MATHEMATICS SPECIALIST UNIT 1

Section One:
Calculator- free

	Total	Result	
Section One	53		
Section Two	97		**_____%**
Total	150		

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

Student's Teacher   **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	8	8	50	53	35
Section Two: Calculator-assumed	13	13	100	97	65
			Total	150	100

Instructions to candidates

1.   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.

2.   Write your answers in this Question/Answer Booklet.

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

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 an answer to 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 and your notes are **not to be handed** in with your Question/Answer Booklet.

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

Section One: Calculator-free   **35% (53 Marks)**

This section has **eight (8)** questions. Answer **all** questions. Write your answers in the spaces provided.

Working time: 50 minutes.

Question 1   **(5 marks)**

Relative to the origin O, points A and B have position vectors $-3i-2j$ and $i-4j$ respectively.

(a)   Determine the unit vector $\hat{c}$, where $c=\overrightarrow{AB}$.   (3 marks)

(b)   Vector d has magnitude $3\sqrt{5}$, is parallel to c and in the opposite direction. Determine d.

(2 marks)

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

Question 2   **(5 marks)**

Let the displacement vectors a, b and c be $(11, -4)$, $(5, 14)$ and $(8, m)$ respectively, where m is a constant.

(a)   Determine the vector $3a + 2b$.   (2 marks)

(b)   Given that $|a + b + k\,c| = 0$, detemine the values of k and m.   (3 marks)

Question 3　　　　　　　　　　　　　　　　　　　　　　　　　　　　　**(8 marks)**

Consider the following statement about a simple (no edges that cross) polygon:

If it has an interior angle sum of 360°, then it is a square.

(a)　　Use a counter-example to explain why the statement is false.　　　　　　　(2 marks)

(b)　　Write the converse statement and state whether it is always, sometimes or never true.

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(c)　　Write the inverse statement and state whether it is always, sometimes or never true.

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　(2 marks)

(d)　　Write the contrapositive statement and state whether it is always, sometimes or never true.

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Question 4   **(6 marks)**

(a)   Determine the value of the constant n, given that the vectors $12i+nj$ and $5i-8j$ are
        perpendicular.   (2 marks)

(b)   The vectors a and b are such that $|a|=18, |b|=12$ and $a \cdot b = -33$. Evaluate
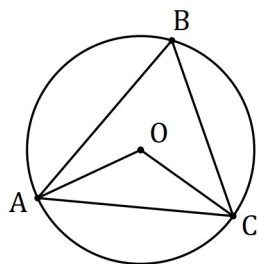
(i) $-2a \cdot 3b$.   (1 mark)

(ii) $(a+b) \cdot (b-a)$.   (3 marks)

Question 5 **(7 marks)**

(a)   In the diagram below, the vertices of triangle ABC lie on a circle with centre O. Given that $\angle ABC = 54°$, determine the values of $\angle AOC$ and $\angle OAC$.   (2 marks)

(b)   The two tangents through a point P exterior to a circle touch it at the points B and D. The chord BD subtends an angle of 130 degrees at a point C on the circumference of the circle as shown below. Determine the angle x between the two tangents.   (5 marks)
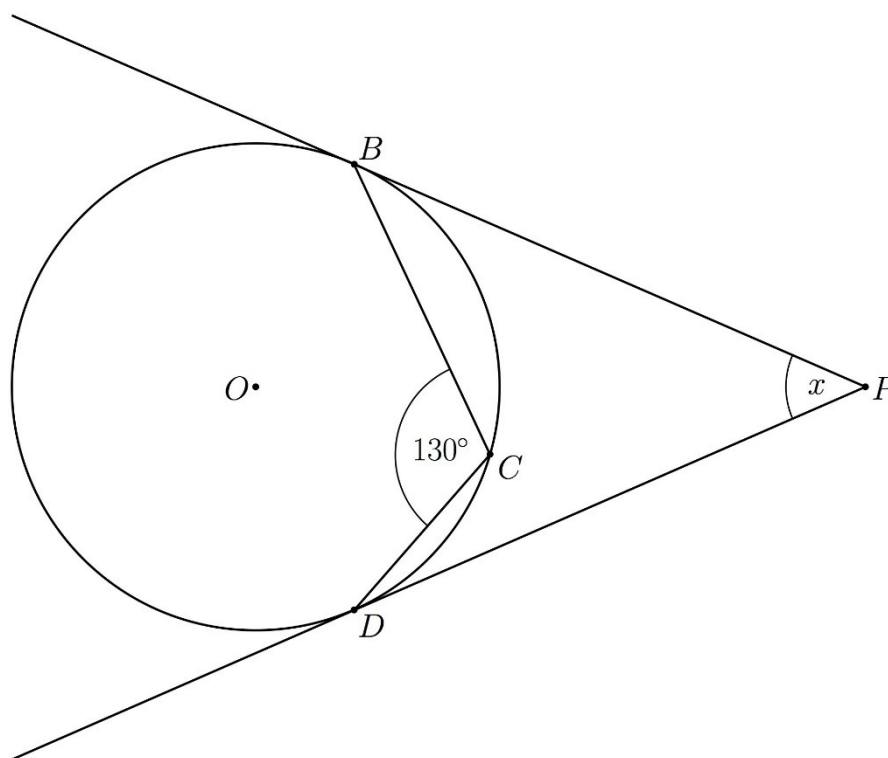
Question 6   **(6 marks)**

A drone leaves point P and travels 115 m on bearing of $340\,°$ to Q, then 30 m on bearing $070\,°$ to R and finally 85 m on bearing $160\,°$ to S.

(a)   Sketch a neat diagram to show the path of the drone.   (2 marks)

(b)   The drone is to return directly from S to P. Determine the distance it must fly and on what bearing.   (4 marks)

Question 7   **(9 marks)**

(a)   Evaluate $^{16}P_{11} \div {}^{14}P_{11}$.   (3 marks)

(b)   Express $9!+8!+7!$ in the form $a^2 b!$, where a and b are positive integers.   (3 marks)

(c)   Show that for $n \in Z, n \geq 3$, the sum $n!+(n-1)!+(n-2)!$ can always be expressed in the form $a^2 b!$ where a and b are positive integers.   (3 marks)
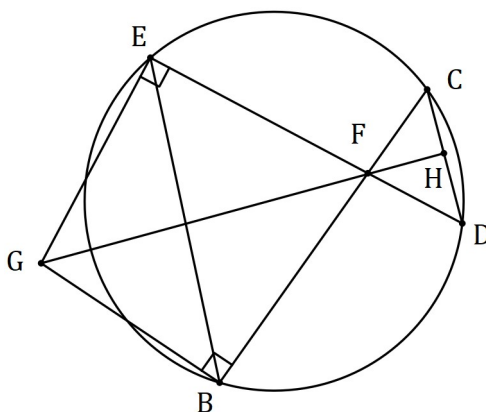
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Question 8   **(7 marks)**

In the diagram below, two chords of a circle, BC and DE, intersect at F. GB is perpendicular to BC at B and $¿$ is perpendicular to DE at E. The line GF intersects chord CD at H.

(a)   Explain why $GEFB$ is a cyclic quadrilateral.   (1 mark)

(b)   Prove that $\angle CDE = \angle EGF$.   (3 marks)

(c)   Prove that GH is perpendicular to CD.   (3 marks)

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END OF QUESTIONS

Additional working space.

Question Number: _____

Additional working space.

Question Number _____

END OF EXAMINATION BOOKLET

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