MATHEMATICS SPECIALIST
UNIT 1
Section One:
Calculator-free

Your Name_____

Your 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.

Question	Mark	Max	Question	Mark	Max
1		5	5		8
2		7	6		8
3		7	7		5
4		10			

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	33
Section Two: Calculator-assumed	11	11	100	100	67
				Total	100

Instructions to candidates

1. The rules for the conduct of the Western Australian Certificate of Education ATAR course examinations are detailed in the *Year 11 Information Handbook 2021*. 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 answers to the specific questions asked and to follow any instructions that are specific to a particular question.

4. Additional pages for the use of planning your answer to a question or continuing your answer to a question have been provided at the end of this Question/Answer booklet. If you use the space to continue an answer, indicate in the original answer space 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 **(50 Marks)**

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

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.

Working time: 50 minutes.

Question 1 {1.1.3, 1.1.8} **(5 marks)**

(a) Simplify $^{n+3}C_{n+1}$ (2 marks)

(b) Find the value of n, if $9 \times {}^{n}P_3 = 10 \times {}^{n-1}P_3$ (3 marks)

Question 2 {1.3.1, 2.3.1}   **(7 marks)**

(a) Complete the table below.   (3 marks)

Statement	If $x = 4$, then $x^2 = 16$.	True
Inverse of Statement		
Converse of Statement		
Contrapositive of Statement		

(b) Let $n \in Z$, prove that if $n + 2$ is even, then $n - 1$ is odd.   (4 marks)

Question 3 {1.2.2, 1.2.3, 1.2.5}   **(7 marks)**

Vector $\begin{bmatrix} a \\ a + b \end{bmatrix}$ has a magnitude of 10 and is parallel to vector $\begin{bmatrix} 2 \\ 4 \end{bmatrix}$. Find all possible values of a and b.

Question 4 {1.2.6, 1.2.7, 1.2.8, 1.2.9} **(10 marks)**

Given the vectors $\boldsymbol{p} = 10\boldsymbol{i} + 6\boldsymbol{j}$, $\boldsymbol{q} = 4\boldsymbol{i} + x\boldsymbol{j}$, $\boldsymbol{r} = \frac{2}{3}\boldsymbol{i} + y\boldsymbol{j}$ and $\boldsymbol{s} = -11\boldsymbol{i} - z\boldsymbol{j}$, find the exact values of x, y and z for which:

(a) $\boldsymbol{p} + \boldsymbol{q}$ is parallel to $\boldsymbol{p} - \boldsymbol{q}$, (3 marks)

(b) $\boldsymbol{r}$ is a unit vector, (3 marks)

(c) the resultant of $\boldsymbol{p}$ and $\boldsymbol{s}$ has magnitude 5 units. (4 marks)

Question 5 {1.3.6, 1.3.7, 1.3.8, 1.3.9}   **(8 marks)**

Point O is the centre of the circle below. Given A, B, C, D are points on the circle, $\angle AOB = 60°$ and $\angle CBD = 70°$, complete the table below.
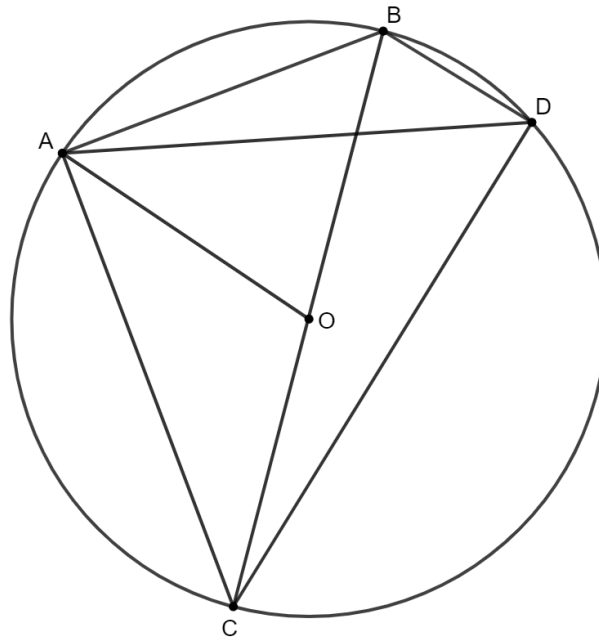
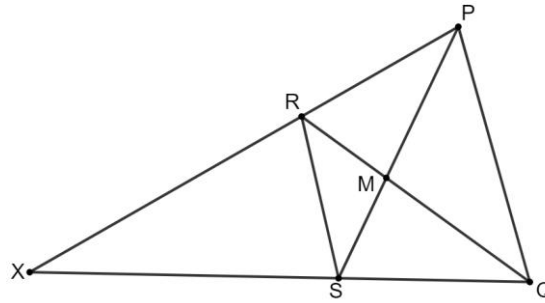| Angle	Size	Reason
$\angle BCD$		
$\angle ADB$		
$\angle ACD$		
$\angle ABD$		

Question 6 {1.3.10, 1.3.12}   **(8 marks)**

In $\triangle XPQ$ (diagram is not drawn to scale), R and S are points on XP and XQ, respectively. PS and QR intersects at M. Given that $\angle PMR = 100°$, $\angle XPS = 20°$ and $\angle PSQ = 60°$,
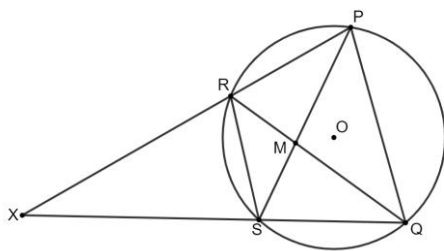

(a) Prove that $XP \cdot XR = XQ \cdot XS$.   (5 marks)

(b) Part (a) implies that P, Q, S and R lie on a circle where point O is the centre of the circle. Given that $PR = QS$, prove that $PQ \parallel RS$.   (3 marks)

Question 7 {1.3.2} **(5 marks)**

Suppose that a and b are positive integers such that $\sqrt{a}$ is irrational. Use the method of 'proof by contradiction' to prove that $\left(\sqrt{a} + b\right)^2$ is not an integer.

Additional working space

Question number: _____

Additional working space

Question number: _____

Additional working space

Question number: _____