UNIVERSITY COLLEGE LONDON

University of London

EXAMINATION FOR INTERNAL STUDENTS

For The Following Qualifications:-

B.A. *B.Eng.* *B.Sc.*

Mathematics A1A: Elementary Mathematics 1

COURSE CODE	:	**MATHA01A**
UNIT VALUE	:	**0.50**
DATE	:	**13-MAY-04**
TIME	:	**14.30**
TIME ALLOWED	:	**2 Hours**

04-C0904-3-50

TURN OVER

All questions may be attempted but only marks obtained on the best **five** *solutions will count.*
The use of an electronic calculator **is** *permitted in this examination.*

1. Simplify the following expressions.

(a) $\dfrac{(x-y)(x^3-4y)(x+y)(xy-1)}{(x+5y)(x^2-y^2)}$.

(b) $\left((\sqrt[3]{x})^2 \dfrac{y^5}{\sqrt[3]{z}}\right) \dfrac{\sqrt[3]{x}}{(x\, z^{1/3}\, y)^2}$.

(c) $x(x-y+xy)^2-(x-y)^3-y(y-x)^2$.

2. (a) Find the points where the curve $y^2+20x+4y-60=0$ meets the y-axis.

(b) Write the equation of the straight line passing through the points $(2,3)$ and $(-1,4)$.

(c) Write the equation of the straight line passing through the point $(2,-4)$ and perpendicular to the line $5x+3y-8=0$.

3. (a) Find the values of $\sin\theta$ and $\cos\theta$, given $\tan\theta=-3/4$.

(b By using the formulas for the summation and subtraction of angles, show that

(i) $2\cos\theta\cos\phi=\cos(\theta+\phi)+\cos(\theta-\phi)$, and verify the identities

(ii) $\sin 2\theta = 2\sin\theta\cos\theta$ and (iii) $1=\sin^2\theta+\cos^2\theta$.

(c) Find exact values of the following expressions:

(i) $\cos(12\pi)$; (ii) $\tan(\frac{17\pi}{4})$; (iii) $\sin(\frac{5\pi}{2})$.

4. Differentiate the following expressions with respect to x.

(a) $(x^2+1)^{1/2}$.

(b) $e^x(x^2-2)$.

(c) $\log(8+x^3)$.

(d) $\cos(\sin(x^2))$.

5. (a) Write the following expressions in the form $z = a + ib$, where z is a complex number and a and b are real numbers:

(i) $z = z_1 z_2$, where $z_1 = -1 + i$, $z_2 = \frac{1}{2} - i$;

(ii) $z = z_1^{12}$, where $z_1 = \sqrt{2}(\cos\frac{\pi}{4} + i\sin\frac{\pi}{4})$.

(b) State De Moivre's Theorem and use it to prove the double-angle formulas, that relate $\sin 2\theta$ and $\cos 2\theta$ to $\sin\theta$ and $\cos\theta$.

6. (a) State the Binomial Theorem and use it to find the coefficient of x^4 in $(1+x)^{16}$.
(b) Write down Maclaurin's formula for expanding a function $f(x)$ as a power series in x and use it to find the power series for $f(x) = (1+x)^a$, a real, up to the term in x^n.

7. (a) Find the equation of the tangent and normal to the curve $y = \frac{1}{x}$ at $x = 2$.

(b) Find the critical value and determine the relative minimum and maximum values of the following functions:

(i) $f(x) = x^2 - 8x$; (ii) $f(x) = 2x^3 - 24x + 5$.

END OF PAPER