



THE MALAWI NATIONAL EXAMINATIONS BOARD

2005 MALAWI-SCHOOL CERTIFICATE OF EDUCATION EXAMINATION

MA

ADDITIONAL MATHEMATICS

Monday 31 October

Subject Number: M132/I

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

PAPER I (100 marks)

Instructions

1. This paper contains 4 pages. Please check.
 2. Answer all seven 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).
- Write your Examination Number on each of your answer sheets.

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Turn over





THE MALAWI NATIONAL EXAMINATIONS BOARD

2004 MALAWI SCHOOL CERTIFICATE OF EDUCATION EXAMINATION

ADDITIONAL MATHEMATICS

Tuesday 26 October

M2

Subject Number: M132/I

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

PAPER I (100 marks)

Instructions

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

Write your Examination Number on each of your answer sheets.

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Section A (60 marks)

Answer all seven questions in this section.

1. a. If $f(x) = 4x$ and $g(x) = 1 + x^2$, find $g\{f(x)\}$. (4 marks)

- b. Given that $f(x) = x^2$, simplify $\frac{f(a+h) - f(a)}{h}$. (5 marks)

2. Find the coefficient of the term with x^{10} in the expansion of $(2x + y)^{14}$. (4 marks)

3. a. Solve the inequality $6 - x - x^2 \leq 0$. (6 marks)

- b. Sketch the graph of $y = 6 - x - x^2$ and illustrate the solution of $6 - x - x^2 \leq 0$ on the graph. (3 marks)

4. Solve the equation $6\cos^2 B - \sin B = 5$ for values of B between 90° and 270° . (6 marks)

5. a. Differentiate $y = \sqrt{x^3 + 1}$ with respect to x . (5 marks)

- b. (i) Evaluate the integral $\int_1^2 (x^4 - \sqrt[3]{x^2}) dx$, leaving your

answer correct to 3 significant figures. (6 marks)

- (ii) Evaluate the following integral:

$$\int_0^{\pi/2} (2 - 2\sin t) dt.$$

$$\frac{14 \cdot 13 \cdot 12 \cdot 11 \cdot (2x)^{10} y^4}{1 \cdot 2 \cdot 3 \cdot 4} = 24024$$

6. a. If $V = t^2 - 5$, approximate the change in V when t changes from 10 to 9.99, using a calculus technique. (5 marks)

- b. Show that $\frac{d}{dx}(\sin x \cos x) = 2\cos^2 x - 1$. (5 marks)

7. In a circle of diameter 20 cm, a chord 12 cm long is drawn. Calculate, in radians, the angle the chord subtends at the centre of the circle. (6 marks)

Cont.

$$2x + 2\cos t$$

$$\left(2\pi/3 + 2\cos \pi/3 \right) -$$

$$\frac{1}{5} - \frac{3}{9}$$

$$- \frac{2}{9}$$

Section B (40 marks)

Answer any two questions from this section.

- a. Given the function $f(x) = x^2 + px + p - 1$, has a minimum value of 0, find, by completing the square:

- (i) the value of x in terms of p at the minimum point.
(ii) the value of p .

(11 marks)

- b. Figure 1 shows two curves $y = x^2$ and $y = x^3$ intersecting at $x = 0$ and at point $x = A$.

