



Rossmoyne Senior High School

Semester One Examination, 2021

Question/Answer booklet

MATHEMATICS SPECIALIST UNIT 1

Section Two: Calculator-assumed

If required by your examination administrator, please
place your student identification label in this box

WA student number: In figures

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Circle your Teacher's Name:

Mrs Alvaro

Mr Koulianos

Mr Tanday

Your name

Time allowed for this section

Reading time before commencing work: ten minutes

Working time: one hundred minutes

Materials required/recommended for this section

To be provided by the supervisor

This Question/Answer booklet

Formula sheet (retained from Section One)

To be provided by the candidate

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items: drawing instruments, templates, notes on two unfolded sheets of A4 paper, and up to three calculators, which can include scientific, graphic and Computer Algebra System (CAS) calculators, are permitted in this ATAR course examination

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.

See next page

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	50	35
Section Two: Calculator-assumed	13	13	100	92	65
Total					100

Instructions to candidates

- 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.
- Write your answers in this Question/Answer booklet preferably using a blue/black pen. Do not use erasable or gel pens.
- You must be careful to confine your answers to the specific question asked and to follow any instructions that are specific to a particular question.
- 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.
- It is recommended that you do not use pencil, except in diagrams.
- Supplementary pages for planning/continuing your answers to questions are 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.
- The Formula sheet is not to be handed in with your Question/Answer booklet.

Markers use only		
Question	Maximum	Mark
9	5	
10	5	
11	8	
12	7	
13	6	
14	8	
15	8	
16	6	
17	8	
18	8	
19	8	
20	7	
21	8	
S2 Total	92	
S2 Wt ($\times 0.7065$)	65%	

Section Two: Calculator-assumed

65% (92 Marks)

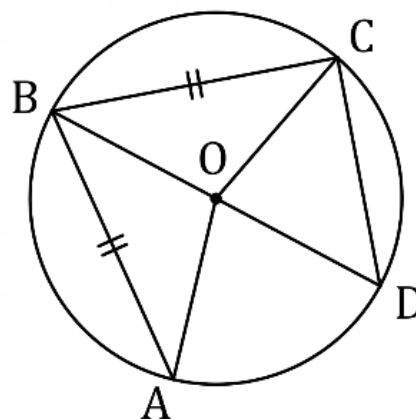
This section has **thirteen** questions. Answer **all** questions. Write your answers in the spaces provided.

Working time: 100 minutes.

Question 9

(5 marks)

Points A, B, C and D lie on the circle with centre O as shown in the diagram, where $\angle BAO = 40^\circ$, $AB = BC$ and BD is a diameter.



- (a) Determine the size of $\angle AOD$. (2 marks)

- (b) Prove that $\triangle OAD \equiv \triangle ODC$. (3 marks)

Question 10**(5 marks)**

Determine **p**, the vector projection of

(a) a force of 320 N on a bearing 028° onto a force of 300 N on a bearing of 345° . (3 marks)

(b) **m** on **n** where $\mathbf{m} = \langle 84, -13 \rangle$ and $\mathbf{n} = \langle 14, -48 \rangle$. (2 marks)

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Question 11**(8 marks)**

- (a) State whether each of the following statements are true or false, supporting each answer with an example or counterexample.
- (i) A polygon with at least six sides will never have an acute interior angle. (2 marks)
- (ii) If a quadrilateral is not a rectangle then the quadrilateral is not a square. (2 marks)
- (b) Consider the statement $\angle P \geq 90^\circ \Rightarrow \angle Q < 90^\circ$ that refers to angles in triangle PQR .
- (i) Write the contrapositive of the statement in simplest form. (1 mark)
- (ii) Write the inverse of the statement in simplest form. (1 mark)
- (iii) Briefly discuss the truth of the original statement, the contrapositive statement, and the inverse statement. (2 marks)

