Premicah

INTERIM JOINT MATRICULATION BOARD
AHMADU BELLO UNIVERSITY
ZARIA

INTERIM JOINT MATRICULATION BOARD EXAMINATION 2016

SUBJECT: 'A' LEVEL MATHEMATICS PAPER II
DATE SCHEDULED: TUESDAY 16TH 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. Differentiate $\cos^{-1}\left(\frac{1-x}{1+x}\right)$. You may simplify your answer. [04marks]

2. Evaluate $\lim_{x\to 9}\left(\frac{x-9}{\sqrt{x}-3}\right)$. [04marks]

3. Find the values of β such that $\beta\mathbf{i}-2\mathbf{j}-\beta\mathbf{k}$ is perpendicular to $\beta\mathbf{i}+4\mathbf{j}-\beta\mathbf{k}$. [04marks]

4. Solve the equation $\frac{dy}{dt}=t^2(1+y)$. [04marks]

5. Evaluate $\int_0^2 \frac{7x}{10+x^2}dx$. [04marks]

SECTION B: CALCULUS

6. (a). Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $(1,1)$ if $\frac{(x-h)^2}{a^2}+\frac{(y-k)^2}{b^2}=1$. [10marks]

(b). If $y=e^{5x}\sin 4x$, show that $y''-10y'+41y=0$. [10marks]

7. (a). Differentiate from first principle $y=100+3x-5x^3$. [10marks]

(b). Find $\int \frac{(x^2+1)dx}{x(x-1)(x+1)}$. [10marks]

8. (a). If $y = \sinh(k\sin^{-1}x)$, show that $(1-x^2)y'' - xy' - k^2y = 0$. [06marks]

(b). Using integration by parts, show that $nI_n = \sin x\cos^{n-1}x + (n-1)I_{n-2}$, given that $I_n = \int \cos^n x dx$. Hence evaluate $\int_0^{\frac{\pi}{2}} \cos^5 x dx$. [14marks]

SECTION C: DIFFERENTIAL EQUATIONS AND VECTORS

9. (a). Solve the equation $(2x-y)dx - ydy = 0$. [12marks]

(b). The vertices of ΔABC are represented by the vectors $2\mathbf{i}+\mathbf{j}+\mathbf{k}$, $\mathbf{i}-2\mathbf{j}+\mathbf{k}$ and $\mathbf{i}+\mathbf{j}-2\mathbf{k}$, respectively. Show that ΔABC is an isosceles triangle and obtain its area. [08marks]

10. (a). Calculate the unit vector in direction of the sum of the vectors $\mathbf{a} = 3\mathbf{i}-\mathbf{j}+3\mathbf{k}$ and $\mathbf{b} = 3\mathbf{i}+\mathbf{j}-\mathbf{k}$. Hence obtain the angle between it and vectors $\mathbf{a}$. [10marks]

(b). Solve the equation $y\frac{dy}{dx} = xe^{x^2-3y^2}$. [10marks]

11. (a). Solve the equation $(x+2)\frac{dy}{dx} - 2y = (x+2)^{-1}$. [10marks]

(b).Given that $\mathbf{p} = \mathbf{i}+3\mathbf{j}+2\mathbf{k}$ and $\mathbf{q} = \mathbf{i}-3\mathbf{j}-3\mathbf{k}$, find the projection of the vector $\mathbf{p}-2\mathbf{q}$ on $2\mathbf{p}+\mathbf{q}$. [10marks]