HARRISON COLLEGE INTERNAL EXAMINATION 2015
CARIBBEAN ADVANCED PROFICIENCY EXAMINATION
SCHOOL BASED ASSESSMENT
PURE MATHEMATICS
UNIT 1 – TEST 2
1 hour 20 minutes

This examination paper consists of 2 pages.
This paper consists of 6 questions.
The maximum marks for this examination is 60.

INSTRUCTIONS TO CANDIDATES

1. Write your name clearly on each sheet of paper used.
2. Answer **ALL** questions.
3. Do **NOT** do questions beside one another.
4. Unless otherwise stated in the question, any numerical answer that is not exact **MUST** be written correct to **three** (3) significant figures.

EXAMINATION MATERIALS ALLOWED

1. Mathematical formulae sheet
2. Scientific Non-programmable calculator (non-graphical)

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1. (i) Prove that

$$\frac{1}{\sin 2\theta} - \frac{\cos 2\theta}{\sin 2\theta} \equiv \tan\theta \qquad [4]$$

(ii) Hence show that $\tan 15° = 2 - \sqrt{3}$ [3]

Total: 7 marks

2. (i) Express $3\sin\theta + 4\cos\theta$ in the form $Rsin(\theta+\alpha)$, where $R > 0$ and $0° < \alpha < 90°$. [3]

(ii) Hence

(a) Solve the equation $3\sin\theta + 4\cos\theta + 1 = 0$, giving all solutions for which $-180° < \theta < 180°$ [4]

(b) Find the values of the positive constants k and c such that

$$-37 \le k(3\sin\theta + 4\cos\theta) + c \le 43$$

for all values of θ. [5]

Total: 12 marks

3. The circle C has equation $x^2 + y^2 - 8x - 16y + 72 = 0$.

(a) Find the coordinates of the centre and the radius of C. [5]

(b) Find the distance of the centre of C from the origin in the form $k\sqrt{5}$. [3]

The point A lies on C and the tangent to C at A passes through the origin O.

(c) Show that $OA = 6\sqrt{2}$. [3]

Total: 11 marks

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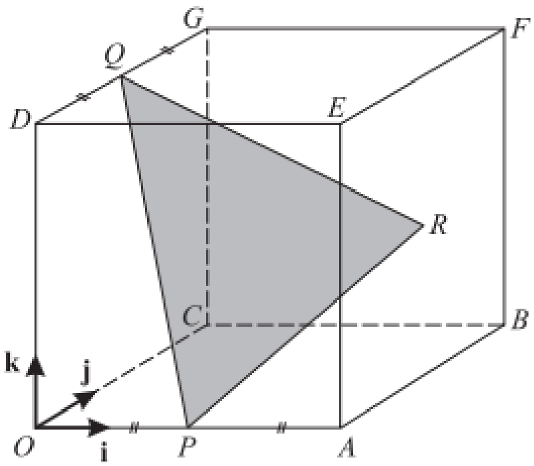
4. Given the following equation $4x^2 + 9y^2 = 36$

   (a) Find the coordinates of the *x* and *y* intercepts of the equation. [6]

   (b) Find the length of the major and minor axes. [2]

   (c) Sketch the graph of the equation. [2]

Total: 10 marks



5. The diagram shows a cube OABCDEFG in which the length of each side is 4 units. The unit vectors **i**, **j** and **k** are parallel to $\overrightarrow{OA}, \overrightarrow{OC}$ and $\overrightarrow{OD}$ respectively. The mid-points of OA and DG are P and Q respectively and R is the centre of the square face ABFE.

   (i) Express each of the vectors $\overrightarrow{PR}$ and $\overrightarrow{PQ}$ in terms of **i**, **j** and **k**. [2]

   (ii) Use a scalar product to find angle QPR. [4]

   (iii)Find the perimeter of triangle PQR, giving your answer correct to 1 decimal place.[3]

Total: 9 marks

6. The points *A* and *B* have position vectors $2i + 6j - k$ and $3i + 4j + k$ respectively.

   The line l_1 passes through the points *A* and *B*.

   (i) Find the vector $\overrightarrow{AB}$. [2]

   (ii) Find a vector equation for the line l_1. [2]

   A second line l_2 passes through the origin and is parallel to the vector $i + k$. The line l_1 meets the line l_2 at the point *C*.

   (iii)Find the position vector of the point *C*. [7]

Total: 11 marks

END OF EXAMINATION