requires 15% more material than its final volume, due to wastage. The company sells each paperweight for 25% more than the cost of the material used.

- (d) Determine the price, to two decimal places, that the company charges for one paperweight. [3]

Let θ be the angle that the edge AE makes with the base of the pyramid.

- (e) (i) Find the size of θ . [2]
- (ii) The designer claims that doubling every coordinate of E would double the angle θ . State, with a reason, whether this claim is correct. [2]

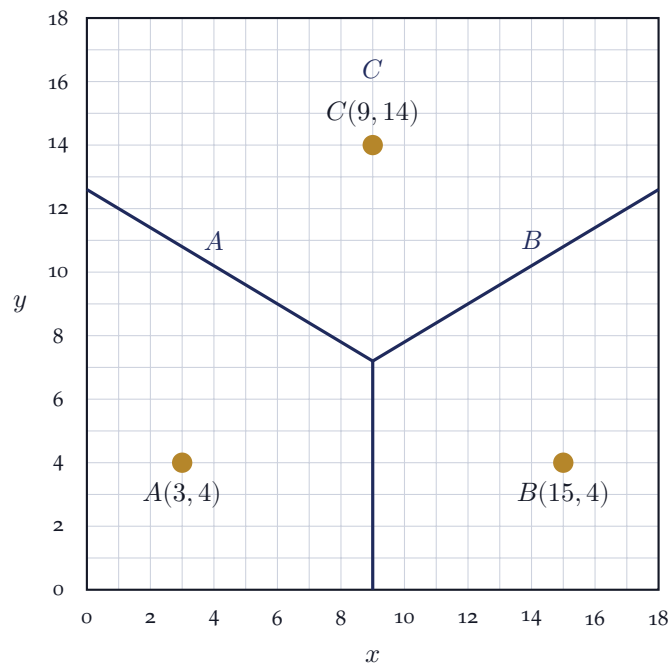
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5. [Maximum mark: 19]

A coastal town is served by three electric-vehicle charging stations, labelled A , B and C . Their positions are shown on the map below. The town can be modelled on a coordinate grid where 1 unit represents 0.5 km, with the stations at

$$A(3, 4), \quad B(15, 4), \quad C(9, 14).$$

A Voronoi diagram is used to assign to each station the region of the town that is closest to it.



- (a) (i) Find the coordinates of the midpoint of $[AC]$. [2]
 (ii) Find the gradient of the perpendicular bisector of $[AC]$. [2]
 (iii) Hence find the equation of the boundary between the regions of stations A and C . [2]

A driver reports a fault at the location $(7, 9)$.

- (b) (i) Using the Voronoi diagram, identify which station is expected to serve this location, and justify your answer. [1]
 (ii) Suggest one reason why a different station might be sent instead. [1]

This question continues on the following page.

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(Question 5 continued)

The three Voronoi boundaries meet at the single point $W(9, 7.2)$.

- (c) (i) Show that the distance from W to station A is 6.80000 units, correct to six significant figures. [2]
- (ii) Given that W is the same distance from each of the three stations, explain why any of the three stations could be sent to a fault reported at W . [2]

The boundary between stations A and C meets the y -axis at $(0, 12.6)$. The boundary between stations A and B is the line $x = 9$.

- (d) (i) Determine the area, in square units, of the region of the Voronoi diagram for which station A is responsible. [5]
- (ii) Hence calculate the actual area, in square kilometres, of the region served by station A . [2]

End of Mock Examination 1

Total: 80 marks