



1998 MALAWI SCHOOL CERTIFICATE OF EDUCATION EXAMINATION

ADDITIONAL MATHEMATICS

Subject Number: M132/II

Tuesday, 23 September

Time Allowed: 2 hrs 30 mins
8.00-10.30 am

PAPER II

(100 marks)

This paper contains 5 pages. Please check.

Answer all six questions in Section A and any two questions from Section B.

Section A carries 60 marks and Section B carries 40 marks.

Graph paper and four-figure mathematical tables will be provided.

Calculators may be used.

All necessary working should be shown and any numerical expression being evaluated by calculators or mathematical tables must be clearly stated; otherwise marks for method may be lost.

The final answer to questions requiring the use of tables or calculators should normally be given to three significant figures.

The marks allocated to each question (or part of a question) are shown in brackets at the end of each question (or part of a question).

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Turn Over



Answer all six questions in this section.

Given that $\underline{u} = 3\underline{i} - 4\underline{j} + \underline{k}$ and $\underline{v} = 2\underline{i} + 3\underline{j} - 1\underline{k}$

- Write down the expression for $2\underline{u} - 3\underline{v}$. (3 mark)
- Calculate the modulus for $2\underline{u} - 3\underline{v}$ (2 mark)
- Find the value x if the vector $2\underline{i} - x\underline{j} + 7\underline{k}$ is perpendicular to $2\underline{u} - 3\underline{v}$ (3 mark)
- Calculate the unit vector in the direction of $2\underline{u} - 3\underline{v}$ (2 mark)

Calculate the standard deviation of:

31.6, 31.8, 32.0, 32.2, 32.3, 32.5, 32.6, 32.7, 33.0, 33.4
(Show all your working).

(7 marks)

- A truck of mass 15 kg is pulled by a horizontal force of 40N and covers a distance of 3 m in 2 seconds starting from rest. Find the magnitude of the friction force (assumed constant) which opposes the motion. (6 marks)
- A body changes its velocity from $6\underline{i} - 2\underline{j}$ to $9\underline{i} + 8\underline{j} \text{ ms}^{-1}$ in 5s.
 - What is the acceleration of the body, assumed uniform?
 - What will be its velocity after a further 2s? (5 marks)

Find the centre and radius of the circle whose equation is $x^2 + y^2 - 6x + 4y + 4 = 0$ (7 marks)

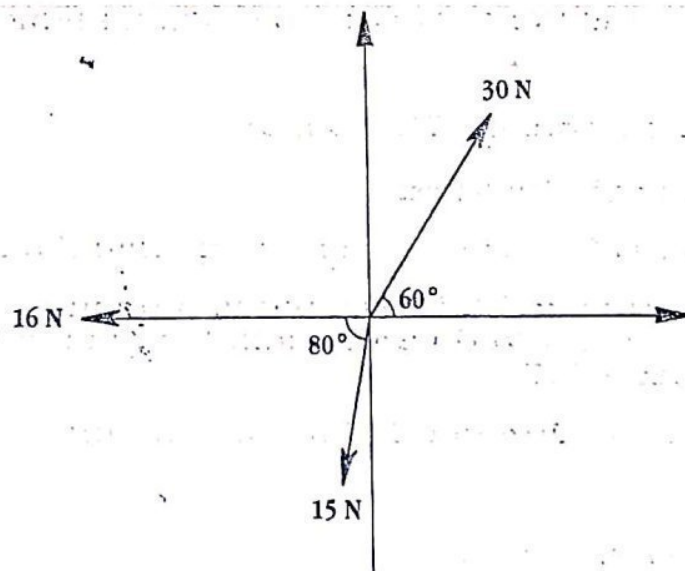


Figure 1

Continued

(Continued)

Figure 1 shows a system of forces (three in all) acting at a point.

Find:

- i. the resultant force. (4 marks)
- ii. the magnitude and direction of the resultant force. (6 marks)

The probability that a pupil wins a cross country race is $\frac{1}{9}$ and the probability that she is selected for University is $\frac{2}{7}$.

Calculate the probability that

- (i) she wins the race and is selected.
- (ii) at least she succeeds in one of them.

(6 marks)

A line through A (1,5) is drawn parallel to the x -axis and meets PB whose equation is $3y = 2x - 5$ at B. If points P and Q on PB lie on the y and x -axis respectively.

