INTERIM JOINT MATRICULATION BOARD
AHMADU BELLO UNIVERSITY
ZARIA

INTERIM JOINT MATRICULATION BOARD EXAMINATION 2016

SUBJECT: 'A' LEVEL MATHEMATICS PAPER I
DATE SCHEDULED: SATURDAY 20TH FEBRUARY, 2016
TIME ALLOWED: TWO HOURS (2 HRS)

Instructions:
(i) Unless otherwise restricted, the use of mathematical tables is PERMITTED.
(ii) Use of SCIENTIFIC calculator is ALLOWED.
(iii) Marks for each question are indicated at the end.
(iv) Do not spend more than HALF (1/2) HOUR on section A.
(v) Attempt ALL questions in section A; and FOUR (4) questions from other sections, choosing at least
ONE (1) question from each of sections B and C.

SECTION A (20%)

1. Given that $\sin 30^0 = \frac{1}{2}$, obtain in surd form $\tan 15^0$. [04marks]

2. Express $\frac{\sqrt{3}+\sqrt{2}i}{\sqrt{3}-\sqrt{2}i}$ in the form $x+iy$. [04marks]

3. Obtain the quadratic equation whose roots are the reciprocals of the roots of the equation $ax^2+x+c=0$. [04marks]

4. What is the remainder when the polynomial $3x^3-2x^2+6x-1$ is divided by $(x+1)$? [04marks]

5. Show that $\sin\phi = \frac{2\tan\frac{\phi}{2}}{1+\tan^2\frac{\phi}{2}}$ [04marks]

SECTION B: ALGEBRA

6. (a) Prove by mathematical induction that

(i) $1^3+2^3+3^3+\ldots+n^3 = \frac{n^2(n+1)^2}{4}$

(ii) $4^{2n}-1$ is a multiple of 5. [10marks]

(b) The polynomial px^3+3x^2+3x+q has a remainder $19x-11$ when divided by x^2-3x+2. Find thevalues of p and q. With these values of p and q factorize the polynomial into linear factors. [10marks]

7. (a) Solve the inequality $\frac{(x-1)(x+3)}{x+2}\geq 0$ [12marks]

(b) If the roots of the quadratic equation $cx^2+ax-b=0$ are α and β, obtain the quadratic equation whose roots are $\frac{\alpha^2}{\beta},\frac{\beta^2}{\alpha}$. [08marks]

8. (a) Given that $A=\begin{pmatrix}1&0&0\\2&1&0\\3&2&1\end{pmatrix}$ and $B=\begin{pmatrix}1&-1&2\\0&1&-1\\0&0&1\end{pmatrix}$, show that $(A+B)^2\neq A^2+2AB+B^2$. [11marks]

(b) Resolve $\frac{x^2+1}{x(x-1)(x+1)}$ into partial fractions. Hence obtain its binomial expression up to term in x^3. [09marks]

SECTION C: TRIGONOMETRY AND COMPLEX NUMBERS

9. (a). Find roots of the equation $Z^5-1=0$ where $Z=x+iy$ [10marks]

(b).Express $\tan 3\theta$ in terms of $\tan\theta$. [10marks]

10. (a) If $\cos(x+\theta)=\cos(x-\phi)$, find $\cot x$ in terms of θ and ϕ. [08marks]

(b). If $\sin A=\frac{-4}{5}$ and $\cos B=\frac{12}{13}$ where A and B are both in quadrant IV, find without using tables, the values of (i) $\cos(A+B)$; (ii) $\sin(A-B)$. [12marks]

11. (a) Describe the locus defined by $|Z+i|=2|3Z+i|$ where $Z=x+iy$. [12marks]

(b). Express $12\sin\theta-5\cos\theta$ in terms of $R\sin(\theta-\alpha)$ and hence solve the equation $12\sin\theta-5\cos\theta=6.5$ for $0\leq\theta\leq 360^0$. [08marks]