

Rossmoyne Senior High School



Semester One Examination, 2018

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

Student Name: _____

Teacher's 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	54	36
Section Two: Calculator-assumed	13	13	100	97	64
Total					100

Instructions to candidates

1. 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.
2. Write your answers in this Question/Answer booklet.
3. You must be careful to confine your response to the specific question asked and to follow any instructions that are specified to a particular question.
4. Supplementary pages for the use of planning/continuing your answer to a question have been 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.
5. 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.
6. It is recommended that you do not use pencil, except in diagrams.
7. The Formula sheet is not to be handed in with your Question/Answer booklet.

Section One: Calculator-free**36% (54 Marks)**

This section has **eight (8)** questions. Answer **all** questions. Write your answers in the spaces provided.

Working time: 50 minutes.

Question 1**(5 marks)**

Relative to the origin O , points A and B have position vectors $-2\mathbf{i} - 3\mathbf{j}$ and $\mathbf{i} - 6\mathbf{j}$ respectively.

(a) Determine the unit vector $\hat{\mathbf{c}}$, where $\mathbf{c} = \overrightarrow{AB}$. (3 marks)

(b) Vector $\mathbf{d}$ has magnitude $4\sqrt{2}$, is parallel to $\mathbf{c}$ and in the opposite direction. Determine $\mathbf{d}$. (2 marks)

Question 2**(5 marks)**

Let the displacement vectors **a**, **b** and **c** be $(11, -4)$, $(5, 14)$ and $(8, m)$ respectively, where m is a real number.

(a) Determine the vector $3\mathbf{a} + 2\mathbf{b}$. (2 marks)

(b) Given that $|\mathbf{a} + \mathbf{b} + k\mathbf{c}| = 0$, determine the values of k and m . (3 marks)

Question 3**(8 marks)**

Consider the following:

If a polygon has an interior angle sum of 360° , then it is a square.

- (a) Use a **counter-example** to explain why the statement is false. (2 marks)
- (b) Write the **converse** statement and state whether it is always, sometimes or never true. (2 marks)
- (c) Write the **inverse** statement and state whether it is always, sometimes or never true. (2 marks)
- (d) Write the **contrapositive** statement and state whether it is always, sometimes or never true. (2 marks)

Question 4

(6 marks)

- (a) Determine the value of the constant n , given that the vectors $5\mathbf{i} + 3\mathbf{j}$ and $-8\mathbf{i} + n\mathbf{j}$ are perpendicular. (2 marks)

- (b) The vectors $\mathbf{a}$ and $\mathbf{b}$ are such that $|\mathbf{a}| = 17$, $|\mathbf{b}| = 13$ and $\mathbf{a} \cdot \mathbf{b} = -21$. Evaluate

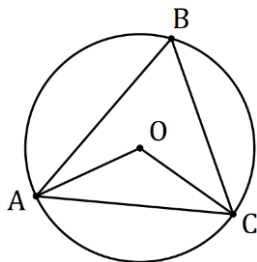
(i) $-2\mathbf{a} \cdot 5\mathbf{b}$. (1 mark)

(ii) $(\mathbf{b} + \mathbf{a}) \cdot (\mathbf{a} - \mathbf{b})$. (3 marks)

Question 5

(8 marks)

- (a) In the diagram below, the vertices of triangle ABC lie on a circle with centre O . Given that $\angle ABC = 54^\circ$, determine the values of $\angle AOC$ and $\angle OAC$. (2 marks)



- (b) Prove that the size of the angle subtended by an arc at the centre of a circle is twice the size of the angle subtended at any point on the circumference by the same arc. Assume only basic axioms and properties of triangles can be used. (6 marks)

Question 6**(6 marks)**

A drone leaves point P and travels 74 m on bearing of 290° to Q , then 40 m on bearing 020° to R and finally 114 m on bearing 110° to S .

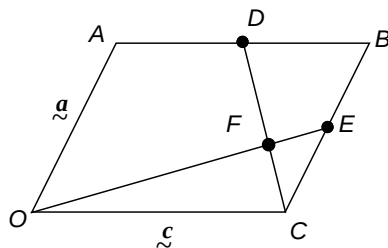
- (a) Sketch a neat diagram to show the path of the drone. (2 marks)

- (b) The drone is to return directly from S to P . Determine the distance it must fly and on what bearing. (4 marks)

Question 7

(7 marks)

A parallelogram OABC has D the midpoint of AB, E the midpoint of BC and DC intersecting OE at F. Let $\vec{OA} = \vec{a}$ and $\vec{OC} = \vec{c}$.



a) Determine the following in terms of $\vec{a}$ and $\vec{c}$:

(2 marks)

i. $\vec{OE}$

ii. $\vec{DC}$

b) By letting $\vec{DF} = h\vec{DC}$ and $\vec{OF} = k\vec{OE}$, show that $h = \frac{3}{5}$ and $k = \frac{4}{5}$.

(5 marks)

Question 8

(9 marks)

(a) Evaluate ${}^{25}P_{19} \div {}^{23}P_{20}$.

(3 marks)

(b) Express $8! + 7! + 6!$ in the form $a^2b!$, where a and b are positive integers.

(3 marks)

(c) Show that for $n \in \mathbb{Z}, n \geq 1$, the sum $(n+2)! + (n+1)! + n!$ can always be expressed in the form $a^2b!$ where a and b are positive integers.

(3 marks)

Supplementary page

Question number: _____

