Insert School Logo

Semester One
Examination 2020
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	Working time (minutes)	Marks available	Percentage of exam
Section One Calculator—free	**6**	**6**	**50**	**50**	**35**
Section Two Calculator—assumed	12	12	100	100	65
				Total marks	100

Instructions to candidates

1. The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2020.* Sitting this examination implies that you agree to abide by these rules.

2. Answer the questions according to the following instructions.

   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 35% (50 marks)

This section has **six (6)** questions. Attempt **all** questions. Write your answers in the spaces provided.

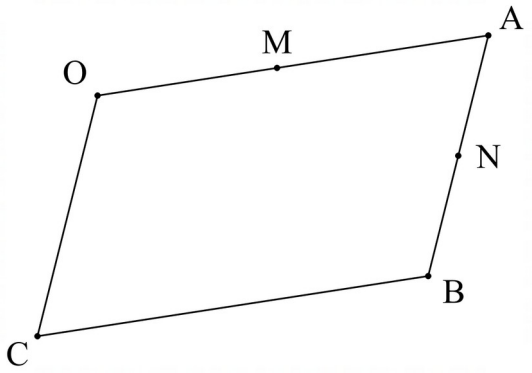
Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

- 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(s) that you are continuing to answer at the top of the page.

Working time: 50 minutes

Question 1 (5 marks)

(a) The diagram shows parallelogram OABC with M and N as the midpoints of line segments $\overline{OA}$ and $\overline{AB}$ respectively.

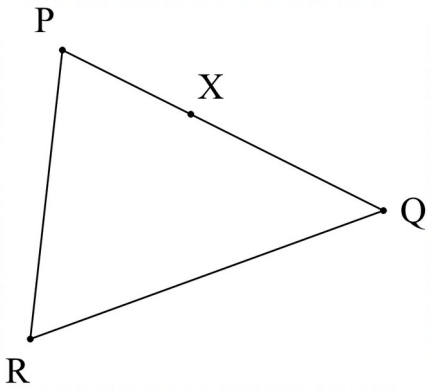


If $\overrightarrow{OA} = a$ and $\overrightarrow{AB} = b$, then express each of the following in terms of **a** and **b.** (2 marks)

(i) $\overrightarrow{CO}=$¿

(ii) $\overrightarrow{MB}=$¿

(b) In ΔPQR shown, X divides PQ in the ratio 2 : 5.
If $\overrightarrow{QR} = a$ and $\overrightarrow{PR} = b$, then determine $\overrightarrow{RX}$ in terms of **a** and **b**. (3 marks)



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Question 2 (12 marks)

Consider the portion of Pascal's triangle shown below.

							1		2		1									
						1		3		3		1								
					1		4		6		4		1							
				1		5		10		10		5		1						
			1		6		15		20		15		6		1					
		1		7		21		35		35		21		7		1				
	1		8		28		56		70		56		28		8		1			

(a) Evaluate.

(i) ${}^5\mathbf{C}_4 =$ (1 mark)

(ii) $\dfrac{7!}{2! \times 5!} =$ (1 mark)

(b) State the value of x in each case below.

(i) ${}^6\mathbf{C}_x = 20$ (1 mark)

(ii) ${}^x\mathbf{C}_2 = 6$ (1 mark)

(iii) ${}^x\mathbf{C}_3 = {}^x\mathbf{C}_4$ (1 mark)

(iv) ${}^4\mathbf{C}_{x-1} = {}^4\mathbf{C}_{x+1}$ (1 mark)

See next page

Question 2 (Continued)

A basketball team requires 5 players.
A team is to be selected from 2 centres, 2 forwards and 3 guards.

(c) (i) How many different teams of 5 are possible if there are no restrictions? (1 mark)

(ii) How many teams can be chosen if it must contain at least one centre? (2 marks)

5 players are chosen as a starting team and line up at the start of a game.

