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Mathematics: applications and interpretation
Higher level
Paper 1

1 May 2024

Zone A afternoon | **Zone B** afternoon | **Zone C** afternoon

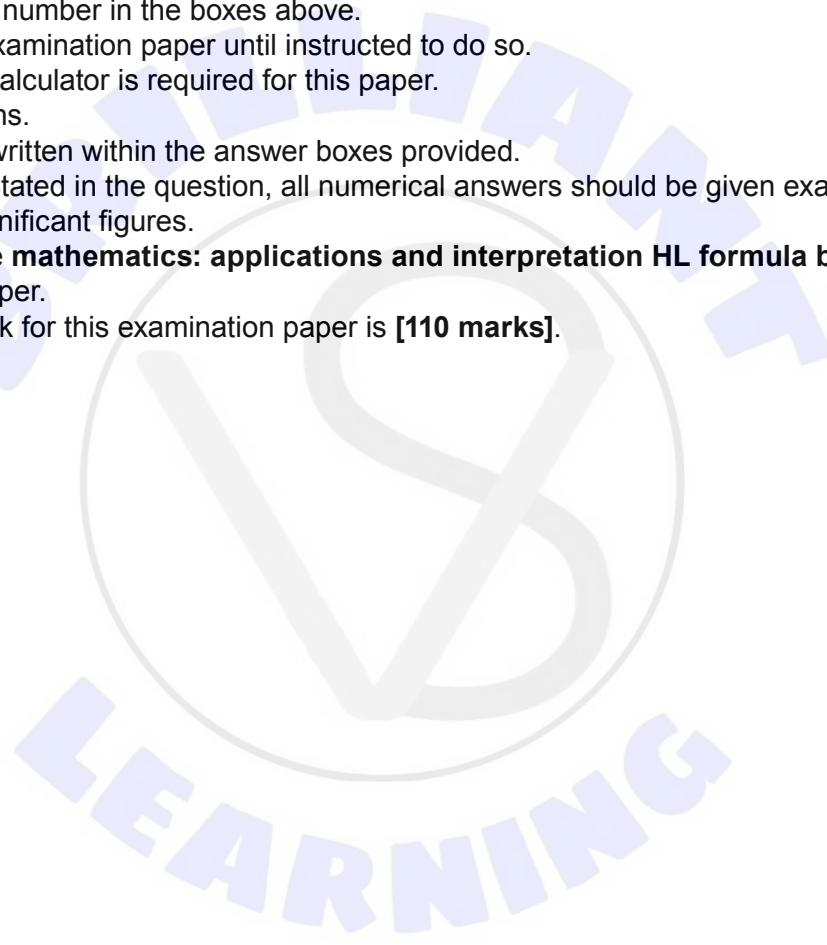
Candidate session number

2 hours

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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 HL formula booklet** is required for this paper.
- The maximum mark for this examination paper is **[110 marks]**.



Answers must be written within the answer boxes provided. Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. Solutions found from a graphic display calculator should be supported by suitable working. For example, if graphs are used to find a solution, you should sketch these as part of your answer. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written working. You are therefore advised to show all working.

1. [Maximum mark: 9]

Imani invests \$3000 in a bank that pays a nominal annual interest rate of 1.25% compounded monthly.

- (a) Calculate the amount of money Imani will have in the bank at the end of 6 years. Give your answer correct to two decimal places. [3]
- (b) Calculate the number of months it takes until Imani has at least \$3550 in the bank. [2]

