



Rossmoyne Senior High School

Semester One Examination, 2021

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

--	--	--	--	--	--	--	--	--

Circle your Teacher's Name:

Mrs Alvaro

Mr Koulianos

Mr Tanday

Your name

Time allowed for this section

Reading time before commencing work: five minutes

Working time: fifty minutes

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	8	8	50	50	35
Section Two: Calculator-assumed	13	13	100	92	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	5	
2	6	
3	4	
4	6	
5	6	
6	8	
7	8	
8	7	
S1 Total	50	
S1 Wt ($\times 0.7$)	35%	
S2 Wt	65%	
Total	100%	

Section One: Calculator-free

35% (50 Marks)

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

Working time: 50 minutes.

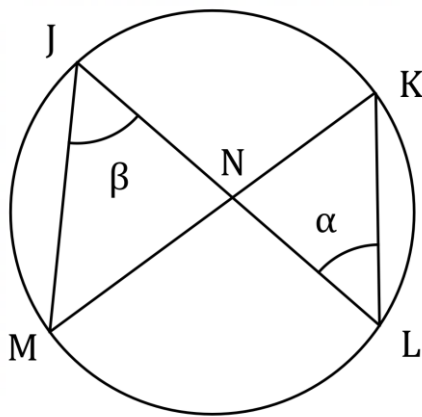
Question 1

(5 marks)

- (a) In the circle shown, chords JL and KM intersect at N , $\angle JMN = 42^\circ$ and $\angle JNK = 97^\circ$.

Determine the size of angles α and β .

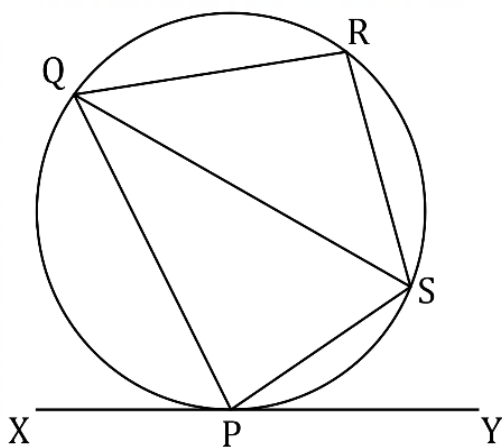
(2 marks)



- (b) In the circle below, $PQRS$ is a cyclic quadrilateral and XY is a tangent to the circle at P .

Given that $\angle SPY = 38^\circ$ and $\angle QSP = 55^\circ$, determine the size of $\angle QRS$.

(3 marks)



Question 2

(6 marks)

Let $\mathbf{a} = 2\mathbf{i} - 4\mathbf{j}$ and $\mathbf{b} = \mathbf{i} + 3\mathbf{j}$.

(a) Determine $|3\mathbf{a} + 2\mathbf{b}|$.

(3 marks)

(b) Determine the vectors $\mathbf{p}$ and $\mathbf{q}$ given that $2\mathbf{a} - 3\mathbf{b} = \mathbf{p} - \mathbf{q}$ and $\mathbf{a} + \mathbf{b} = \mathbf{q} - 3\mathbf{p}$.

(3 marks)

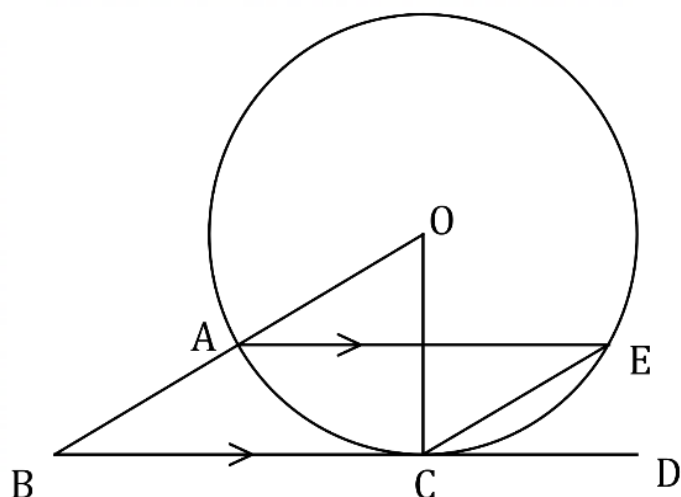
Question 3

(4 marks)

In the diagram, BD is a tangent at C to the circle with centre O , OB intersects the circle at A and chord AE is parallel to tangent BD .

Determine the size of $\angle ECD$ when the size of $\angle ABC = 38^\circ$.

Justify your answer.



DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

Question 4**(6 marks)**

If there are a objects and b boxes, then the Pigeonhole principle says:

“If $a > b$, then at least one box must contain more than one object”

(a) Write the contrapositive of this statement. **(2 marks)**

(b) (i) Prove that in any set of 6 distinct integers, it is possible to choose two of the integers such that their difference is divisible by 5. **(2 marks)**

(ii) Show that if eight of the first ten positive integers are selected at random, the selection contains at least three pairs whose sum is 11. **(2 marks)**

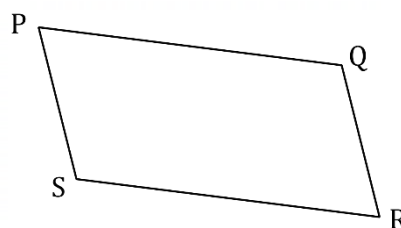
DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

Question 5

(6 marks)

The diagram shows parallelogram $PQRS$.

A theorem states that the sum of the squares of the lengths of the diagonals of a parallelogram is equal to the sum of the squares of the lengths of its sides.



- (a) Complete the following expression of the theorem using vector notation:

(1 mark)

$$|\overrightarrow{PR}|^2 + |\overrightarrow{QS}|^2 =$$

- (b) Letting $\overrightarrow{PQ} = \mathbf{q}$ and $\overrightarrow{PS} = \mathbf{s}$, use a vector method to prove the theorem.

(5 marks)

Question 6

(8 marks)

- (a) Determine the vector(s) that are parallel to $3\mathbf{i} - 4\mathbf{j}$ and have the same magnitude as $\mathbf{i} + 7\mathbf{j}$. (4 marks)

- (b) Two vectors are $4\mathbf{i} + (1 - \mu)\mathbf{j}$ and $\mathbf{i} + (2\mu + 5)\mathbf{j}$, where μ is a constant. Determine the value(s) of μ so that the vectors are perpendicular. (4 marks)

Question 7

(8 marks)

(a) Show that $4 \binom{5}{1} = 2 \binom{5}{2}$, that is $4 \times {}^5C_1 = 2 \times {}^5C_2$ (2 marks)

(b) Show that $(n - r) \binom{n}{r} = (r + 1) \binom{n}{r + 1}$ for all n and r that are positive integers, $n > r$. (4 marks)

(c) Hence, or otherwise, evaluate $\binom{65}{59}$, given that $\binom{65}{60} = 8\,259\,888$. (2 marks)

DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

Question 8**(7 marks)**

Points P , Q and R have position vectors $\langle 0, 5 \rangle$, $\langle -6, -5 \rangle$ and $\langle 10, -1 \rangle$ respectively.

(a) Determine the position vector of M , the midpoint of Q and R . (1 mark)

(b) Determine the vectors $\overrightarrow{QR}$ and $\overrightarrow{PM}$. (1 mark)

(c) Show that $\overrightarrow{QR}$ and $\overrightarrow{PM}$ are perpendicular. (2 marks)

(d) Hence, or otherwise, determine the area of triangle PQR . (3 marks)

DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

Supplementary page

Question number: _____

DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

