



Rossmoyne Senior High School

Semester One Examination, 2022

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

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Circle your Teacher's Name:

Mrs Alvaro

Mr Gibbon

Ms Robinson

Mr Tan

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	5	
3	8	
4	7	
5	8	
6	8	
7	8	
S1 Total	50	
S1 Wt ($\times 0.7$)	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)**

C_1 and C_2 are chords in the same circle. Let P be the statement 'chords C_1 and C_2 have equal lengths' and Q be the statement 'chords C_1 and C_2 subtend equal angles at the centre'.

- (a) Write, in words, the negation of P . (1 mark)
- (b) Write, in words, the meaning of $P \Rightarrow Q$. (1 mark)
- (c) Write, symbolically, the converse of $P \Rightarrow Q$. (1 mark)
- (d) Write, in any form, the inverse of $P \Rightarrow Q$. (1 mark)
- (e) Write, in any form, the contrapositive of $P \Rightarrow Q$ and state, with justification, whether the contrapositive is true. (2 marks)

Question 2**(5 marks)**

Use the inclusion-exclusion principle to determine how many integers between 1 and 181 inclusive are divisible by 3, 5 or 10.

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Question 3

(8 marks)

Let $\mathbf{a} = \begin{pmatrix} 7 \\ 2 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 2 \\ 4 \end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix} -1 \\ 2 \end{pmatrix}$.

(a) Determine

(i) $2\mathbf{a} + 3\mathbf{c}$.

(2 marks)

(ii) $|\mathbf{b} - \mathbf{a}|$.

(2 marks)

(b) Given that $\mathbf{a} = \lambda\mathbf{b} + \mu\mathbf{c}$, determine the value of the constant λ and the value of the constant μ . (4 marks)

Question 4

(7 marks)

Two vectors are $\mathbf{a} = 6\mathbf{i} + 8\mathbf{j}$ and $\mathbf{b} = 3\mathbf{i} - \mathbf{j}$.

(a) Determine the vector projection of $\mathbf{a}$ on $\mathbf{b}$.

(3 marks)

(b) Vector $\mathbf{c} = x\mathbf{i} + y\mathbf{j}$ has the same magnitude as $\mathbf{a}$ and is perpendicular to $\mathbf{b}$. Determine the values of the constants x and y . (4 marks)

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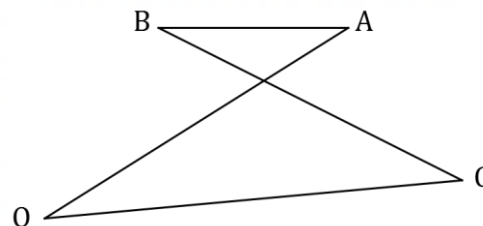
Question 5

(8 marks)

Crossed quadrilateral $OABC$ is shown in the diagram.

The midpoints of sides OA, AB, BC and CO are P, Q, R and S respectively.

Let $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$ and $\overrightarrow{OC} = \mathbf{c}$.



(a) Draw quadrilateral $PQRS$ on the diagram. (1 mark)

(b) Determine expressions for $\overrightarrow{OP}$, $\overrightarrow{OQ}$, $\overrightarrow{OR}$ and $\overrightarrow{OS}$ in terms of $\mathbf{a}$, $\mathbf{b}$ and $\mathbf{c}$. (3 marks)

(c) Prove that the midpoints of the sides of a crossed quadrilateral join to form a parallelogram. (4 marks)

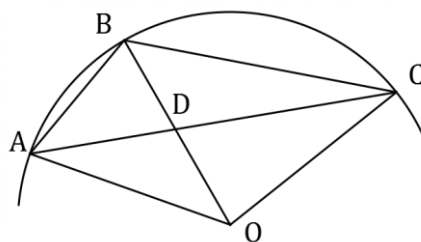
Question 6

(8 marks)

- (a) Points A, B and C lie on an arc of a circle with centre O as shown at right.

Chord AC intersects OB at point D .

The diagram is not drawn to scale.



When $\angle ABC = 128^\circ$ and $\angle BAC = 28^\circ$, determine the size of $\angle ADB$.

(4 marks)

- (b) A secant cuts a circle with centre O at points A and B . Secant AB is extended beyond B to point P , where it meets a line that is a tangent to the circle at point C . Prove that the size of $\angle CPB$ is equal to one half the difference of the sizes of $\angle AOC$ and $\angle BOC$. (4 marks)

Question 7

(8 marks)

- (a) Determine all vectors $\mathbf{u}$ that meet the following two conditions:

(3 marks)

$$(3\mathbf{i} + 4\mathbf{j}) \cdot \mathbf{u} = 0 \quad \text{and} \quad \mathbf{u} \cdot \mathbf{u} = 1$$

- (b) $ABCD$ is a parallelogram and M is the midpoint of DC . Diagonal DB intersects AM at Q so that $\overrightarrow{AQ} = h\overrightarrow{AM}$ and $\overrightarrow{DQ} = k\overrightarrow{DB}$. Use a vector method to determine the value of the constant h and the value of the constant k . **(5 marks)**

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Supplementary page

Question number: _____

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