

PROF: V.C MTSUKO *Lee Aken Banda*



# THE MALAWI NATIONAL EXAMINATIONS BOARD

2002 MALAWI SCHOOL CERTIFICATE OF EDUCATION EXAMINATION

## ADDITIONAL MATHEMATICS

Friday, 18 October

Subject Number: M132/II

Time Allowed: 2 h 30 mins  
11.30-1.30 pm

### PAPER II (100 marks)

1. This paper contains 4 pages. Please check.
2. Answer all seven 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.

All necessary working should be shown and any numerical expression being evaluated by calculator 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).

Write your Examination Number on top of each page of your Answer

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Turn Over



## Section A (60 marks)

Answer all six questions in this section.

1. The probability that it rains on Monday next week is 0.06. If it rains on Monday next week, the probability that we shall have a big walk on Tuesday is 0.1. If it does not rain on Monday next week, the probability that we shall have a big walk is 0.5. Find the probability that we shall have a big walk on Tuesday next week. (Hint: Use tree diagram).

2. Let P be a point where line  $x - y - 2 = 0$  and  $2x + y + 3 = 0$  intersects. Find the equation of line, through the point of intersection perpendicular to the line  $4x - 3y = 5$ .

3. Find the scalar product of the following vectors:

a.  $\underline{a} = \underline{i} + \underline{j}$ ,  $\underline{b} = 3\underline{i} + 4\underline{j}$ ;  $\Rightarrow (\underline{i} \cdot \underline{i}) + (\underline{j} \cdot \underline{j}) + (\underline{i} \cdot \underline{j}) + (\underline{j} \cdot \underline{i}) = 1 + 1 + 0 + 0 = 2$

b.  $\underline{a} = \begin{pmatrix} 1 \\ 3 \end{pmatrix}$ ,  $\underline{b} = \begin{pmatrix} -2 \\ -6 \end{pmatrix}$ ;  $\Rightarrow 1 \cdot (-2) + 3 \cdot (-6) = -2 - 18 = -20$

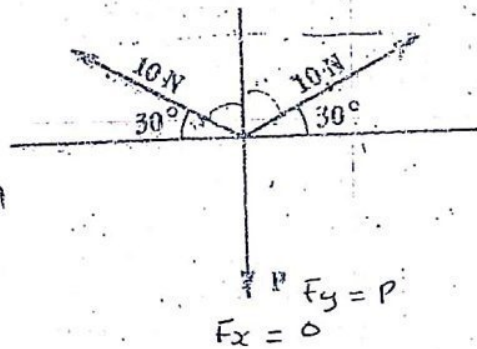
- a. An orange is thrown upwards with an initial velocity of 42 m/s from the edge of a building of height 120 m.

Calculate:

- (i) the time when the orange hits the ground;  
(ii) the speed when the orange hits the ground.

- b. Triangle ABC is such that points A(2, -1), B(3, 2) and C(4, 3). If D is the mid point of BC, show that  $AB^2 + AC^2 = 2AD^2 + BC^2$ . *Chandley*

5. a. The figure below shows three co-planar forces.



$$F_x = 0$$

If the resultant force is 0, calculate the magnitude of the resultant force.

- b. Below is a list of numbers representing hours that 100 randomly chosen patients took to stop experiencing side-effects after taking a malaria drug.

|    |    |    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|----|----|
| 21 | 31 | 22 | 38 | 23 | 55 | 24 | 49 | 25 | 31 |
| 33 | 26 | 35 | 27 | 31 | 28 | 55 | 29 | 35 | 30 |
| 41 | 32 | 34 | 37 | 31 | 45 | 39 | 35 | 42 | 38 |
| 30 | 33 | 29 | 44 | 28 | 41 | 27 | 45 | 26 | 33 |
| 33 | 39 | 33 | 36 | 32 | 39 | 41 | 34 | 43 | 25 |
| 41 | 34 | 44 | 49 | 41 | 55 | 38 | 55 | 35 | 55 |
| 38 | 11 | 32 | 35 | 33 | 45 | 55 | 4  | 48 | 30 |
| 47 | 35 | 41 | 45 | 41 | 43 | 37 | 45 | 34 | 49 |
| 26 | 41 | 27 | 28 | 34 | 29 | 45 | 30 | 41 | 39 |
| 31 | 25 | 31 | 24 | 47 | 23 | 31 | 22 | 35 | 21 |

Continued.