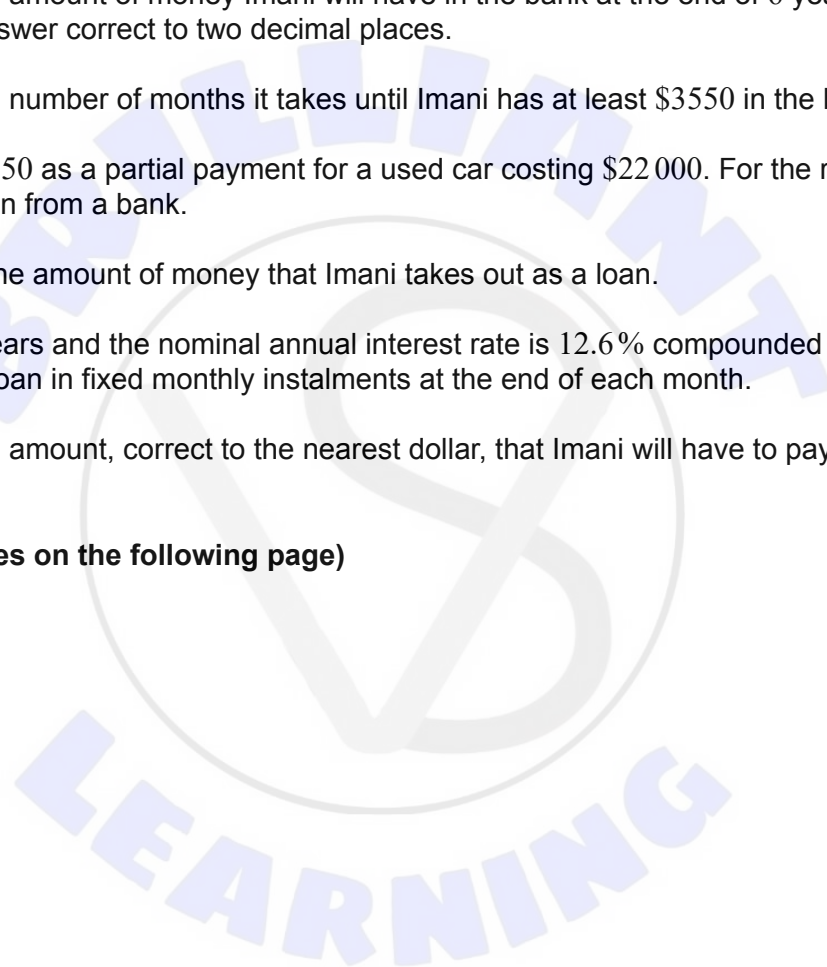
Imani uses the \$3550 as a partial payment for a used car costing \$22 000. For the remainder she takes out a loan from a bank.

- (c) Write down the amount of money that Imani takes out as a loan. [1]

The loan is for 8 years and the nominal annual interest rate is 12.6% compounded monthly. Imani will pay the loan in fixed monthly instalments at the end of each month.

- (d) Calculate the amount, correct to the nearest dollar, that Imani will have to pay the bank each month. [3]

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6. [Maximum mark: 6]

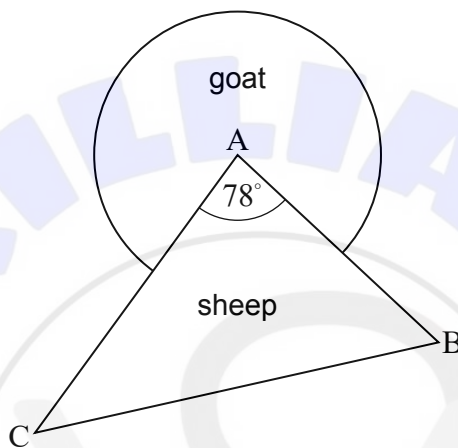
A sheep is in a field in the shape of a triangle, ABC.

AC = 21 metres, AB = 15 metres and $\hat{CAB} = 78^\circ$.

A goat is in an adjacent field in the shape of a sector of a circle with centre, A, and radius 8 metres.

The fields are shown in the diagram.

diagram not to scale



Determine which animal, the sheep or the goat, is in the field with the larger area, and state how many extra square metres are in this larger field.

