



Rossmoyne Senior High School

Semester One Examination, 2023

Question/Answer booklet

MATHEMATICS SPECIALIST UNIT 1

Section One: Calculator-free

WA student number: In figures

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Circle your teacher:

Ms Chua	Mr Koulianos
Mr Liu	Ms Robinson

In words

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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	50	35
Section Two: Calculator-assumed	12	12	100	91	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	6	
3	7	
4	9	
5	7	
6	8	
7	7	
S1 Total	50	
S1 Wt ($\times 0.7143$)	35%	
S2 Wt	65%	
Total	100%	

Section One: Calculator-free**35% (50 Marks)**

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

Working time: 50 minutes.

Question 1**(6 marks)**

Relative to an origin O , the position vectors of points K, L and M are $\begin{pmatrix} 5 \\ 1 \end{pmatrix}$, $\begin{pmatrix} -1 \\ -7 \end{pmatrix}$ and $\begin{pmatrix} -3 \\ -1 \end{pmatrix}$ respectively.

- (a) Determine $\overrightarrow{LK}$. (1 mark)
- (b) Determine the magnitude of $\overrightarrow{LK}$. (1 mark)
- (c) Determine a vector in the same direction as $\overrightarrow{LK}$ that has the same magnitude as $\overrightarrow{LM}$. Simplify your answer. (4 marks)

Question 2**(6 marks)**

A student, mindful of the fact that a square, rectangle and rhombus are special cases of a parallelogram, wrote the following true statement:

If a quadrilateral is a parallelogram, then opposite angles in the quadrilateral are congruent.

(a) Write the converse of the statement and state whether it is true. (2 marks)

(b) Write the inverse of the statement and state whether it is true. (2 marks)

(c) Write the contrapositive of the statement and state whether it is true. (2 marks)

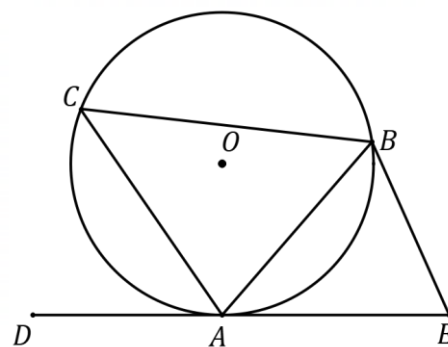
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Question 3

(7 marks)

- (a) In the diagram, DE is tangential to the circle, with centre O , at A and the vertices of triangle ABC lie on the circle as shown.

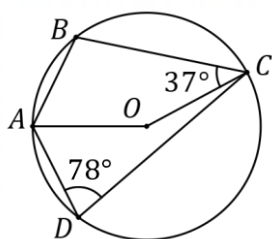
Prove the “angle in the alternate segment theorem”, i.e. that $\angle BAE = \angle BCA$.



(4 marks)

- (b) In the diagram below, A, B, C and D lie on circle with centre O . Determine the size of $\angle OAB$ when $\angle OCB = 37^\circ$ and $\angle ADC = 78^\circ$. Reasons are not required.

(3 marks)



Question 4

(9 marks)

Consider the vectors $\vec{r} = \begin{pmatrix} 5 \\ -8 \end{pmatrix}$, $\vec{s} = \begin{pmatrix} 2 \\ 1 \end{pmatrix}$ and $\vec{t} = \begin{pmatrix} 5 \\ 13 \end{pmatrix}$. Determine

(a) a unit vector in the same direction as $\vec{r} + 8\vec{s}$. (2 marks)

(b) vectors $\vec{a}$ and $\vec{b}$ given that $\vec{r} = \vec{a} - 2\vec{b}$ and $\vec{s} = \vec{a} + \vec{b}$. (3 marks)

(c) the value of the constants λ and μ when $\lambda\vec{r} + \mu\vec{s} = \vec{t}$. (4 marks)

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Question 5**(7 marks)**

(a) The letters of the word MATAMATA are arranged randomly in a line. Determine

(i) the number of different ways this can be done. (2 marks)

(ii) the number of arrangements in which all the A's are grouped together. (2 marks)

(b) A bag consists of 10 blocks, numbered 0 to 9 inclusive.
Show that if someone selects 7 blocks at random, then there are two blocks which will
sum to 10. (3 marks)

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Question 6

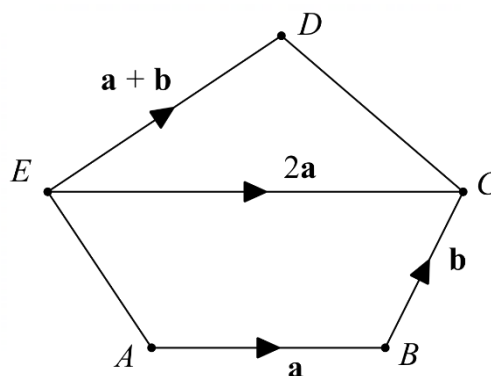
(8 marks)

- (a) Consider parallelogram $OKLM$, so that $\overrightarrow{OK} = \vec{k}$ and $\overrightarrow{OM} = \vec{m}$. Use a vector method to show that when diagonals $\overrightarrow{OL}$ and $\overrightarrow{KM}$ are perpendicular, then the parallelogram is a rhombus.

(4 marks)

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- (b) $ABCDE$ is a pentagon, with $\overrightarrow{AB} = \mathbf{a}$, $\overrightarrow{BC} = \mathbf{b}$, $\overrightarrow{EC} = 2\mathbf{a}$ and $\overrightarrow{ED} = \mathbf{a} + \mathbf{b}$.



- (i) Determine an expression for $\overrightarrow{CD}$ in terms of $\mathbf{a}$ and $\mathbf{b}$. (1 mark)
- (ii) Determine an expression for $\overrightarrow{AE}$ in terms of $\mathbf{a}$ and $\mathbf{b}$. (1 mark)
- (iii) Hence, state **two** geometric facts about the sides CD and AE . (2 marks)

Question 7

(7 marks)

(a) Vectors $\vec{m}$ and $\vec{n}$ have magnitudes 3 and 5 respectively, and $\vec{m} \cdot \vec{n} = -4$. Evaluate

(i) $(6\vec{m}) \cdot \left(\frac{1}{3}\vec{n}\right)$. (1 mark)

(ii) $(2\vec{m} - \vec{n}) \cdot (\vec{m} - 3\vec{n})$. (3 marks)

(b) The vector projection of $\begin{pmatrix} 5 \\ m \end{pmatrix}$ on $\begin{pmatrix} -2 \\ 2 \end{pmatrix}$ is $\begin{pmatrix} 6 \\ -6 \end{pmatrix}$. Determine the value of the constant m . (3 marks)

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Supplementary page

Question number: _____

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