Find:

- (i) the length of PB.
- (ii) the equation of the perpendicular from A to PQ.

(9 marks)

Section B (40 marks)

Answer any two questions from this section.

A tangent is drawn from a point T(6,8) to the circle

$$(x+2)^2 + (y-3)^2 = 25$$

- (i) Find the length of the tangent.
- (ii) Show that A(-2,8) is one place where the tangent from T touches the circle.
- (iii) Let B be the other point of contact where the tangent from T touches the circle, and C be the centre of the circle. Find the area of the quadrilateral ATBC.

(12 marks)

The points (8,4) and (2,2) are the ends of a diameter of a circle.

Find:

- (i) the equation of the circle.
- (ii) the equation of the tangent at (8,4).

(8 marks)

Continued/...



A botanist has a large batch of seeds in which 60% give white flowers, 30% pink flowers and 10% red flowers. If he plants three seeds, what is the probability of obtaining:

- (i) 3 pink flowers.
- (ii) 2 white flowers and 1 red flower.
- (iii) at least 1 red flower.

(8 marks)

9. The table below shows the distribution of marks in an examination taken by 500 candidates.

Marks	No. of candidates
1-10	5
11-20	20
21-30	35
31-40	70
41-50	110
51-60	110
61-70	85
71-80	50
81-90	10
91-100	5

Draw a cumulative frequency graph and use it to estimate:

- (i) the median mark of these candidates.
- (ii) the pass mark if 55% of the candidates pass the examination.
- (iii) the interquartile range.

(12 marks)

- a. A particle moves along a straight line OA in such a way that it is S metres from O after t seconds, where $S = 6t - t^2$.

- (i) Find the velocity of the particle after 2 seconds.
- (ii) Find the acceleration after 2 seconds.
- (iii) What is the value of S when the particle changes its direction?

(10 marks)

Continue



Continued)

A tennis ball of mass 150 g strikes the racket with velocity $25\mathbf{i} - \mathbf{j} \text{ ms}^{-1}$ and leaves the racket with velocity $-23\mathbf{i} + 15\mathbf{j} \text{ ms}^{-1}$.

- What is the momentum of the ball just before the impact?
- Find the magnitude of the impulse the ball receives.
- Find the magnitude of the impulse between the racket and the ball.
- If the racket and the ball are in contact for 0.05 seconds, find the force on the ball.

(10 marks)

The position vectors of the points A and B relative to the origin O are

$$\begin{pmatrix} 2 \\ 4 \\ -10 \end{pmatrix} \text{ and } \begin{pmatrix} 6 \\ -4 \\ -2 \end{pmatrix} \text{ respectively.}$$

- Find the vector equation of the line AB.
- Calculate the angle between $\vec{OA}$ and $\vec{OB}$.

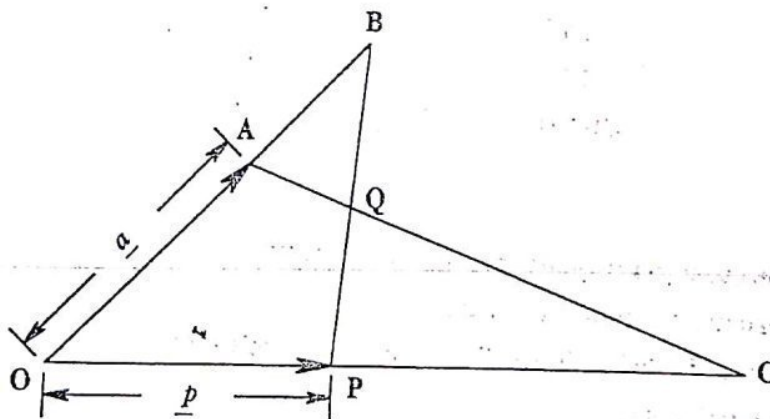


Figure 2

In Figure 2, $\vec{OA} = \underline{a}$, and $\vec{OP} = \underline{p}$, $OC = 2\underline{p}$ and $OB = \frac{3}{2} \underline{a}$. If $\vec{BQ} = r \vec{BP}$ and $\vec{AQ} = t \vec{AC}$, find two distinct expressions in terms of $\underline{a}$, $\underline{p}$, r and t for $\vec{OQ}$.

(10 marks)

END OF QUESTION PAPER

This paper contains 5 pages.

