PURE MATHS WITH STATISTICS 2
0770

GOVERNMENT BILINGUAL HIGH SCHOOL YAOUNDE

MOCK GCE

APRIL 2021 **ADVANCED LEVEL**

Subject Title	**PURE MATHS WITH STATISTICS**
Paper Number	**PAPER 2**
Subject Code	**0770**

THREE HOURS

Full marks may be obtained for answers to **ALL** questions. All questions carry equal marks

Mathematical formulae booklets published by the CGCE Board are allowed

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

Calculators are allowed

Start each question on a fresh page.

TURN OVER

1. The polynomial $f(x) = 2x^3 + px^2 + qx - 30$ leaves a remainder -28 when divided by $(x-1)$ and a remainder 66 when divided by $(x-3)$
   (a) Find the values of the constants p and q
   (5marks)
   (b) Given that the $(x-2)$ is a factor of $f(x)$, factorise $f(x)$ completely.
   (5marks)

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2. (i) The roots of a quadratics equation $2x^2 - x + 6 = 0$ $are\ \alpha\ and\ \beta$. Find the quadratic equation with integral coefficients whose roots are $\alpha - 2\beta\ and\ \beta - 2\alpha$.
   (4marks)
   (ii) Find the value of the constant k for which the quadratic equation $x^2 + (2-k)x + 2(2-k) = 0$ has complex roots.
   (3marks)

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3. (i) A function f is defined by $f: x \mapsto \frac{2x+1}{x-4}, x \in \mathbb{R}, x \neq 4$.
   (a) Show that f is injective.
   (b) Find the inverse function $f^{-1}(x)$, stating its domain.
   (4marks)
   (c) Prove by mathematical induction that $\sum_{r=1}^{n}(4r+3) = 2n^2 + 5n$.
   (4marks)

   (ii) A relation R is defined on a set of integers by: $aRb \Leftrightarrow a + b = 2m + 1$ where m is an integer. Show that R is an equivalence relation.
   (4marks)

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4. (i) S_1 and S_2 are two concentric circles with center A. The radius of S_1 is three times the radius of S_2. Given that the equation of $S_1 : x^2 + y^2 + 2x - 4y - 31 = 0$. Find
   (a) An equation of the circle S_2
   (b) An equation of the circle with OA as diameter where O is the origin.
   (6marks)
   (ii) Of Peter's 13 friends, 7 are older than him. In how many ways can he invite 6 friends including at least 4 older friends.
   (5marks)

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5. Express $4sin\theta - 3cos\theta$ in the form $Rsin(\theta - \beta)$, where $R > 0$ and $\beta\ is\ acute$. Hence or otherwise, find all the solution of the equation $4sin\theta - 3cos\theta = 3$ in the interval $0° \leq \theta \leq 360°$ giving your answer to the nearest degree
   Determine the greatest and least values of $\frac{1}{4sin\theta - 3cos\theta + 6}$
   (11marks)

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6. (i) Find the coefficient of x^5 in the binomial expansion of $\left(\frac{x^2}{2} - \frac{3}{x^2}\right)^{10}$
(5marks)
(ii) The ninth term of an arithmetic progression is three times the third term. If the sum of the first four terms is 30, find the first term and the common difference of the progression.
(6marks)

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7. Find $\frac{dy}{dx}$ if
(a) $y = \ln\left(\frac{3+x}{3-x}\right)$ (3marks)
(b) $y = arctan\left(\frac{1-x}{1+x}\right)$
(3marks)
(c) $cos2y + xy^2 = 7x$
(2marks)

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8. (i)Express $f(x) = \frac{x-1}{(x+2)(x+1)}$ in partial fractions.
Hence or otherwise evaluate
$\int_1^3 f(x)\, dx$ (7marks)

(ii) Evaluate $\int_0^{\frac{\pi}{2}} sin^4 x\, dx$ (4marks)

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9. The vector equation of two lines L_1 *and* L_2 are given by
L_1: r= $i - j + 3k + \lambda(i - j + k)$
L_2: r= $2i + aj + 6k + \mu(2i + j + 3k)$, where a, λ and μ are real constants.

Given that the lines L_1 and L_2 intersect, find

(a) The value of the constant a.
(5marks)
(b) The position vector of the point of intersection of lines $L_{1\,and}\,L_2$.
(3marks)
(c) The cosine of the acute angle between lines $L_{1\,and}\,L_2$.
(3marks)

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10. Given that **A** = $\begin{pmatrix} 1 & -1 & 1 \\ 0 & 2 & -1 \\ 2 & 3 & 0 \end{pmatrix}$ and **B** = $\begin{pmatrix} 3 & 3 & -1 \\ 0 & -2 & 1 \\ -4 & -5 & 2 \end{pmatrix}$ are two matrices.
Find the matrix product **AB** and **BA**.
State the relationship between **A** and **B**.

Find also the matrix product **BM**, where $\mathbf{M} = \begin{pmatrix} 8 \\ -7 \\ 1 \end{pmatrix}$

Hence solve the system of equations

$$\begin{aligned} x - y + z &= 8 \\ 2y - z &= -7 \\ 2x + 3y &= 1 \end{aligned}$$

(10marks)

STOP. GO BACK AND CHECK YOUR WORK