Insert School Logo

Semester One Examination 2018

Question/Answer Booklet

MATHEMATICS SPECIALIST
UNIT 1

Section One:
Calculator-free

Student Name: _____

Teacher's Name: _____

Time allowed for this section

Reading time before commencing work: five minutes
Working time for paper: fifty minutes

Material 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 tape/fluid, erasers, 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 notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

Structure of this paper

	Number of questions available	Number of questions to be attempted	Suggested working time (minutes)	Marks available
Section One Calculator—free	**7**	**7**	**50 minutes**	**50**
Section Two Calculator—assumed	12	12	100 minutes	100
				150

Instructions to candidates

1. The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2018.* Sitting this examination implies that you agree to abide by these rules.

2. Answer the questions according to the following instructions.

   Section One: Write answers in this Question/Answer Booklet. Answer **all** questions.

   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.

3. 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.

4. 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 that you are continuing to answer at the top of the page.

5. The Formula Sheet is **not** handed in with your Question/Answer Booklet.

See next page

Section One: Calculator–free 50 marks

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

Working time: 50 minutes

Question 1 (6 marks)

Points A and B have position vectors $a = 2i + j$ and $b = i + 3j$ respectively.

(a) Show that a is perpendicular to $b - a$. (3 marks)

(b) Given that OABC is a square, with O as the origin, state:

(i) the position vector of vertex C. (1 mark)

(ii) $\left|\overrightarrow{AC}\right|$ (2 marks)

Question 2 (8 marks)

(a) Evaluate each of the following.

(i) $\dfrac{13!+12!}{13!-12!}$ (2 marks)

(ii) $\dfrac{{}^{10}C_4}{{}^{8}C_4}$ (2 marks)

(b) Show that $k\binom{n}{k}=n\binom{n-1}{k-1}$ is true for all integers n, k with $n>k$. (4 marks)

See next page

Question 3 (7 marks)

Consider the following statements.

A: If $m>n$, with $m, n \in R$, then $m^2>n^2$.

B: If the triangle has three equal angles, then the triangle is equilateral.

C: $\forall\ p \in N, \exists q \in R$ such that $q=\sqrt{p}$

D: If n is divisible by 6, then n is divisible by 3.

(a) Provide a counter example for statement A. (1 mark)

(b) Write down the contrapositive of statement B.
Is the contrapositive always true? Explain. (2 marks)

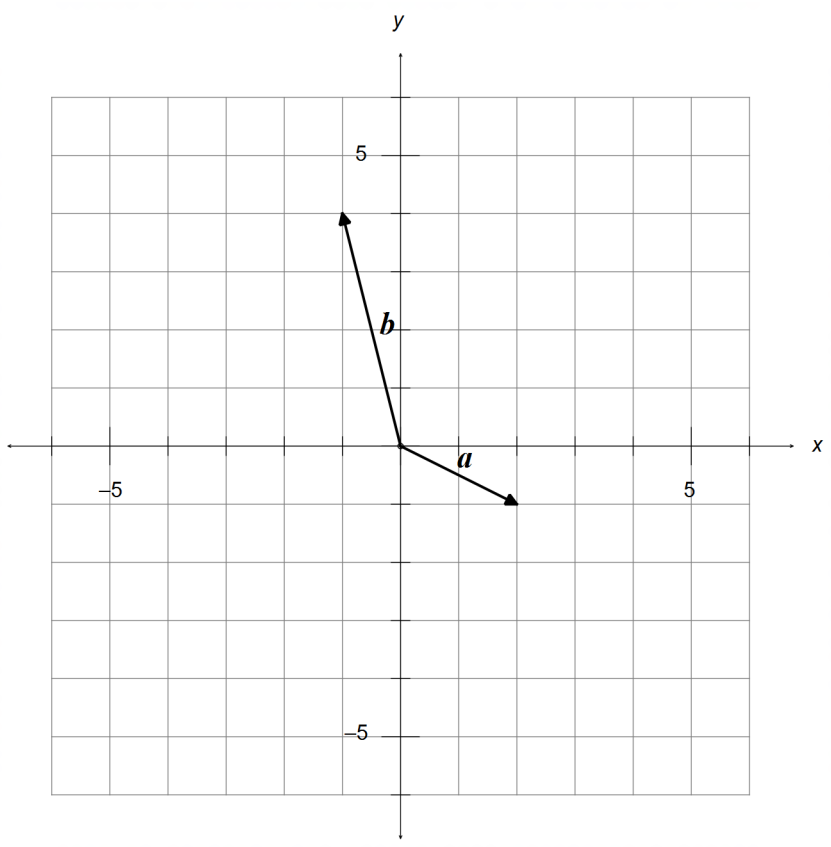
(c) Write down the converse of statement D.
Is the converse always true? Explain. (2 marks)

(d) Rewrite statement C in words. (2 marks)

See next page

Question 4 (10 marks)

Consider the vectors a and b shown below.