Question 12**(7 marks)**

- (a) Points P , Q and R lie on a circle of radius 5 cm, so that PR is a diameter and $QR = 4$ cm. Determine the exact area of triangle PQR . (3 marks)

- (b) A secant meets a circle at points A and B , where $AB = 4$ cm. A tangent to the same circle at point D intersects the secant at point C , where $CD = 14$ cm. Given that $BC < AC$, determine the exact distance AC and the exact distance BC . (4 marks)

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Question 13

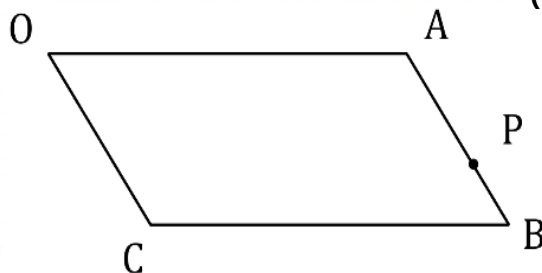
(6 marks)

Parallelogram $OABC$ is shown where point P lies on side AB such that $AP:PB = 2:1$.

Point Q , not shown, lies on diagonal OB such that $OQ:QB = 2:3$.

Let $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$.

Express the following in terms of $\mathbf{a}$ and $\mathbf{c}$.



(a) $\overrightarrow{AC}$.

(1 mark)

(b) $\overrightarrow{OQ}$.

(2 marks)

(c) $\overrightarrow{PQ}$.

(3 marks)

Question 14**(8 marks)**

Consider the set of integers between 1000 and 7000 inclusive.

(a) Show that there are 546 integers in this set that are a multiple of 11. (2 marks)

(b) Determine the number of integers in this set that are

(i) a multiple of 11 and a multiple of 24. (3 marks)

(ii) not a multiple of 11 and not a multiple of 24. (3 marks)

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Question 15**(8 marks)**

A small body is acted on by force $\mathbf{F}_1$ of 33 N on a bearing of 165° and by force $\mathbf{F}_2$ of 75 N on a bearing of 280° .

(a) Sketch a diagram to show $\mathbf{F}_1 + \mathbf{F}_2$ and their resultant $\mathbf{R}$. (2 marks)

(b) Determine the magnitude and bearing of $\mathbf{R}$. (4 marks)

(c) Express $\mathbf{R}$ in component form $a\mathbf{i} + b\mathbf{j}$. (2 marks)

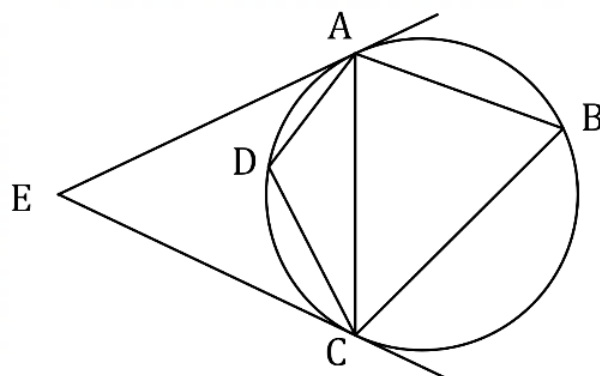
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Question 16

(6 marks)

- (a) The diagram shows points A, B, C and D on the circumference of a circle. Tangents to the circle from A and C meet at point E .

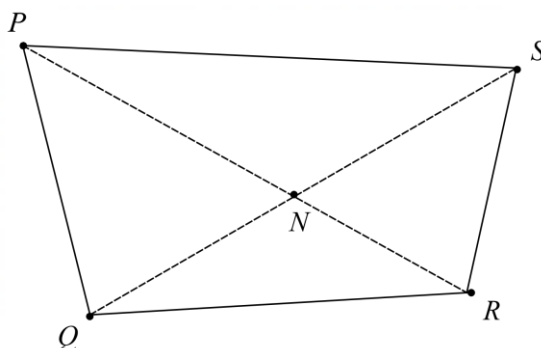
Given that $\angle E = 48^\circ$, determine the size of $\angle B$ and the size of $\angle D$.



