



IB Demystified

Mathematics: Applications and Interpretation SL

Paper 1 Mock Examination

Mock Exam 1

Calculator: A graphic display calculator (GDC) is required

Time allowed: 1 hour 30 minutes

Maximum mark: 80 marks

Instructions to Candidates

- Do not open this examination paper until you are told to begin.
- A graphic display calculator is needed throughout this paper.
- A clean copy of the *Mathematics: Applications and Interpretation SL* formula booklet may be used.
- Answer every question. Write your responses in the answer spaces provided.
- Unless a question states otherwise, give numerical answers either exactly or rounded correct to three significant figures.
- Any answer obtained from a calculator must be supported by suitable working, a clear setup, a sketch, or an explanation.
- If you solve a problem using a graph, include a sketch or a clear description of the graphing method used.
- Unsupported answers may not receive full marks, so you are advised to show all of your working.
- The maximum mark for this paper is **80 marks**.
- The time allowed for this paper is **1 hour 30 minutes**.

Candidate name:
Session number:
Date:

This paper consists of 13 questions. The marks for each question are shown in brackets.

1.

[Maximum mark: 6]

A bottling plant fills sports drink bottles with a nominal (intended) volume of 500 mL.

(a) One sample bottle is found to contain 0.486 L. Convert this volume to millilitres. [1]

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(b) Calculate the percentage error of this bottle relative to the nominal volume of 500 mL. [2]

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(c) In one day the plant fills 9.0×10^4 bottles, each holding the nominal 500 mL. Find the total volume of drink, in litres, giving your answer in the form $a \times 10^k$, where $1 \leq a < 10$ and $k \in \mathbb{Z}$. [3]

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2.

[Maximum mark: 5]

A juice bar sells two sizes of smoothie: a **Mango** smoothie and a **Berry** smoothie. Let the price of one Mango smoothie be \$ x and the price of one Berry smoothie be \$ y .

On Saturday the bar sold 12 Mango and 9 Berry smoothies for a total of \$100.80.

On Sunday the bar sold 7 Mango and 15 Berry smoothies for a total of \$113.40.

(a) Write down two equations in x and y to represent this information. [2]

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(b) Find the price of one Mango smoothie and the price of one Berry smoothie. [2]

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(c) Find the total cost of buying 5 Mango smoothies and 4 Berry smoothies. [1]

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3.

[Maximum mark: 5]

A concert hall is arranged so that the first row contains 18 seats. Each row after the first contains 3 more seats than the row in front of it.

(a) Find the number of seats in row 10. **[2]**

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(b) The hall has 20 rows in total. Find the total number of seats in the hall. **[2]**

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(c) A fire-safety regulation states that the hall may seat at most 1000 people. State, with a reason, whether the hall meets this regulation. **[1]**

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4.

[Maximum mark: 5]

A hiker leaves point P and walks 4.2 km on a bearing of 062° to reach point Q . From Q she walks 5.8 km on a bearing of 152° to reach point R .

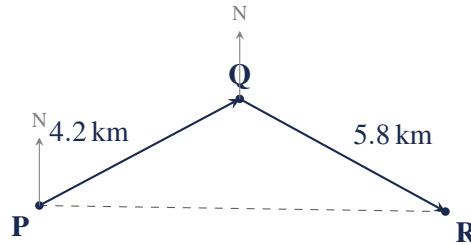


Diagram not to scale

(a) Show that $\widehat{PQR} = 90^\circ$. [1]

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(b) Find the distance PR . [2]

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(c) Find the bearing of R from P . [2]

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5.

[Maximum mark: 7]

A sports scientist records the number of hours of weekly endurance training, x , and the distance, y kilometres, that each of eight cyclists can ride before reaching fatigue. The results are shown in the table.

Training hours, x	2	4	5	7	8	10	11	13
Distance, y (km)	20	32	34	46	47	60	61	73

(a) Find the value of Pearson's product-moment correlation coefficient, r . [2]

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(b) Describe the correlation between training hours and distance. [1]

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(c) Find the equation of the regression line of y on x . [2]

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(d) Use your regression line to estimate the distance ridden by a cyclist who trains for 9 hours per week. [1]

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(e) Give one reason why this model may be unreliable for a cyclist who trains for 25 hours per week. [1]

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6.

[Maximum mark: 6]

A rotating garden sprinkler waters a sector of a circle. The sector has radius 6.5 m and a central angle of 120° , as shown.