$$+ px + p - 1$$

$$+ px + p + \left(\frac{p}{2}\right) - 1 - \left(\frac{p}{2}\right)^2$$

$$+ \left(\frac{p}{2}\right)^2 - 1 - \frac{p^2}{4}$$

$$y = x^2$$

$$\frac{p^2}{4} = 0$$

$$2 = 1$$

$$2 = -4$$

$$2 = -2$$

$$\frac{2}{3} + 1$$

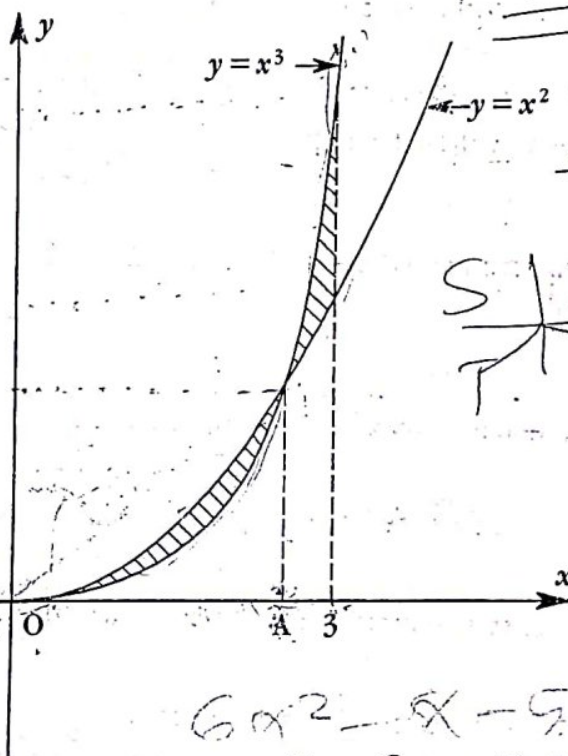


Figure 1

$$\frac{dy}{dx} =$$

- (i) Find the value of A .
(ii) Calculate the area of the shaded region between $x = 0$ and $x = 3$.

(9 marks)

- a. Given that $y = \frac{2}{x^2}$ and $T = x - 2y$, find the value of x for which

T is maximum and hence find the maximum value of T .

(9 marks)

$$T = x - 2y$$

$$T = x - 4x^{-2}$$

$$\frac{dT}{dx} = 1 + 8x^{-3}$$

$$1 + 8x^{-3} = 0$$

$$8x^{-3} = -1$$

$$x^{-3} = -\frac{1}{8}$$

$$x = -\sqrt[3]{\frac{1}{8}}$$

$$x = -\frac{1}{2}$$

Continued/...

$$\frac{1}{5} - \frac{3}{9}$$

$$4.495 + 0$$

9. (Continued)

- b. Figure 2 shows two equal circles intersecting at X and Y such that their centres A and B are on the circumference of the other.

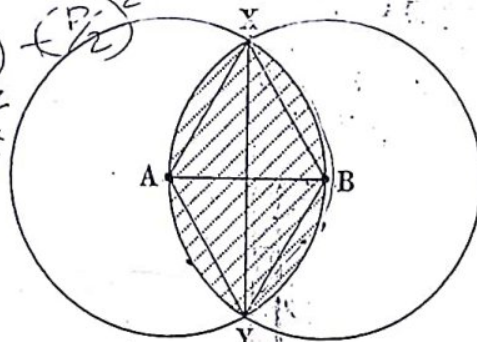


Figure 2

If the radius of each circle is 6 cm, calculate the area of the overlap. (11 marks)

$$y = x^2 + px + p - 1$$

$$= x^2 + px + \left(\frac{p}{2}\right)^2 + (p-1) - \left(\frac{p}{2}\right)^2$$

$$= \left(x + \frac{p}{2}\right)^2 + (p-1) - \frac{p^2}{4}$$

$$\sin \theta = \frac{6}{10}$$

$$= 0.6$$

$$= 73^\circ 44'$$

$$\frac{x}{r} = \frac{180}{73^\circ 44'}$$

$$x = \frac{73^\circ 44' \times 180}{180} = 0.41$$

10. a. For what values of x does the inequality $\frac{3x}{x-1} > 3$ hold? (4 marks)

- b. The table below contains information for the function $y = 2\sin(x - 30)^\circ$.

$\angle(^\circ)$	0	30	60	90	120	150	180	210	240	270	300	330	360
y	-1.00		1.00		2.00	1.73	1.00	0	-1.00	-1.73		-1.73	-1.00

- (i) Calculate the missing values in the table. (4 marks)

- (ii) Using a scale of 2 cm to represent 1 unit on vertical axis, and 2 cm to represent 60° on horizontal axis, plot a graph of $y = 2\sin(x - 30)^\circ$. (6 marks)

- (iii) Use your graph to

- (1) find the range of values of x in which $2\sin(x - 30)^\circ > 0$. (2 marks)

- (2) solve the equation $\sin(x - 30)^\circ + \frac{1}{4} = 0$. (4 marks)

11. a. Given that $\frac{d}{d\theta}(\theta \sin \theta) = \sin \theta + \theta \cos \theta$, evaluate $\int_0^{\frac{\pi}{2}} \theta \cos \theta \, d\theta$. (7 marks)

- b. The table below shows values of x and y obtained from an experiment.

x	0.2	0.5	1	2	5
y	100	16	4	1	0.16

$$y = ax^b$$

If it is known that the relationship between x and y is $y = ax^b$ where a and b are constants, draw a suitable graph to determine the values of the constants a and b .

(13 marks)

$$\log y = b \log x + \log a$$

END OF QUESTION PAPER

NB: This paper contains 4 pages.