(d) How many different arrangements are possible if:

(i) no restrictions apply? (1 mark)

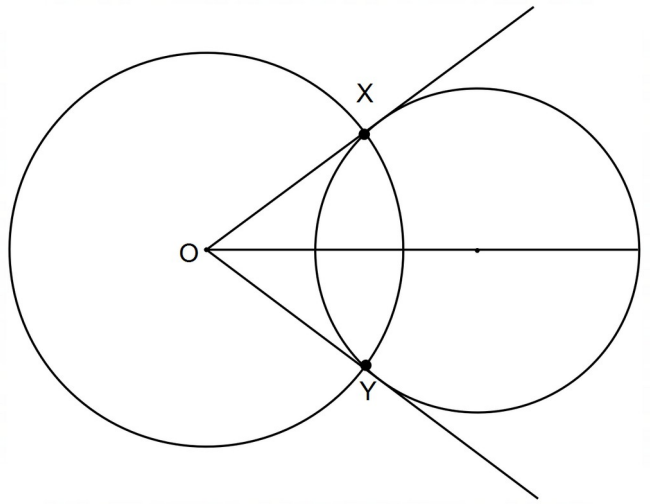
(ii) the starting team has 2 guards, and they must stand next to each other? (2 marks)

See next page

Question 3 (10 marks)

(a) OC is a radius of a given circle, with centre O.
A and B are points on OC and OC extended, such that OA x OB = OC^2.
A circle passes through A and B, and intersects the given circle in X and Y.

(i) Complete the diagram by marking A, B and C on the diagram. (1 mark)



(ii) Prove that $\overline{OX}$ and $\overline{OY}$ are tangents to this circle. (4 marks)

Question 3 (Continued)

Food items are to be made into parcels.

(b) 16 food items are to be made into two parcels; one containing 10 items and the other 6 items. In how many ways can the two parcels be formed?

Leave your answer in the form ${}^{n}\mathbf{C}_{r}$ or ${}^{n}\mathbf{P}_{r}$. (2 marks)

(c) 16 food items are to be made into three parcels, containing 10, 4 and 2 items respectively.

(i) In how many ways can the three parcels be formed?

Leave your answer in the form ${}^{n}\mathbf{C}_{r}$ or ${}^{n}\mathbf{P}_{r}$. (2 marks)

(ii) Once the three parcels have been made, how many ways can they be delivered to three needy families, one parcel to each family? (1 mark)

See next page

Question 4 (12 marks)

Three vectors are given by $\mathbf{a} = 3\mathbf{i} - 6\mathbf{j}$, $\mathbf{b} = -3\mathbf{i} - 4\mathbf{j}$ and $\mathbf{c} = \mathbf{i} + 3\mathbf{j}$.

(a) Determine:

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

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

(iii) $3\mathbf{b} + 2\mathbf{c}$. (2 marks)

(iv) the unit vector $\hat{\mathbf{d}}$ that is parallel and in the same direction as $\mathbf{b} - \mathbf{a}$. (3 marks)

See next page

Question 4 (continued)

(b) Determine the projection vector of **c** onto **a**. (4 marks)

(c) Draw a vector diagram containing the vectors **m**, **n** and **p** such that **m** – **n** + **p** = 0. (1 mark)

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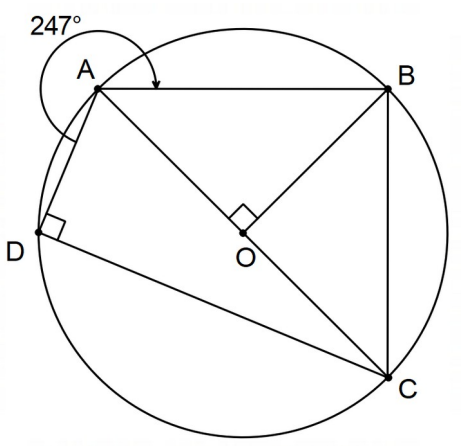
Question 5 (6 marks)

Consider the diagram shown. O is the centre of the circle.



Determine the size of the following angles giving reasons for your answers:

(a) $\angle ABC$ (2 marks)

(b) $\angle CAD$ (2 marks)

(c) $\angle OCB$ (2 marks)

See next page

Question 6 (5 marks)

Use proof by contradiction to show that there are no integers for which $8x - 24y = 5$.

End of questions

Additional working space

Question number(s): ……