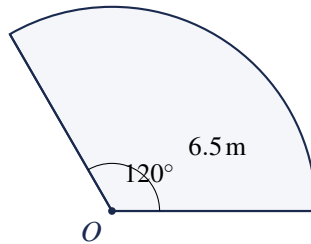


Diagram not to scale

(a) Find the area of the region watered by the sprinkler. [2]

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(b) Find the length of the curved (arc) boundary of this region. [2]

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(c) Find the perimeter of the watered region. [2]

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7.

[Maximum mark: 5]

A machine produces LED bulbs. It is known that 4% of the bulbs produced are defective. A quality inspector selects a random sample of 20 bulbs. Let X be the number of defective bulbs in the sample. You may assume that X follows a binomial distribution.

(a) Write down the expected number of defective bulbs in the sample. [1]

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(b) Find $P(X = 2)$. [2]

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(c) Find the probability that the sample contains at least one defective bulb. [2]

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8.

[Maximum mark: 7]

A stone is thrown upwards from the top of a low wall. Its height above the ground, h metres, t seconds after being thrown, is modelled by

$$h(t) = -4.9t^2 + 14.7t + 1.6, \quad t \geq 0.$$

(a) Write down the height from which the stone is thrown. [1]

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(b) Find the time at which the stone reaches its maximum height, and find this maximum height. [3]

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(c) Find the time at which the stone hits the ground. [2]

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(d) State one limitation of using this model to describe the motion of the stone. [1]

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9.

[Maximum mark: 4]

A group of 200 students were asked whether they prefer to study **online** or **in person**. The results, classified by year group, are shown in the table.

	Online	In person	Total
Year 12	48	62	110
Year 13	54	36	90
Total	102	98	200

A student is chosen at random.

(a) Find the probability that the student prefers to study online. [1]

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(b) Find the probability that the student is in Year 13 **and** prefers to study in person. [1]

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(c) Given that the student is in Year 12, find the probability that the student prefers to study in person. [2]

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10.

[Maximum mark: 7]

A transport authority surveyed 300 commuters to investigate whether there is an association between a commuter's **age group** and their **preferred mode of transport**. The observed results are shown below.

	Car	Bicycle	Public transport	Total
Under 30	45	38	57	140
30 and over	72	24	64	160
Total	117	62	121	300

A χ^2 test for independence is carried out at the 5% significance level.

(a) State the null hypothesis H_0 and the alternative hypothesis H_1 . [2]

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(b) Write down the number of degrees of freedom. [1]

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(c) Find the χ^2 test statistic and the p -value. [2]

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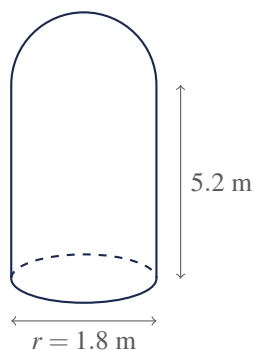
(d) State, with justification, the conclusion of the test in context. [2]

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11.

[Maximum mark: 5]

A grain storage silo is modelled as a cylinder with a hemisphere on top. The cylinder has radius 1.8 m and height 5.2 m. The hemisphere has the same radius as the cylinder.



(a) Find the total volume of the silo. [3]

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(b) Grain fills the silo to 80% of its total volume. Find the volume of grain in the silo. [1]

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(c) Grain costs \$145 per cubic metre. Find the total cost of the grain in the silo, to the nearest dollar. [1]

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A company's daily profit, P hundred dollars, from producing x hundred items per day is modelled by

$$P(x) = -2x^3 + 21x^2 - 36x + 10, \quad 0 \leq x \leq 8.$$

(a) Find $P'(x)$. [2]

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(b) Find the values of x for which $P'(x) = 0$. [2]

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(c) Determine which of these values gives the maximum profit, and justify your answer. [2]

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(d) Find the maximum daily profit, in dollars. [2]

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(e) State the interval of values of x for which the daily profit is increasing. [1]

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Water flows into a reservoir. The rate of inflow, R cubic metres per hour, is modelled by

$$R(t) = 25 + 18t - 1.5t^2, \quad 0 \leq t \leq 12,$$

where t is the number of hours after midnight. At midnight ($t = 0$) the reservoir already contains 150 m^3 of water.

(a) Find the rate of inflow at $t = 4$. [1]

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(b) Find the time at which the rate of inflow is greatest. [2]

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(c) Find $\int_0^8 R(t) dt$. [3]

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(d) Hence find the volume of water in the reservoir at $t = 8$. [1]

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(e) Explain what the value of $\int_0^8 R(t) dt$ represents in this context. [1]

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(f) State one limitation of this model. [1]

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END OF EXAMINATION