



Semester One Examination, 2025

Question/Answer booklet

MATHEMATICS SPECIALIST UNIT 1

Section One: Calculator-free

If required by your examination administrator, please place your student identification label in this box

WA student number: In figures

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In words

Circle your Teacher's Name: Ms Lee Mr Liu Mr Mohammadi Mrs Murray

Time allowed for this section

Reading time before commencing work: five minutes
Working time: fifty minutes

Number of additional
answer booklets used
(if applicable):

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Materials required/recommended for this section

To be provided by the supervisor

This Question/Answer booklet
Formula sheet

To be provided by the candidate

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items: nil

Important note to candidates

No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised material. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

Structure of this paper

Section	Number of questions available	Number of questions to be answered	Working time (minutes)	Marks available	Percentage of examination
Section One: Calculator-free	7	7	50	51	35
Section Two: Calculator-assumed	12	12	100	90	65
Total					100

Instructions to candidates

- The rules for the conduct of examinations are detailed in the school handbook. Sitting this examination implies that you agree to abide by these rules.
- Write your answers in this Question/Answer booklet preferably using a blue/black pen. Do not use erasable or gel pens.
- You must be careful to confine your answers to the specific question asked and to follow any instructions that are specific to a particular question.
- Show all your working clearly. Your working should be in sufficient detail to allow your answers to be checked readily and for marks to be awarded for reasoning. Incorrect answers given without supporting reasoning cannot be allocated any marks. For any question or part question worth more than two marks, valid working or justification is required to receive full marks. If you repeat any question, ensure that you cancel the answer you do not wish to have marked.
- It is recommended that you do not use pencil, except in diagrams.
- Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.
- The Formula sheet is not to be handed in with your Question/Answer booklet.

Markers use only		
Question	Maximum	Mark
1	6	
2	7	
3	9	
4	8	
5	7	
6	7	
7	7	
Section 1 Total	51	
Weighted ($\times 0.7143$)	35%	
Section 2 Weighted	65%	
Total	100%	

Section One: Calculator-free

35% (51 Marks)

This section has **seven** questions. Answer **all** questions. Write your answers in the spaces provided.

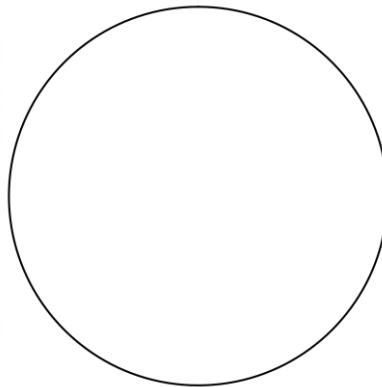
Working time: 50 minutes.

Question 1

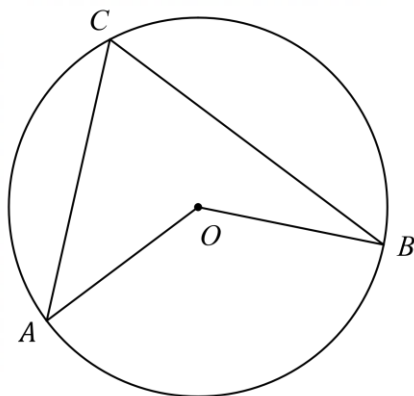
(6 marks)

- (a) Use the circle below to illustrate the alternate segment theorem when one pair of equal angles in alternate segments are clearly obtuse. Label this pair of angles with θ .

(2 marks)



- (b) In the following diagram, points A , B and C lie on the circle with centre O . Assuming only basic axioms and triangle properties, prove that the size of the angle subtended by arc AB from point O is twice the size of the angle subtended by arc AB from C . (4 marks)



Question 2

(7 marks)

- (a) Forces $\vec{F}_1 = \begin{pmatrix} -66 \\ 120 \end{pmatrix}$ newtons, $\vec{F}_2 = \begin{pmatrix} 48 \\ 33 \end{pmatrix}$ newtons and $\vec{F}_3$ are in equilibrium. Determine $\vec{F}_3$.
(2 marks)

- (b) Given that unit vectors $\vec{i}$ and $\vec{j}$ are directed due east and due north respectively, express a velocity of 6 metres per second on a bearing of 120° in exact component form.
(2 marks)

- (c) A particle is moving with constant velocity $\vec{v}$, so that at $t = 3$ it has position vector $\begin{pmatrix} 2.5 \\ -3.5 \end{pmatrix}$ metres and when $t = 13$ it has position vector $\begin{pmatrix} -3.5 \\ 4.5 \end{pmatrix}$ metres, where t is the time in seconds. Determine the speed of the particle.
(3 marks)

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Question 3

(9 marks)

- (a) Consider the statement:

If n is a square number and if n is a multiple of 2, then n is a multiple of 4.

