



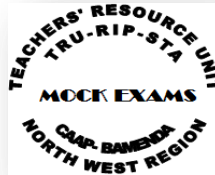
REPUBLIQUE DU CAMEROUN
Paix-Travail-Patrie

MINISTÈRE DES ENSEIGNEMENTS SECONDAIRES

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MINISTRY OF SECONDARY EDUCATION

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MARCH 2021

The Teachers' Resource Unit and the Regional Inspectorate of Pedagogy in collaboration with MTA	SUBJECT CODE NUMBER 0770	PAPER NUMBER 2
GENERAL CERTIFICATE OF EDUCATION REGIONAL MOCK EXAMINATION	SUBJECT TITLE MATHEMATICS WITH STATISTICS	
ADVANCED LEVEL		

Time Allowed: THREE hours
INSTRUCTIONS TO CANDIDATES

Mobile phones are **NOT ALLOWED** in the examination room.

Answer ALL TEN questions

Full marks may be obtained for answers to ALL questions.

For your guidance, the appropriate mark for each part of a question is indicated in brackets.

Mathematical formulae Booklets published by the Cameroon GCE Board are allowed.

In calculations, you are advised to show all the steps in your working, giving the answer at each stage.

Calculators are allowed.

Start each question on a new page.

You are reminded of the necessity for good English and orderly presentation in your answers.

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1. (i) Given that $P(x) = 2x^3 - 3x^2 + ax + b$ leaves a remainder of -20 when divided by $(x + 2)$ and that $(x - 2)$ is a factor of $P(x)$.

Find

- (a) The values of a and b . (5 marks)
 (b) The remainder when $P(x)$ is divided by $(x^2 - 4)$. (2 marks)
 (ii) Given that $\log_x y + 3 \log_x 2 = 5$, express y in terms of x . (3 marks)

2. (i) Given that α and β are the roots of the equation $x^2 - 3x + 5 = 0$, find an equation whose roots are $\frac{\alpha-1}{\beta}$ and $\frac{\beta-1}{\alpha}$. (4 marks)

(ii) The table below shows the values of two variables obtained from an experiment.

x	1.659	3.801	5.248	8.708	16.595	19.960
y	10.317	6.596	5.630	4.512	3.585	3.380

The variables x and y are related by an equation of the form $y = 2 + \lambda x^a$. By drawing a suitable graph of $\log_{10}(y - 2)$ against $\log_{10} x$, estimate the values of λ and a correct to 2 decimal places. (8 marks)

3. (i) Express $f(\theta)$ where $f(\theta) \equiv \cos\theta - \sqrt{3}\sin\theta$ in the form $R\cos(\theta + \lambda)$ where $R > 0$ and λ is an acute angle.

Hence, find the maximum and minimum values of $\frac{5}{f(\theta)+7}$ (6marks)

- (ii) (a) Prove that $\sec 2A + \tan 2A \equiv \frac{\cos A + \sin A}{\cos A - \sin A}$, $A \neq (2n + 1)\frac{\pi}{4}$, $n \in \mathbb{Z}$ (3marks)

Hence (b) solve for $0^\circ \leq x \leq 360^\circ$, the equation $\sec 2x + \tan 2x = \frac{1}{2}$ (3 marks)

4. (i) Find the expansion of $\frac{1}{(2+5x)^3}$, $\left|\frac{5x}{2}\right| < 1$, in ascending powers of x , up to and including the term in x^2 , giving each coefficient as a fraction in its lowest term. (3 marks)

- (ii) A committee of three people is to be selected from eight club members. Find the number of Committees that can be formed if two particular members cannot both be on the committee. (3 marks)

(iii) Prove by mathematical induction that $3^n + 2n + 3$ is divisible by 4 for all positive integers n . (5marks)

5. (i) Solve in the form $y = f(x)$ the differential equation $(x + 1)\frac{dy}{dx} = (x + 2)y$, given that $y = 2$ when $x = 1$ (5marks)

- (ii) Figure 1 shows a shaded region in the xy -plane bounded by the curve $y = x(x - 3)^2$, the x -axis and the lines $x = 1$ and $x = 4$. The unit of length is cm.

