



THE MALAWI NATIONAL EXAMINATIONS BOARD

1996 MALAWI SCHOOL CERTIFICATE OF EDUCATION EXAMINATION

ADDITIONAL MATHEMATICS

Subject Number: M132/II

Pure Mathematics

Monday, 29 July

Time Allowed: 2 hrs 30 mins
1.30 - 4.00 pm

PAPER II (100 marks)

Instructions:

1. This paper contains 6 pages. Please check.
2. Answer all six questions in Section A and any two questions from Section B.
3. Section A carries 60 marks and Section B carries 40 marks.
4. Graph paper and four-figure mathematical tables will be provided.
5. Calculators may be used.
6. 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.
7. The final answer to questions requiring the use of tables or calculators should normally be given to three significant figures.
8. The marks allocated to each question (or part of a question) are shown in brackets at the side of each question (or part of a question).



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Turn over

Section A (60 marks)

Answer all six questions in this section.

- ✓ 1. A right-angled triangle ABC has two of its vertices as A(1,6) and B(-1,2). If BC is perpendicular to AB, find:
- the equation of the line AB (3 marks)
 - the equation of the line BC (3 marks)
 - the coordinates of C if C lies on the x-axis (1 mark)
 - the length of the line segment AB (2 marks)
2. a. If $\underline{x} = 2\underline{i} - 3\underline{j} + \underline{k}$ and $\underline{y} = 6\underline{i} + \underline{j} - 2\underline{k}$, find u and v if the vector $\underline{i} + v\underline{j} + u\underline{k}$ is perpendicular to both $\underline{x}$ and $\underline{y}$. (4 marks)
- b. The lines with vector equations
- $$\underline{r}_1 = \begin{pmatrix} 1 \\ -5 \\ 2 \end{pmatrix} + t \begin{pmatrix} -3 \\ 4 \\ 0 \end{pmatrix} \text{ and } \underline{r}_2 = \begin{pmatrix} 3 \\ -13 \\ 1 \end{pmatrix} + s \begin{pmatrix} 4 \\ 0 \\ k \end{pmatrix} \text{ meet at } Q.$$
- Find:
- the value of k
 - the position vector of Q , and
 - the distance of Q from the origin. (7 marks)
3. A stone of mass 2 kg is thrown up with an initial velocity of 40 ms^{-1} .
- How high does it rise? (3 marks)
 - How long does it take to reach its highest point? (2 marks)
4. a. Of 48 pupils, 6 take Commercial Studies, 8 take Accounts and 12 take Agriculture. If these events may be considered to be independent, what is the probability that the first pupil talked to by a teacher takes:
- both Commercial Studies and Accounts?
 - either Commercial Studies or Agriculture?
 - at least one of the three subjects? (1 mark)

4. (Continued)

b. Given the following set of marks for 9 students, 7, 11, 5, 16, 10, 13, 3, 12 and 13. Calculate:

- (i) the mean mark,
- (ii) the median mark and
- (iii) the variance for the distribution of the marks.

(7 marks)

5.

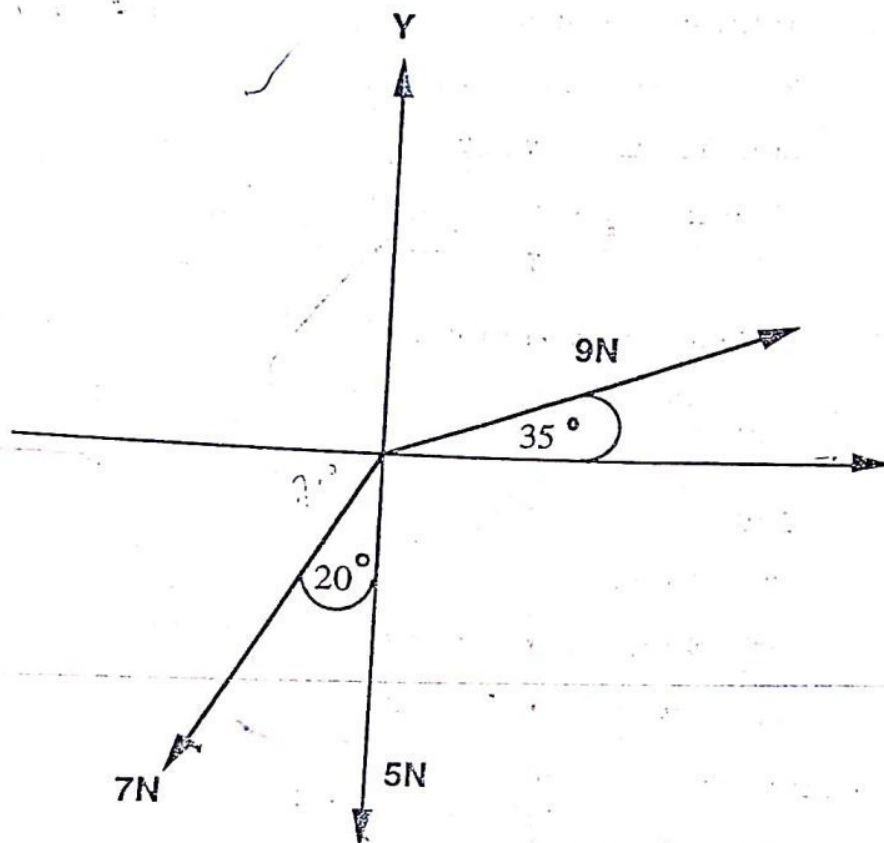


Figure 1

Figure 1 above, shows a system of forces acting at a point. Find:

- a. the sum of the components of the above system of forces along the x and y axes
- b. the magnitude and direction of the resultant force of the system of forces.