Write down the inverse of this statement.

(1 mark)

- (b) (i) Prove the following statement is false:

(3 marks)

$\exists$ a real number, x , such that $-x^2 + 4x - 5 \geq 0$

- (ii) State the range of values of c for which the following statement is true:

(2 marks)

$\exists$ some real numbers, x , such that $-x^2 + 4x - c \geq 0$

- (c) Prove that, if two even counting numbers differ by four, then their squares differ by a multiple of 16.

(3 marks)

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Question 4**(8 marks)**

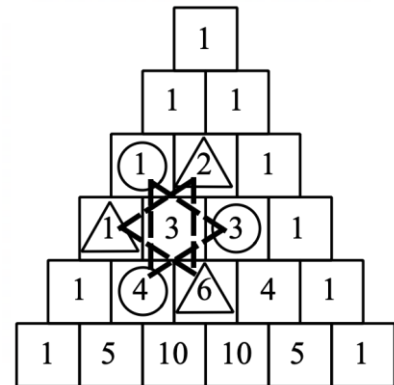
The first six rows of Pascal's triangle are shown on the right.

An example of the 'star' pattern is shown on Pascal's triangle.

In the star pattern we sum the product of the three numbers in the circles, with the product of the three numbers in the triangles, and the number in the middle of the star.

For example, using the highlighted numbers:

$$1 \times 3 \times 4 + 2 \times 1 \times 6 + 3 = 27 = 3^3$$



(a) State the star pattern that gives 125. (2 marks)

(b) (i) Write down an expression in terms of combinations that gives n^3 , where n is defined as row n . (3 marks)

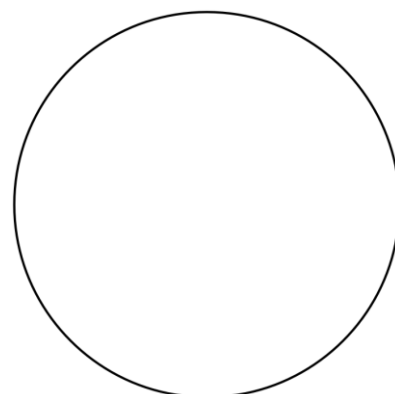
(ii) Prove that your expression in part (b)(i) gives n^3 . (3 marks)

Question 5

(7 marks)

- (a) The vertices of parallelogram $EFGH$ lie in alphabetical order on the circumference of a circle. Sketch a diagram of the parallelogram and show that $\angle EFG = 90^\circ$.

(3 marks)



- (b) Use a vector method to prove that the diagonals OS and RT of parallelogram $ORST$ intersect at right angles if and only if the parallelogram is a rhombus.

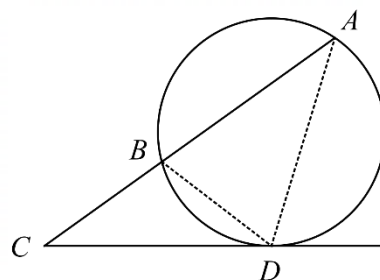
Let $\overrightarrow{OR} = \underline{\underline{r}}$ and $\overrightarrow{OT} = \underline{\underline{t}}$.

(4 marks)

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Question 6**(7 marks)**

In the diagram, a secant meeting the circle at A and B and a tangent meeting the circle at D are drawn to the circle from C .



- (a) Prove that $CD^2 = CA \times CB$.

(3 marks)

- (b) Given that all dimensions are in centimetres, determine as exact values

- (i) the length of CD when $CB = 15$ and $AB = 9$.

(2 marks)

- (ii) the length of AC when $CD = 5$ and $AB = 10$.

(2 marks)

Question 7

(7 marks)

Let $\vec{r} = \begin{pmatrix} -11 \\ -3 \end{pmatrix}$, $\vec{s} = \begin{pmatrix} -15 \\ 5 \end{pmatrix}$ and $\vec{t} = \begin{pmatrix} 4 \\ -4 \end{pmatrix}$.

(a) Determine $\vec{r} + 2\vec{s} + 3\vec{t}$.

(2 marks)

(b) Determine the magnitude of $\vec{s} - \vec{r}$.

(2 marks)

(c) Determine the value of the constant μ and the value of the constant λ when $\vec{r} = \mu\vec{s} + \lambda\vec{t}$.

(3 marks)

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Supplementary page

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