

Wednesday 8 November

Subject Number: M132/II

Time Allowed: 2 h 30 mins
8:30 – 11:00 am

PAPER II
(100 marks)

Instructions

1. This paper contains 6 pages. Please check.
2. Answer all six questions in Section A and 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 a question 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
end of each question (or part of a question).
9. Write your Examination Number on each of your answer sheets.

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Turn over

Section A (60 marks)

Answer all six questions in this section.

1. The position vectors of points A, B and C are $3\mathbf{i}+5\mathbf{j}$, $4\mathbf{i}+7\mathbf{j}$ and $6\mathbf{i}+11\mathbf{j}$ respectively. Show that the points are collinear. (5 marks)
2. Points A, B and C lie on a straight line such that B is the mid point of AC. If points A and B have co-ordinates $(-1, 0)$ and $(2, 4)$ respectively, find the co-ordinates of point C. (7 marks)
3. a. A particle P of mass 3 kg is initially at rest at a point D whose position relative to origin O is $\vec{OD} = (i+2j)$ metres. If force $\vec{F} = (9i+3j)$ Newtons acts on P, calculate the displacement of the particle after 2 seconds. (6 marks)
- b. Find the equation of a straight line passing through point $(4, -3)$ perpendicular to $y = 2x - 1$. (5 marks)
4. a. The position vectors of points P and Q relative to origin O are $\begin{pmatrix} 5 \\ 2 \end{pmatrix}$ and $\begin{pmatrix} 1 \\ -4 \end{pmatrix}$, respectively. If R is a point such that $\vec{OP} = 3\vec{OQ} + 2\vec{OR}$, find the position vector of R. (5 marks)
- b. Figure 1 shows a venn diagram representing the probabilities of Kondwani and Maliya playing a game on Saturday.

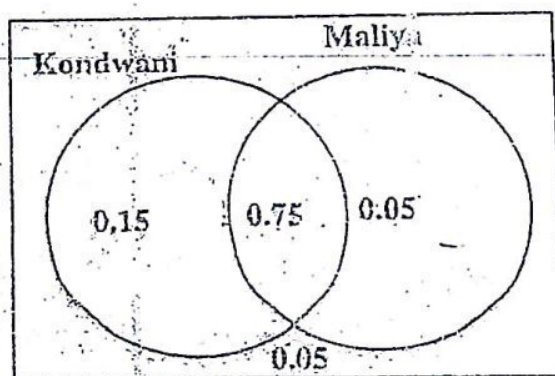


Figure 1

Find the probability that;

- (i) Kondwani plays the game on Saturday.

(3 marks)

Continued/..

4. b. (Continued)

(ii) Maliya does not play the game on Saturday. (3 marks)

(iii) Kondwani plays the game given that Maliya is playing on Saturday. (4 marks)

5. A particle, initially at a point O, moves in a straight line. Its displacement, in metres, from O after t seconds is given by $S = 2t^3 - 21t^2 + 60t$.

Calculate the:

a. times the particles is momentarily at rest. (6 marks)

b. initial velocity of the particle. (4 marks)

c. acceleration of the particle after 3 seconds. (4 marks)

6. A random sample of ages for n students gave the following statistics:

$\bar{X} = 25$, $\sum x = 200$ and $\sum (x^2 - 2x\bar{x} + (\bar{x})^2) = 212$ where x represent student ages.

Calculate the:

a. number of students; (4 marks)

b. standard deviation of the student age. (4 marks)

Section B (40 marks)

Answer any two questions from this section.

7. a. Triangle OQR has points X and Y on OR and QR, respectively.

If $RX:XO = RY:YQ = 1:3$, $\vec{RQ} = \underline{p}$ and $\vec{OR} = \underline{r}$, show that vector XY is parallel to vector OQ. (5 marks)

Four forces simultaneously act on a stationary particle as follows:
2 Newtons due west, 1 Newton in the direction $N61^\circ W$, 7 Newtons in the direction $N46^\circ E$ and 1 Newton due south.

Calculate the magnitude and direction of the resultant force. (15 marks)

Continued/...

- a. A fair die is tossed 5 times. Calculate the probability that a number less than 3 appears exactly 4 times. (5 marks)
- b. Figure 2 is a bar chart showing percentages of females and males who attended a workshop in Zomba, Lilongwe and Mzimba districts. Of the 1 200 people who attended the workshop, 25%, 40% and 35% were from Zomba, Lilongwe and Mzimba districts respectively.