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b. (Continued)

Complete the frequency table below and sketch cumulative frequency distribution curve.

| Time hours | 1-10 | 11-20 | 21-30 | 31-40 | 41-50 | >50 | Total |
|------------|------|-------|-------|-------|-------|-----|-------|
| Frequency  | 0    | 1     | 26    | 40    | 2     | 1   | 100   |

(7 marks)

In triangle PQR,  $\vec{PQ} = p$ ,  $\vec{PR} = r$  and M is the mid point of PQ. Express in terms of  $p$  and  $r$ :

(i)  $\vec{PM}$ ;

(ii)  $\vec{MR}$ ;

(iii)  $\vec{RM}$ .

(6 marks)

(b) Find a unit vector which is in the opposite direction to the sum of the vectors  $(3\mathbf{i} + 2\mathbf{j} + \mathbf{k})$  and  $(-5\mathbf{i} - 3\mathbf{j} + 6\mathbf{k})$ .

Prove that this unit vector is perpendicular to the vector  $(9\mathbf{i} - 4\mathbf{j} + 2\mathbf{k})$ .

(7 marks)

### Section B (40 marks)

Answer any two questions from this section.

a. A school has 60 pupils taking history, 70 pupils taking mathematics and 20 pupils taking both mathematics and history. If 30 pupils take none of the two subjects, what is the probability that a randomly chosen pupil from this school will be found to take both mathematics and history? Use Venn diagram.

(7 marks)

b. Two companies make the same type of bolts used on bicycles. A random sample of 10 worn out bolts were taken out from bicycles. The number of months they stayed working were recorded in the table below:

|           |    |   |    |    |   |    |    |   |    |    |
|-----------|----|---|----|----|---|----|----|---|----|----|
| Company A | 10 | 9 | 11 | 10 | 8 | 12 | 8  | 9 | 11 | 12 |
| Company B | 14 | 6 | 7  | 13 | 2 | 18 | 13 | 7 | 13 | 7  |

(i) Compare the reliability of the bolts using standard deviations.

(ii) Which of the two companies would have an easy task announcing the expected life span of its bolts?

(13 marks)

The line  $2x - 6 = -3y$  meets the  $y$ -axis at A and the  $x$ -axis at B. C is a point such that  $AB = 3C$ . CD is drawn perpendicular to AC to meet the line through A parallel to  $5x = 7 - y$  at D.

(7 marks)

2. Find the coordinates of A, B and C.

(9 marks)

b. State the equations of CD and AD. Hence find the coordinates of D.

(4 marks)

c. Calculate the area of the triangle ACD.

Continued/...



9.

- a. The vertices of a triangle ABC have position vectors  $(2\mathbf{i} - 3\mathbf{j})$ ,  $(\mathbf{i} + 2\mathbf{j})$  and  $(4\mathbf{i} - \mathbf{j})$  respectively.

- Find the vector  $\overrightarrow{AB}$ .
- If L and M are the position vectors of the mid points of AB and AC respectively, find L and M.
- Hence, find the vector LM.

(9 marks)

- b. Relative to an origin O, the position vectors of two points A and B are

$$\vec{a} = \begin{pmatrix} 1 \\ 0 \\ -2 \end{pmatrix} \text{ and } \vec{b} = \begin{pmatrix} 0 \\ 2 \\ 1 \end{pmatrix} \text{ respectively.}$$

- If the unit vector  $\vec{u} = \begin{pmatrix} a \\ b \\ c \end{pmatrix}$  is perpendicular to both  $\vec{a}$  and  $\vec{b}$ , find  $a$ ,  $b$  and  $c$ .
- If a third point C lies on the line AB and divides it in the ratio  $AC:CB = 2:1$ , find the cosine of the angle COB.

(11 marks)

10.

- a. A particle P, of mass 2 kg is at rest at the origin O. The forces  $F = (4\mathbf{i} + 3\mathbf{j})$  and  $G = (2\mathbf{i} + \mathbf{j})$  act simultaneously on P. Calculate the distance the particle has travelled after 4 seconds.

(4 marks)

- b. A particle moves along a straight line and the distance from a fixed point O on the line is given by  $S = 2t^3 - 15t^2 + 36t + 4$  metres at time  $t$  seconds.

- sketch the velocity-time graph.
- calculate the time at which the particle is at rest.
- calculate the velocity at  $t = 1$ .
- calculate the acceleration at  $t = 1$ .

(16 marks)

**END OF QUESTION PAPER**

NB: This paper contains 4 pages.