(a) Find a vector u that is parallel to $a+b$ with a magnitude of $2\sqrt{10}$ units.
Sketch u on the same grid above. (4 marks)

Question 4 – Continued

Vector $c=\begin{pmatrix}-4\\ \alpha\end{pmatrix}$ where $\alpha \in R$.

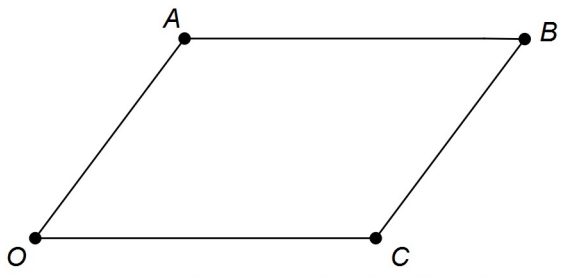
(b) Find α given that:

(i) a and c are parallel. (2 marks)

(ii) $|c-b|=3|a|$ (4 marks)

Question 5 (7 marks)

The diagram shows parallelogram OABC.
Let: $\overrightarrow{OA} = a$ and $\overrightarrow{OC} = c$.



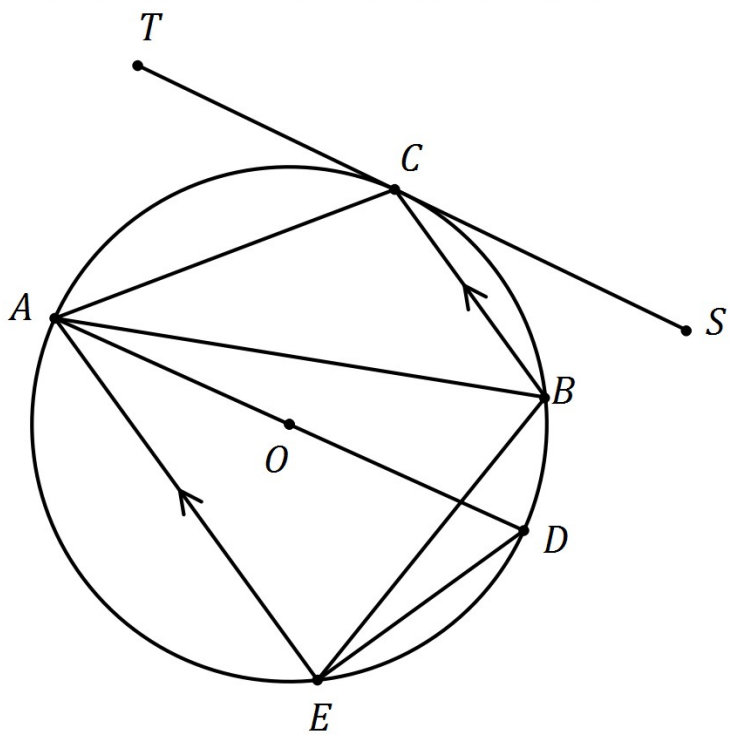
(a) Use the fact that AC and OB are perpendicular to prove that OABC is a rhombus. (3 marks)

(b) Show 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 the sides. (4 marks)

See next page

Question 6 (8 marks)

Consider the circle shown below with centre at O and diameter AD, with TS tangent to the circle at C. Points B and E lie on the circumference with EA parallel to BC, ∠ADE = 60° and ∠ABC = 40°.



Determine the size of the following angles giving reason(s) to justify your answer.

(a) ∠AED (2 marks)

(b) ∠ABE (2 marks)

(c) ∠CAE (2 marks)

(d) ∠TCE (2 marks)

See next page

Question 7 (4 marks)

Points A, B and C have position vectors $a = xi - j$, $b = i + 3j$ and $c = 4i + yj$ respectively, where $x, y \in R$.

Given that AB:BC = 2:1, determine the value(s) of x and y. (4 marks)

End of Section One

Additional working space

Question number(s): ……

Additional working space

Question number(s): ……