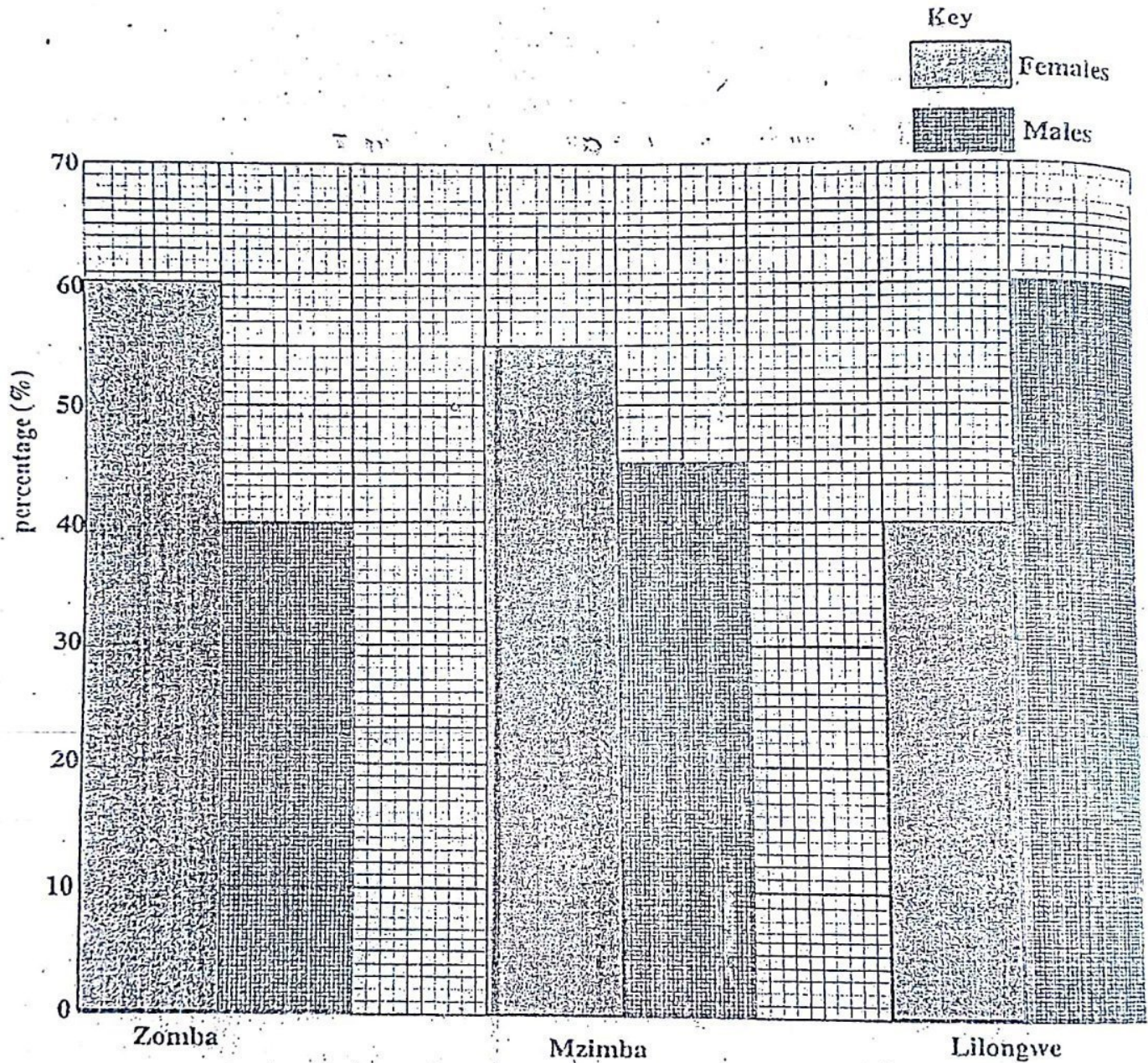


Figure 2

Continued/...

8. a. b. (Continued)

(i) Calculate the number of people who attended the workshop in each district. (6 marks)

(ii) Find the district which had the highest number of females that attended the workshop. (5 marks)

c. In a class of 40 students, 18 students like Mathematics while 16 students like English. If 6 students like both Mathematics and English, find the probability that a student chosen at random likes Mathematics or English. (4 marks)

9. a. Points A and B are (1, 1, 1) and (13, 4, 5) respectively.

(i) Find $\vec{AB}$. (3 marks)

(ii) Calculate the length of $\left| \frac{1}{13} \vec{AB} \right|$. (4 marks)

b. The table below shows the distances travelled by a moving body after time t minutes.

Time (t minutes)	0	5	10	15	20	25	30
Distance (km)	0	10	15	19	22	24	25

(i) Using a scale of 2 cm to represent 5 units on the horizontal axis and 4 cm to represent 5 units on the vertical axis, draw the distance-time graph.

(ii) Use the graph to estimate the average velocity of the body

(1) during the first 5 minutes.

(2) during the last 5 minutes.

Hence

(3) estimate the acceleration of the body between the first and the last 5 minutes. (13 marks)

Continued/...



10. Given the equation of a circle $x^2 + y^2 - 2x - 2y = 7$ and that of a line $3x + 4y = 7$, find the:

- a. centre of the circle. (4 marks)
- b. equation of the line, L , passing through the centre of the circle perpendicular to the line $3x + 4y = 7$. (5 marks)
- c. Coordinates of the points where line L intersects the circle. (11 marks)

END OF QUESTION PAPER

NB: This paper contains 6 pages.

