TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSISCS

DIPLOMA IN PHARMACEUTICAL TECHNOLOGY

AMA 2103: CALCULUS FOR SCIENCES

END OF SEMESTER EXAMINATION
SERIES: APRIL 2015
TIME ALLOWED: 2 HOURS

<u>**Instructions to Candidates:**</u>
You should have the following for this examination
- *Answer Booklet*
- *Mathematical Table*

This paper consist of **FIVE** questions
Answer question **ONE (COMPULSORY)** and any other **TWO** questions
Maximum marks for each part of a question are as shown

This paper consists of **THREE** printed pages

Question One (Compulsory)

a) Given the function $f(x) = x^2 + 5$. Find:

    (i) $f(5)$ **(1 mark)**

    (ii) $f(-15)$ **(2 marks)**

    (iii) $f^{-1}(x)$ **(2 marks)**

b) Use the quadratic formula to solve $2x^2 + 4x - 5 = 0$ **(2 marks)**

c) Give $A = \begin{pmatrix} 3 & 2 \\ 4 & 1 \end{pmatrix}$ find B given $A^2 = A + B$ **(2 marks)**

d) Given $S = 3t^3 + 2t^2 + t + 5$ the distance covered by a particle in time t, find:

    (i) The velocity at t = 5 seconds   **(2 marks)**

    (ii) The acceleration at t = 10 seconds   **(2 marks)**

e) Find $\int_0^2 x^8 \, dx$ **(2 marks)**

f) The velocity of an electron is given by $\alpha = \sqrt{\dfrac{2ve}{m}}$ make m the subject of the equation   **(2 marks)**

g) Differentiate from first principles given $y = x^2 + 2$ **(3 marks)**

Question Two

a) Solve $\begin{aligned} 3x + y &= 5 \\ x + 2y &= 2 \end{aligned}$ by elimination   **(3 marks)**

b) Use the chain rule to differentiate $y = (x^2 + 5)^7$ **(3 marks)**

c) Evaluate $\int_0^5 xe^x \, dx$ **(2 marks)**

d) Find the equation of the normal to the curve $y = x^2$ at x = 5   **(2 marks)**

Question Three

a) Differentiate implicitly given:
$$x^3 + 4xy^3 - y^5 = 7$$
   (i)   **(2 marks)**
$$x^2 + y^2 x = 25$$
   (ii)   **(2 marks)**

b) Find $99^2 - 1$ by using the difference of two squares **(1 mark)**

c) Find the area under the curve $y = x^2 - x + 2, \ x = -1$ and x = 2 **(1 mark)**

d) Given the points A(3, 7) and B(-4, 9) Find:

    (i) The gradient of the line segment $\overline{AB}$

    (ii) The equation of the line AB

    (iii)   The coordinates of the midpoint of the line segment $\overline{AB}$

    (iv) The length of the line segment $\overline{AB}$ **(4 marks)**

Question Four

a) Given the curve $y = x^2$ find:

    (i) The volume generated by rotating the area under the curve the x-axis, x = 1 and x = s through 360° about the x-axis **(2 marks)**

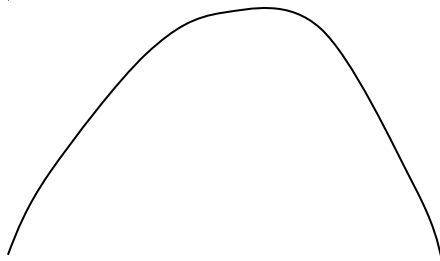   (ii) The surface area of the solid generated **(2 marks)**

b) Find the equation of the tangent to the curve $y = x^3 + 2x$ at x = 2 **(2 marks)**

c) Solve $3^x = 27$ **(2 marks)**

d) Find the exact area shown below **(2 marks)**

Question Five

a) Find:

(i) $\int \sin x\, dx$ **(2 marks)**

(ii) $\int \left(3x^3 - 4x^{\frac{1}{2}} + 5 \right) dx$ **(2 marks)**

b) Use the quotient rule to differentiate $y = \dfrac{e^r}{\cos x}$ **(2 marks)**

c) Find the inverse of $A = \begin{pmatrix} 3 & 4 \\ 1 & 2 \end{pmatrix}$ and hence use it to determine AA^{-1} **(2 marks)**

d) Find the turning points of the curve $y = x^3 - 6x + 2$ **(2 marks)**