(4 marks)

(3 marks)

Continued/.

6. a. Figure 2 shows a velocity-time graph for a journey.

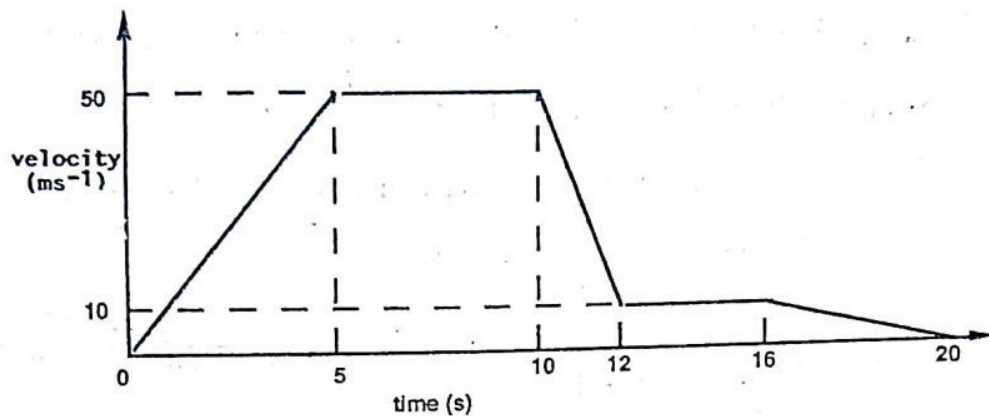


Figure 2

Calculate:

- (i) the acceleration in the first 5 seconds
- (ii) the total distance travelled in the first 12 seconds

(6 marks)

- b. A force $\underline{F} = 14\underline{i} - 20\underline{j}$ N acts for 6 seconds on a body of mass 8 kg.

Calculate:

- (i) the impulse the body receives,
- (ii) the velocity of the body at the instant the force ceases if its initial velocity was $-3\underline{i} + 2\underline{j} \text{ m s}^{-1}$

(7 marks)

Continued.

Section B (40 marks)

Answer two questions only from this section.

7. a. (i) Write the equation of the circle with centre $(2, -3)$ and radius 5.
 (ii) Calculate the length of the tangent to the circle from the point $Q(7,6)$.
 (iii) Show that the line $y = \frac{3}{4}x + 1\frac{3}{4}$ is a tangent to the circle. (12 marks)
- b. (i) Show that the point $Z(4,2)$ lies on the circle $(x-1)^2 + (y+2)^2 = 25$.
 (ii) Find the equation of the tangent at Z . (8 marks)
8. a. ABCD is a quadrilateral and the points W, X, Y and Z are the mid-points of AB, BC, CD and DA respectively.
 If $\overrightarrow{AB} = \underline{b}$, $\overrightarrow{BC} = \underline{c}$, $\overrightarrow{CD} = \underline{d}$ and $\overrightarrow{DA} = \underline{a}$, prove that:
 (i) WXYZ is a parallelogram, and hence
 (ii) the perimeter of WXYZ is equal to the sum of the diagonals of ABCD. (12 marks)
- b. Relative to an origin O, the points A, B and C have position vectors:
 $\begin{pmatrix} 2 \\ -2 \end{pmatrix}$, $\begin{pmatrix} 3 \\ 1 \end{pmatrix}$ and $\begin{pmatrix} 2 \\ 4 \end{pmatrix}$ respectively.
 (i) Find, in vector form, an equation for the straight line through A and B.
 (ii) Find a vector equation for the straight line through C which is perpendicular to AB and
 (iii) Position vector for point F is $5\mathbf{i} + \mathbf{j}$. Show that the line in b(ii) passes through point F. (8 marks)

$$\frac{21 \times}{16}$$

$$\frac{7 \times}{4}$$

Continued/...

9. a. In the Republic of Koto, 70% of the people belong to the Progressive Party and the rest to the Conservative Party.

Calculate the probabilities that, among four randomly selected persons eligible to vote, there are 0, 1, 2, 3 and 4 persons who will vote for the Conservative Party.

(10 marks)

- b. The table below shows the analysis of examination marks scored by 80 pupils.

Marks	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91
Frequency	1	3	8	14	17	13	11	7	4	

- (i) Using the table or otherwise, calculate the median mark.
- (ii) Using the same data, construct a cumulative frequency table.
- (iii) Draw an accurate cumulative frequency curve (an ogive) for the distribution.

(10 marks)

10. a. A car takes 60 s to travel between two sets of traffic lights, starting from rest at the first and coming to rest again at the second. It accelerates uniformly to 12 ms^{-1} and then uniformly decelerates to rest. How far apart are the two sets of lights?

(6 marks)

- b. A particle of mass 10 kg moves in a straight line from point A to point B and then to point C. The distance from A to B is 80 m and from B to C is 60 m. It leaves A acted on by a constant force F_1 at 4 ms^{-1} and reaches B travelling at $V \text{ ms}^{-1}$. It leaves B at the same speed $V \text{ ms}^{-1}$ and comes to rest at C acted on by a force F_2 . The whole journey takes 20 s.

Find:

- (i) the value of V
- (ii) the values of F_1 and F_2

(10 marks)

END OF QUESTION PAPER ©

NB: This paper contains 6 pages.

