



Applecross Senior High School
Western Australian Certificate of Education
Semester One Examination, 2015

Question/Answer Booklet

**MATHEMATICS:
SPECIALIST
UNIT 1**

**Section One:
Calculator- free**

	Total	Result	
Section One	52		
Section Two	98		
Total	150		

_____%

Student's Name: _____
As shown on your exam timetable

Student's Teacher
(Circle your teacher's name.)

Mr Bellis

Mrs Waddell

Time allowed for this section

Reading time before commencing work: five minutes
Working time for this section: 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 unauthorized notes or other items of a non-personal nature in the examination room. If you have any unauthorized material with you, hand it to the supervisor **before** reading any further.

Section	Number of questions available	Number of questions to be answered	Working time (minutes)	Marks available	Percentage of exam
Section One: Calculator-free	7	7	50	52	35
Section Two: Calculator-assumed	13	13	100	98	65
Total				150	100

Instructions to candidates

- The rules for the conduct of examinations are detailed in the *School Examination Rules* provided with your exam timetable. Sitting this examination implies that you agree to abide by these rules.
- Write your answers in this Question/Answer Booklet.
- You must be careful to confine your responses to the specific questions asked and to follow any instructions that are specific to a particular question.
- Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.
 - Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
 - Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question(s) that you are continuing to answer at the top of the page.
- 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 an answer to 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.
- The formula sheet and your notes are **not to be handed** in with your Question/Answer Booklet.

Section One: Calculator-free

(52 Marks)

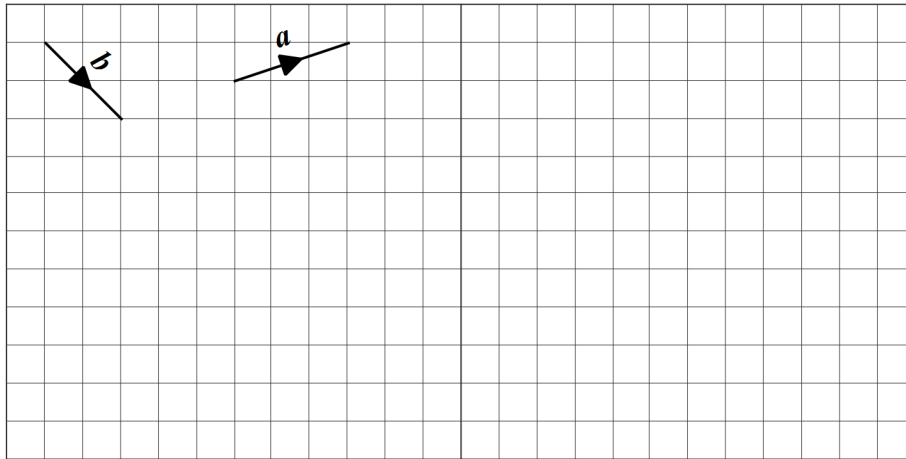
This section has **seven (7)** questions. Answer **all** questions. Write your answers in the spaces provided.

Working time for this section is 50 minutes.

Question 1

(7 marks)

- (a) Two vectors, **a** and **b** are shown on the grid below.



Draw and label the vectors **c** and **d** on the grid, where $c = a + 2b$ and $d = b - 3a$.

(2 marks)

- (b) Determine a unit vector perpendicular to the vector $8\mathbf{i} - 6\mathbf{j}$.

(2 marks)

- (c) The point P divides the line segment from M(-3, 3) to N(13, -9) in the ratio 1:3. Determine the position vector of point P.

(3 marks)

DO NOT WRITE IN THIS SECTION AS IT WILL BE CUT OFF.

Question 2**(6 marks)**

The statement '***If two rectangles are congruent then they have the same area.***' is true.

- (a) Write the inverse of the statement and explain whether or not the inverse is also true.
(2 marks)

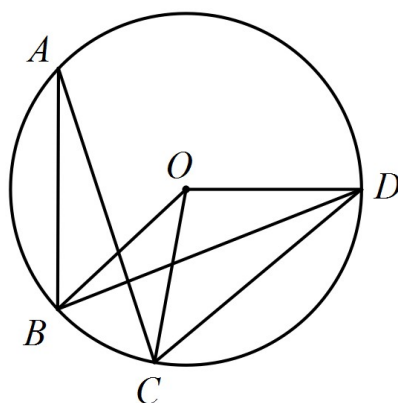
- (b) Write the contrapositive of the statement and explain whether or not the contrapositive is also true.
(2 marks)

- (c) Write the converse of the statement and explain whether or not the converse is also true.
(2 marks)

Question 3

(6 marks)

- (a) In the diagram below, $\angle OBD = 25^\circ$ and $\angle OCD = 40^\circ$.



