



IB Demystified

Mathematics: Applications and Interpretation SL

Paper 1 Mock Examination

Mock Exam 2

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]

Maria invests \$6500 in a savings account that pays a nominal annual interest rate of 4.8%, compounded quarterly. Give monetary answers correct to two decimal places.

(a) Find the value of the investment after 5 years. [3]

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(b) Find the total interest earned over the 5 years. [1]

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(c) Find the number of complete years required for the investment to first exceed \$9000. [2]

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2.

[Maximum mark: 5]

A cup of coffee is left to cool in a room. Its temperature T , in degrees Celsius, t minutes after it is poured, is modelled by

$$T(t) = 22 + 58e^{-0.045t}.$$

(a) Write down the temperature of the coffee at the moment it is poured. [1]

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(b) Find the temperature of the coffee after 15 minutes. [2]

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(c) Find the time taken for the coffee to cool to 40°C. [2]

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3.

[Maximum mark: 5]

An employee's annual salary increases by 3% at the end of each year. In her first year, her salary is \$42 000.

(a) Find her salary in her fifth year, to the nearest dollar. [2]

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(b) Find the total amount she earns during her first 10 years, to the nearest dollar. [2]

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(c) Find the first year in which her salary exceeds \$55 000. [1]

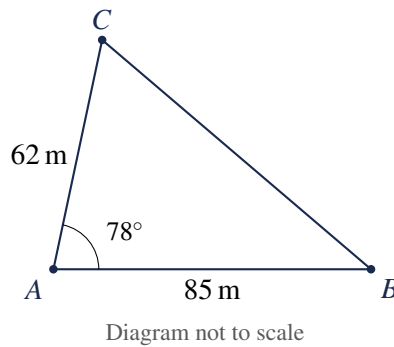
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4.

[Maximum mark: 5]

A triangular plot of land ABC has $AB = 85$ m, $AC = 62$ m and angle $\widehat{BAC} = 78^\circ$.



(a) Find the length of BC . [2]

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(b) Find the area of the plot of land. [2]

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(c) The land is sold for \$45 per square metre. Find the selling price, to the nearest dollar. [1]

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5.

[Maximum mark: 7]

The masses of apples from an orchard are normally distributed with mean 145 g and standard deviation 18 g.

(a) Find the probability that a randomly chosen apple has a mass less than 130 g. [2]

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(b) Find the probability that a randomly chosen apple has a mass between 140 g and 160 g. [2]

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.....

(c) An apple is classified as *premium* if its mass is among the heaviest 15% of apples. Find the minimum mass of a premium apple. [2]

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(d) A crate contains 200 apples. Find the expected number of apples in the crate with a mass less than 130 g.
[1]

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6.

[Maximum mark: 6]

A ship sails from port P for 24 km on a bearing of 035° to a buoy Q . It then changes course and sails 31 km on a bearing of 110° to a lighthouse R .

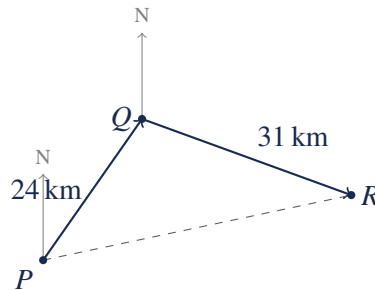


Diagram not to scale

- (a) Show that angle $P\hat{Q}R = 105^\circ$. [2]

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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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7.

[Maximum mark: 5]

A radioactive sample has a half-life of 8 years. Its mass m , in grams, after t years is modelled by

$$m(t) = 120 \left(\frac{1}{2}\right)^{t/8}.$$

- (a) Write down the initial mass of the sample. [1]

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- (b) Find the mass remaining after 20 years. [2]

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- (c) Find the time taken for the mass to decrease to 30 g. [2]

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8.

[Maximum mark: 7]

An open-topped box is made from a rectangular sheet of card measuring 40 cm by 25 cm. A square of side x cm is cut from each corner and the sides are folded up.

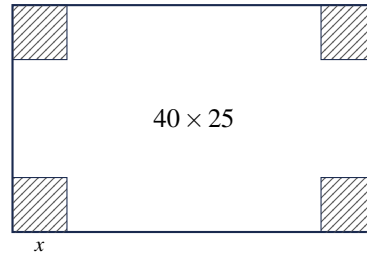


Diagram not to scale

(a) Show that the volume of the box is $V(x) = x(40 - 2x)(25 - 2x)$. [1]

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(b) Show that $V(x) = 4x^3 - 130x^2 + 1000x$. [1]

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(c) Find $V'(x)$. [2]

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(d) Find the value of x that gives the maximum volume. [2]

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(e) Find the maximum volume of the box. [1]

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9.

[Maximum mark: 4]

The number of subscribers, N thousand, to a streaming service t months after its launch is modelled by

$$N(t) = 8 + 12t - 0.5t^2, \quad 0 \leq t \leq 20.$$

(a) Find $N'(t)$. [1]

.....

(b) Find the rate of change of the number of subscribers at $t = 4$, and interpret this value. [2]

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.....
(c) Find the value of t at which the number of subscribers stops increasing.

[1]
.....

10.

[Maximum mark: 7]

A toy car accelerates from rest along a straight track. Its velocity, v metres per second, at time t seconds is modelled by

$$v(t) = 3t^2 - 0.4t^3, \quad 0 \leq t \leq 6.$$

(a) Find the velocity of the car at $t = 3$. [1]

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(b) Find the time at which the car reaches its maximum velocity. [2]

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(c) Find the distance travelled by the car during the first 6 seconds. [3]

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(d) Explain what the value found in part (c) represents. [1]

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11.

[Maximum mark: 5]

Devi pays \$250 at the end of every month into a savings account that pays a nominal annual interest rate of 3.6%, compounded monthly. Give monetary answers correct to two decimal places.

(a) Find the value of the account after 4 years. [3]

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(b) Find the total amount Devi has paid into the account. [1]

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(c) Find the total interest earned. [1]

.....

A biologist measures the number of bacteria, N thousand, in a culture at hourly intervals. The results are shown in the table.

Time, t (hours)	0	1	2	3	4	5
Number, N (thousand)	50	82	115	195	285	475

The number of bacteria is modelled by $N = ab^t$.

- (a) Find the value of a and the value of b . [2]

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- (b) Write down the value of the correlation coefficient, and comment on the fit of the model. [2]

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- (c) Use the model to predict the number of bacteria after 7 hours. [2]

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- (d) Find the time at which the number of bacteria first reaches 2 000 thousand. [2]

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- (e) State one reason why the model may not be valid for large values of t . [1]

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The depth of water, d metres, in a harbour t hours after midnight is modelled by

$$d(t) = 6 + 2.5 \sin(0.5t), \quad 0 \leq t \leq 24,$$

where the argument of the sine function is measured in radians.

- (a) Find the depth of water at $t = 3$. [1]

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- (b) Find the maximum depth of water, and the first time at which it occurs. [3]

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- (c) Find the first time after midnight at which the depth of water is 4.5 m. [2]

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- (d) Find the period of the model and explain what it represents in this context. [2]

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- (e) State one limitation of using this model to describe the depth of water in the harbour. [1]

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END OF EXAMINATION