**Uganda Advanced Certificate of Education**

Pure Mathematics Paper 1

**Time: 3 Hours**

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| ***INSTRUCTIONS TO CANDIDATES:*** * *Answer* ***all*** *the* ***eight*** *questions in Section* ***A*** *and only* ***five*** *questions in Section* ***B****.*
* *Indicate the five questions attempted in section B in the table aside.*
* *Additional question(s) answered will* ***not*** *be marked.*
* ***All*** *working* ***must*** *be shown clearly.*
* *Graph paper is provided.*
* *Silent, non-programmable scientific calculators and mathematical tables with a list of formulae may be used.*
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**SECTION A (40 MARKS)**

**Qn 1:** An arithmetic progression contains terms. The first term is 2 and its common difference is . If the sum of the last four terms is 72 more than the sum of the first four terms, find. [5marks]

**Qn 2:** Find the equation of a circle which touches the line has a centre . [5marks]

**Qn 3:** Differentiate from first principles. [5marks]

**Qn 4:** Four letters of the word “**HYPERBOLA**” are to be arranged in a row. In how many of these arrangements are the vowels separate? [5marks]

**Qn 5:** Solve for , , where . [5marks]

**Qn 6:** Prove that the integral of for between and is . [5marks]

**Qn 7:** Find the shortest distance of a point from the line . [5marks]

**Qn 8:** The surface area of a sphere is decreasing at a rate of when the radius is . Find the rate of change of the volume of the sphere at this instant. [5marks]

**SECTION B (60 MARKS)**

**Question 9:**

(a). If the roots of the equation are and ;

(i). Prove that .

(ii). Find a quadratic equation whose roots are and .

(b). (i). Given that , expand upto the term in .

(ii). By substituting in (b)(i) above, deduce the approximation of correct to 4 decimal places. [12marks]

**Question 10:**

Given that

(i). Prove that , and hence express the exact value of in the form where , and are integers.

(ii). Hence find the value of between and for which

 . [12marks]

**Question 11:**

Given the curve ;

(a). Find the:

(i). value of for which .

(ii). assymptotes for .

(iii). and intercepts for the curve.

(b). Sketch the curve. [12marks]

**Question 12:**

A point representing the complex number moves such that

(i). Prove that the locus of is a circle.

(ii). Find the centre and radius of this circle.

(iii). Represent on the argand diagram.

(iv). State the least and greatest values of . [12marks]

**Question 13:**

(a). Given two vectors and ; find:

(i). the angle between and ,

(ii). a vector that makes a right angle with and with .

(b). Find the equation of the plane passing through the points , , and find the shrotest distance of the point to the plane. [12marks]

**Question 14:**

(a). Using calculus of small increments, or otherwise, find correct to one decimal place. [4marks]

(b). Use Maclaurin’s theorem to expand where is a constant. Hence or otherwise expand up to the term in . For what value of is the expansion valid? [8marks]

**Question 15:**

A tangent to the ellipse at a point, meets the minor axis at . If the normal at meets the major axis at , find the:

(i). Coordinates of ,

(ii). Coordinates of ,

(iii). Locus of the midpoint of . [12marks]

**Question 16:**

(a). Find the general solution of

(b). A moth ball evaporates at a rate proportional to its volume, losing half of its volume every 4 weeks. If the volume of the moth ball is initially and becomes ineffective when its volume reaches , how long is the moth ball effective? [12marks]

**\*\*\*END\*\*\***