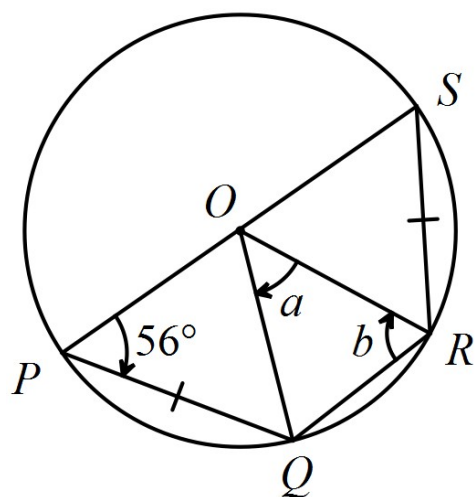
Determine the sizes of

(i) $\angle BDC$. (1 mark)

(ii) $\angle BOC$. (1 mark)

(iii) $\angle CAB$. (1 mark)

- (b) Determine the sizes of the angles marked a and b in the diagram below. Show your reasoning on the diagram. (3 marks)



DO NOT WRITE IN THIS SECTION AS IT WILL BE CUT OFF.

Question 4

(8 marks)

- (a) Simplify $\frac{28! \times 7!}{10! \times 26!}$. (2 marks)

- (b) Prove that ${}^nP_r = n \times {}^{n-1}P_{r-1}$. (3 marks)

DO NOT WRITE IN THIS SECTION AS IT WILL BE CUT OFF.

(c) Use the result ${}^nP_r = n \times {}^{n-1}P_{r-1}$ to determine:

(i) 9P_5 given that ${}^{10}P_6 = 151200$ (1 mark)

(ii) ${}^{11}P_5$, given that ${}^9P_3 = 504$ (2 marks)

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Question 5**(9 marks)**

The vectors \mathbf{a} and \mathbf{b} are given by $\mathbf{a} = (5, 12)$ and $\mathbf{b} = (2, -1)$.

(a) Determine

(i) $\mathbf{a} - 3\mathbf{b}$. (1 mark)

(ii) $|\mathbf{a}| \times |\mathbf{b}|$. (1 mark)

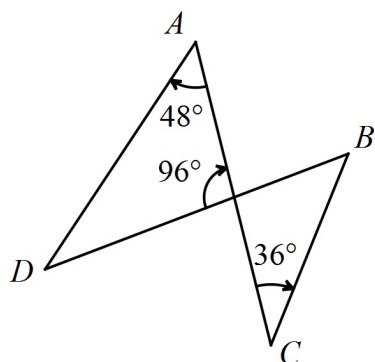
(iii) the vector projection of \mathbf{a} onto \mathbf{b} . (3 marks)

(b) Determine the vectors \mathbf{c} and \mathbf{d} if $2\mathbf{c} - 3\mathbf{d} = \mathbf{a}$ and $\mathbf{c} - 2\mathbf{d} = 2\mathbf{b}$. (4 marks)

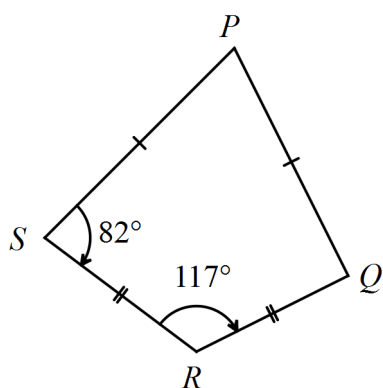
Question 6

(7 marks)

- (a) Prove that it is possible to draw a circle through the points A , B , C and D shown below. (Assume A and B are on a circle and show that C and D must also be on the same circle.) (3 marks)



- (b) Prove by contradiction that it is impossible to draw a circle through the vertices of the quadrilateral shown below. (4 marks)



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Question 7**(9 marks)**

- (a) A bag contains 17 identical cubes except for their 3 different colours. There are four coloured orange, six coloured blue and seven coloured white.
- (i) How many different arrangements of coloured cubes are possible when three cubes are drawn from the bag and placed in a line? (1 mark)
- (ii) How many different combinations of coloured cubes are possible when three cubes are drawn from the bag? (3 marks)
- (iii) Determine the least number of cubes that should be removed from the bag to ensure that the resulting selection contains at least three cubes of one colour. Justify your answer. (2 marks)
- (b) Find the number of different integers you need to select from the set $\{1, 2, 3, \dots, 98, 99, 100\}$ so that there is at least one pair of integers with a sum of 99. (3 marks)

Additional working space.

Question Number: _____

DO NOT WRITE IN THIS SECTION AS IT WILL BE CUT OFF.

Additional working space.

Question Number: _____

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