

Revision 4

Year 11 Examination
Question/Answer Booklet

MATHEMATICS SPECIALIST UNITS 1 AND 2 Section Two: Calculator-assumed

Student Number: In figures

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In words

Teacher name

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

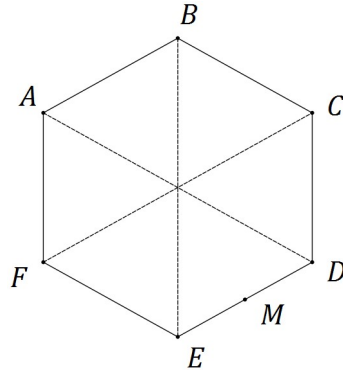
Special items: nil

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 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.

Section Two: Calculator-assumed**65% (58 Marks)**This section has **eight (8)** questions. Answer **all** questions. Write your answers in the spaces provided.

Working time: 60 minutes.

Question 1**(7 marks)**(a) $ABCDEF$ is a regular hexagon. The midpoint of side DE is M .Let $\mathbf{a} = \overrightarrow{AB}$ and $\mathbf{b} = \overrightarrow{AF}$. Express each of the following in terms of \mathbf{a} and \mathbf{b} .(i) \overrightarrow{BC} . (1 mark)(ii) \overrightarrow{AE} . (1 mark)(iii) \overrightarrow{MB} . (1 mark)

(b) Three forces, F_1 , F_2 and F_3 act on a body that remains in equilibrium.

F_1 has a magnitude of 400 N. The angle between the directions of F_1 and F_2 is 150° , between F_1 and F_3 is 135° and between F_2 and F_3 is 75° .

Determine the magnitudes of F_2 and F_3 , rounding your answers to the nearest whole number. (4 marks)

Question 2**(7 marks)**

(a) A number is to be formed by randomly selecting three **different** digits from those in the number 93265. Determine how many different numbers

(i) start with an odd digit. (1 mark)

(ii) end with an even digit. (1 mark)

(iii) start with an odd digit or end in an even digit. (2 marks)

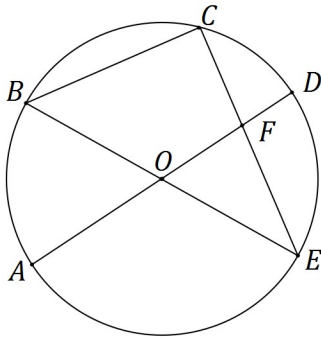
(b) A computer user has forgotten their six character, case-sensitive password, but know that they always use a permutation of F, F, 1, 9, 9, and 9 - their initials and the year they were born. Determine how many passwords are possible if

(i) the F's must both be uppercase. (2 marks)

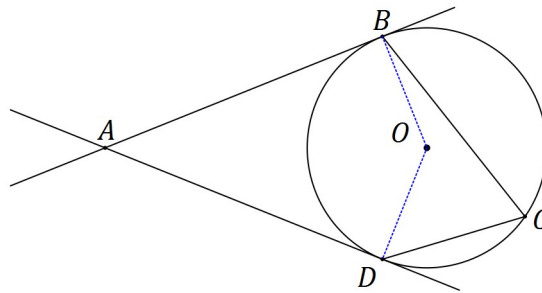
(ii) either F can be lowercase or uppercase. (1 mark)

Question 3**(8 marks)**

- (a) Triangle BCE is such that B , C and E lie on a circle with centre O and radius 29 cm. Diameter AD and chord CE intersect at F , so that $DF = 8.5$ cm and $EF = 25.5$ cm. Determine the lengths OF , CF and BC . (5 marks)



- (b) In the diagram below, points B , C and D lie on a circle with centre O . The tangents to the circle at B and D intersect at point A . If $\angle BAD = x$, prove that $\angle BCD = 90^\circ - \frac{x}{2}$. (3 marks)



Question 4**(9 marks)**

Transformation A is an anti-clockwise rotation about the origin of 90° and matrix $B = \begin{bmatrix} 2 & 0 \\ 0 & 3 \end{bmatrix}$.

(a) Represent transformation A as a 2×2 matrix. (2 marks)

(b) Describe the transformation represented by matrix B . (2 marks)

(c) Determine the coordinates of the point $P(-15, -11)$ following transformation A and then transformation B . (2 marks)

(d) Following transformation B and then transformation A , point Q is transformed to point $Q'(12, 7)$.

Determine the single matrix that will transform Q' back to Q and hence determine the coordinates of point Q .
(3 marks)

Question 5**(8 marks)**

(a) Consider the vectors $\mathbf{p} = (24, -143)$ and $\mathbf{q} = (20, -21)$. Determine

(i) the angle between the directions of vectors \mathbf{p} and \mathbf{q} . (1 mark)

(ii) two vectors that are perpendicular to \mathbf{q} and have the same magnitude as \mathbf{p} . (3 marks)

(b) If $\overrightarrow{AB} = (3, 4)$ and $\overrightarrow{AC} = (-2, 1)$, determine

(i) the component of \overrightarrow{AB} parallel to \overrightarrow{AC} . (2 marks)

(ii) the component of \overrightarrow{AB} perpendicular to \overrightarrow{AC} . (2 marks)

Question 6**(7 marks)**

- (a) The work done, in joules, by a force \mathbf{F} Newtons in changing the displacement of an object s metres is given by the scalar product of \mathbf{F} and s . Calculate the work done when a force of 750 N moves an object a distance of 85 cm at an angle of 5° to the force.

(2 marks)

- (b) A drone flies with a constant velocity and height above level ground, over which a wind blows from the north west at 3.5 metres per second. After 15 seconds, the drone reaches a point 85 metres on a bearing of 020° from where it was launched. Determine the velocity of the drone, giving its magnitude to two decimal places and bearing to the nearest degree.

(5 marks)

Question 7**(8 marks)**

- (a) A high school has 5 male and 9 female volunteers from which to choose a debating team of 5 students. Determine the number of different teams that can be formed if
- (i) there are no special requirements. (1 mark)

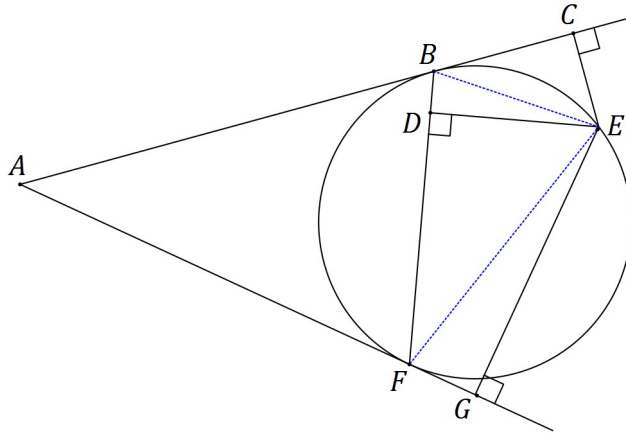
 - (ii) there must be a captain and a vice-captain. (2 marks)

 - (iii) there must be more females than males, but at least one male. (2 marks)
- (b) Determine how many **different** numbers must be selected from the first 25 positive integers to be certain that at least one of them will be twice the other. (3 marks)

Question 8

(7 marks)

In the diagram below, the tangents from point A touch the circle at B and F . Point E lies on the major arc BF and D lies on BF so that $DE \perp BF$. Points C and G lie on AB and AF extended respectively such that $EC \perp AC$ and $EG \perp AG$.



(a) Show that $\triangle BCE$ and $\triangle FDE$ are similar.

(3 marks)

(b) Show that $DE^2 = CE \times GE$.

(4 marks)