(3 marks)

- (b)

In quadrilateral $PQRS$, the diagonals PR and SQ intersect at N .



Identify any geometric properties of quadrilateral $PQRS$, if $PN \times NR = SN \times NQ$.

(3 marks)

Question 17**(8 marks)**

Each letter in the word CLOUDLESS is printed individually on a card. When cards are arranged next to each other in a line, determine the number of different permutations

(a) of all the cards. (2 marks)

(b) of all the cards where all the consonants are adjacent. (2 marks)

(c) using any 4 of the cards. (4 marks)

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Question 18**(8 marks)**

A circle is drawn with eight points equally spaced on the circumference.

- (a) How many different chords can be drawn between these eight different points? (2 marks)

A student creates triangles by connecting three points on the circumference with straight lines.

- (b) (i) Determine the number of triangles that the student can create. (2 marks)

- (ii) How many of the triangles in part (b)(i) will not be right angled? (2 marks)

A student creates polygons with three or more sides by connecting the points on the circumference with straight lines.

- (c) Determine the total number of polygons the student can create. (2 marks)

Question 19**(8 marks)**

Small bodies P and Q are moving with constant velocities $(2, -2)$ m/s and $(1, 0)$ m/s respectively.

P has initial position vector $(5, 7)$ m and Q has initial position vector $(-3, 13)$ m.

- (a) Determine the distance between the bodies after two seconds. (3 marks)

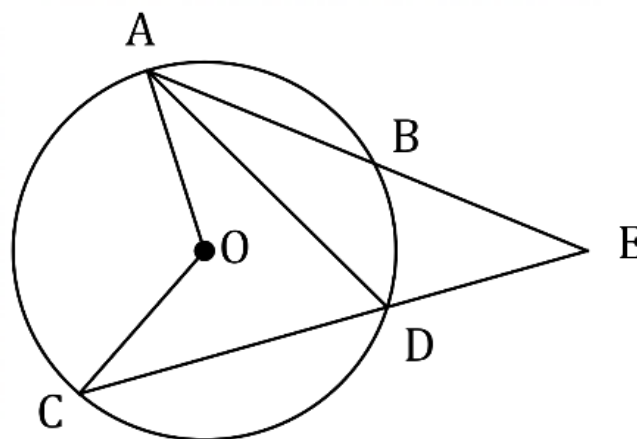
- (b) Show that the distance between the bodies after t seconds is given by $\sqrt{5t^2 + 40t + 100}$. (3 marks)

- (c) Prove that the bodies do not meet. (2 marks)

Question 20

(7 marks)

In the diagram shown, secants AB and CD intersect at E , a point outside the circle with centre O



- (a) Determine the size of $\angle ADC$ and $\angle AOC$ when $\angle E = 28^\circ$ and $\angle EAD = 22^\circ$. (2 marks)

- (b) Prove that when secants AB and CD intersect at E , a point outside the circle with centre O , then $\angle E = \frac{1}{2}(\angle AOC - \angle BOD)$. (4 marks)

- (c) Determine the size of $\angle E$ when $\angle BOD = 30^\circ$ and $\angle AOC = 80^\circ$. (1 mark)

Question 21**(8 marks)**

Harbour Y lies on a bearing of 055° from harbour X and the straight line distance between the harbours is 47 km. Between the harbours, a steady current is moving in a northerly direction at a speed of 1.75 metres per second.

A boat with a cruising speed of 6.5 metres per second is to travel from harbour X to harbour Y in the least possible time.

- (a) Sketch a diagram, roughly to scale, to show the resultant of the sum of the displacement vectors of the boat and the current. **(2 marks)**

- (b) Determine the bearing it should steer, to the nearest degree, and the time its journey takes, to the nearest minute. **(6 marks)**

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End of Exam**See next page**

Supplementary page

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