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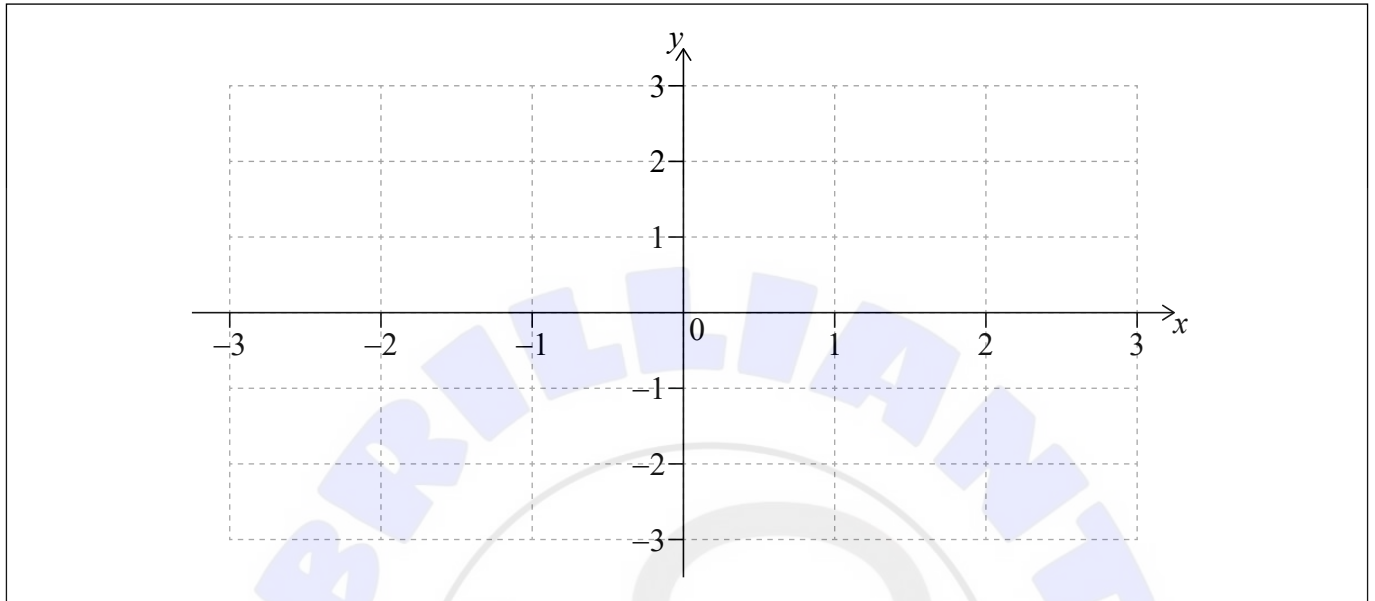


10. [Maximum mark: 9]

Consider the function $f(x) = x\sqrt{3-x^2}$, $-\sqrt{3} \leq x \leq \sqrt{3}$.

(a) Sketch the graph of $y = f(x)$ on the following pair of axes.

[2]



The area between the graph of $y = f(x)$ and the x -axis is rotated through 360° about the x -axis.

(b) (i) Write down an integral that represents this volume.

(ii) Calculate the value of this integral.

[4]

The graph of the function f is transformed, to give the graph of the function g , in the following way:

- It is first stretched by scale factor 2, parallel to the x -axis with the y -axis invariant.
- It is then stretched by scale factor 0.5, parallel to the y -axis with the x -axis invariant.

(c) Find the volume obtained when the area between the graph of $y = g(x)$ and the x -axis is rotated through 360° about the x -axis.

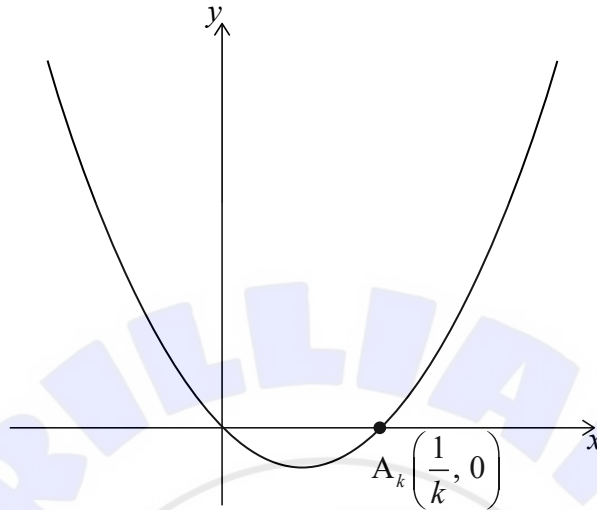
[3]

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11. [Maximum mark: 9]

The diagram shows the curve with equation $y_k = kx^2 - x$, $k > 0$, which intersects the x -axis at the origin and at the point $A_k\left(\frac{1}{k}, 0\right)$.



The normal to the curve at A_k intersects the curve again at point B_k .

(a) Show that the x -coordinate of B_k is $-\frac{1}{k}$. [6]

Consider the case where $k = 2$.

(b) Calculate the finite area of the region between the curve with equation $y_2 = 2x^2 - x$ and the normal at A_2 . [3]

(This question continues on the following page)





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

Answers written on this page
will not be marked.