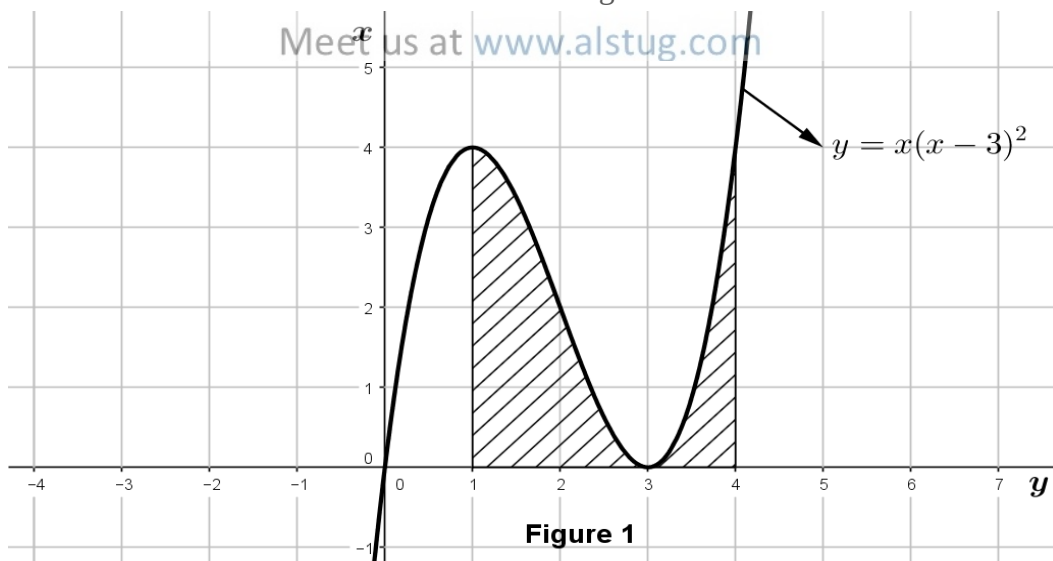


Figure 1

Find the area of this shaded region. (3marks)

6. (i) Given the line $\frac{x-2}{2} = \frac{y-1}{2} = \frac{z}{1}$ and the plane $3x - 2y + 2z + 4 = 0$, find

(a) the measure, to two decimal places, of the acute angle between the line and the plane,

(4marks)

(b) the coordinates of the point of intersection of the line and the plane.

(4marks)

(ii) Two circles S_1 and S_2 are given by the following equations:

$$S_1: x^2 + y^2 - 10x + 4y - 7 = 0$$

$$S_2: x^2 + y^2 + 14x - 6y + 9 = 0$$

Show that S_1 and S_2 touch externally.

(3marks)

7. (i) Find the values between which the expression $\frac{x^2-4x+3}{x^2+3}$, $\in \mathbb{R}$, lies.

(3marks)

(ii) Given that $z = \cos\theta + i\sin\theta$ use De Moivre's theorem to show that

$$\sin n\theta = \frac{1}{2i} \left(z^n - \frac{1}{z^n} \right) \text{ and } \cos n\theta = \frac{1}{2} \left(z^n + \frac{1}{z^n} \right)$$

(3marks)

Hence express $\sin^2\theta \cos^4\theta$ in the form $A + B\cos 2\theta + C\cos 4\theta + D\cos 6\theta$ where

A, B, C and D are real constants.

(4marks)

8. The function g is defined by

$$g(x) = \frac{2x-1}{x+3}, \quad x \in \mathbb{R}, x \neq -3$$

(a) Show that g is injective.

(3 marks)

(b) Sketch the curve $y = g(x)$, showing clearly the behavior of the curve as it approaches its asymptotes.

(5 marks)

9. (i) Given that $x = 3 \cos \theta$, $y = 2 \cos(\theta - \frac{\pi}{6})$ show that $\frac{dy}{dx} = \frac{1}{3}(\sqrt{3} - \cot \theta)$

(5marks)

(ii) Given that $f(x) = e^x - 3x$

(a) Show that a root, α , of the equation $f(x) = 0$ lies in the interval $1 < x < 2$

(3marks)

(b) With $x = 1.5$ use one iteration of Newton-Raphson procedure to find, to two decimal places, an approximate value of α .

(3marks)

10. (i) A relation R is defined on the set of integers by

$$aRb \Leftrightarrow a^2 + b^2 = (a+b)^2 - 2ab$$

Show that R is symmetric

(3marks)

(ii) Find the inverse of the matrix $\begin{pmatrix} 2 & -3 & 2 \\ 1 & 4 & -1 \\ 5 & 2 & 1 \end{pmatrix}$.

Hence solve the system of equations $\begin{cases} 2x - 3y + 2z = 2 \\ x + 4y - z = -4 \\ 5x + 2y + z = -2 \end{cases}$

(9marks)

END



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