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MTH 103 –MATHEMATICS III

FIRST SEMESTER EXAMINATION 2019.

INSTRUCTION: ANSWER ANY FOUR. TIME: 2 HOURS.

Q1. (a) Identify whether the following physical quantities should be described as vectors or scalars: Volume, Electric potential, Electric field, Heat flow.

(b) If $a = j$ and $b = 2i - 3j + k$ find $a \cdot b$ and if $a = 2i - j$ and

$$b = 3i + k, \text{ show that } a \cdot b = 6$$

(c) Find the value of λ for which the two vectors $2i - j + 2k$ and $3i + \lambda j + k$ are perpendicular.

Q2. (a) Define Dot product.

If $A \cdot B = 0$ and if A and B are not zero, show that A is perpendicular to B .

(b) Find the area of the triangle whose vertices are $(1, -1, 2)$, $(2, 1 - 2)$ and $(3, -1, 2)$

(c) If $a = 3i + 2j - 6k$ and $b = 4i - 3j + k$. Find $a \cdot b$ also find the angle between a and b .

Q3. (a) Find the equation of line through the point $(3, 2)$ and making angle 45° with the line $x - 2y = 3$

(b) Find the equation to the straight line passing through the point of intersection of the lines $5x - 6y - 1 = 0$ and $3x + 2y + 5 = 0$ and perpendicular to the line

$$3x - 5y + 11 = 0$$

(c) Find the equation of the line passing through $(1, 2)$ and perpendicular to $x + y + 7 = 0$

Q4. (a) Find the equation of a circle, in standard form, having a centre at $(3, 2)$ passing through $(-1, 1)$ on its edge.

(b) Write the standard equation for the following circle and find the centre and its radius $x^2 + y^2 + 6x - 14y - 42 = 0$

Q5. (a) Given the parabola $x = \frac{y^2}{4} + 1$, find the coordinate of the vertex and the equation of axis of symmetry.

(b) Given the equation $x = -y^2 + 1$.

(i) Find the vertex and the axis of symmetry.

(ii) Determine if the parabola opens to the right or to the left.

(iii) Graph the parabola.

Q6. (a) Find the Centre, Foci and Vertices of the ellipse

$$25x^2 + 9y^2 + 100x + 18y - 116 = 0$$

(b) Write the standard equation for the hyperbola given below:

$y^2 - 9x^2 - 6y - 36 = 36x$. Find the coordinates of the centre, vertices, co-vertices and foci.