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(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2016/2017 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER

SUPPLEMENTARY/SPECIAL EXAMINATION

FOR THE DEGREE OF BACHELOR OF EDUCATION AND BACHELOR OF SCIENCE

MATHEMATICS

COURSE CODE: MAT 122

TITLE: ELEMENTARY APPLIED MATHEMATICS

DATE: 28/09/2017 **TIME:** 8 AM- 10 AM

INSTRUCTIONS TO CANDIDATES

Answer Question **One** and **Any other TWO** Questions

TIME: 2 Hours

QUESTION ONE (30 MARKS)

(a) Two perpendicular lines L_1 and L_2 intersects at the point P (2, 4). If the gradient of L_1 is 0.5, determine the equation of L_2 in the form $y = mx + c$ (3mks)

(b) Calculate the radius and coordinates of the center of circle. (4mks)

$2x^2 + 2y^2 - 8x + 5y + 10 = 0$

(c) Find the Polar coordinate representation for the rectangular point (-1, 1) (3mks)

(d) Given two vectors $< 2, -1, 0 >$and $< 2, 4, 1 >$, find their dot product of the two vectors and hence state whether they are perpendicular or not. (3mks)

(e) A circle with centre (2, 3) passes through the point (2, 8). Determine the equation of the circle in the form $x^2 + y^2 + Dx + Ey + f = 0$ (3mks)

(f) Define the term momentum, hence determine the momentum of a motorcycle of mass 325kg moving at 140km/h (4mks)

(g) A model of a car moves round a circular path of radius 0.5m at 2 revolutions per second. Calculate;

(i) Period, T (2mks)

(ii) Angular velocity, ω (2mks)

(h) Given that $a = 2i - j + 3k$ and$b = -i + 5j - 3k$, find

(i) $|2\mathbf{a} - 3\mathbf{b}|$ (3mks)

(ii) the angle between **a** and **b** (3mks)

QUESTION TWO (20 MARKS)

(a) Convert the point $(4, \frac{\pi}{3})$ from polar to Cartesian coordinates. (2 mks)

(b) Sketch the graph of $r = \cos 2\theta$ (7mks)

(c) Given the polar equation, $r = 1 + \cos\theta$;

(i) Sketch its graph (6 mks)

(ii) Find the area of the region bounded by the curve (5 mks)

QUESTION THREE (20 MARKS)

(a) Let the vector $v = <v_1, v_2, v_3>$. Show that $v \times v = 0$ (3mks)

(b) Find the angle θ between the vectors $v$and w if $v =< 5,1,-2 >$and $w =< 4,-4,3 >$ (4mks)

(c) Write the equation of the line L through the point P_1 = (-3, 1, -4) and P_2 = (4, 4, -6) in parametric form. (3mks)

(d) (i) Show that the points P(2, 1, 3), Q(1, -1, 2) and R(3, 2, 1) are not collinear (4mks)

(ii) hence find the vector perpendicular to the plane (3mks)

(e) A line L passes through appoint (3, 7) and meets the y axis at y= 5. Find the equation of the line L_1passing through the point (-4, 5) and perpendicular to L. in the form $y = mx + C$ (3mks)

QUESTION FOUR (20 MARKS)

(a) The equation of a circle is given by $r^2 + 6r\cos\theta + 4r\sin\theta = 12$

 (i) Write the equation in rectangular coordinates (1mk)

 (ii) Hence find the center and radius of the circle. (4mks)

(b) Find the equation of a circle passing through the points (2, 1), (0, 5) and (-1,2) in the form $y = mx + C$ (9mks)

(c) The diameter of a circle meets the circumference of the circle at the points (4, 8) and (6, 16). Find;

 (i) The equation of the circle (3mks)

 (ii) Determine whether the point P(5, 20) lies inside, on or outside the circle. (3mks)

QUESTION FIVE (20 MARKS)

(a) Define moment of force (1mk)

(b) State Newton's second law of motion and hence derive the relationship Force = mass x acceleration (5mks)

(c) Show that if a particle has an initial velocity u, final velocity v and moves with an acceleration a, then its displacement, s at any time t is given by $s = ut + \frac{1}{2}at^2$ (3mks)

(d) A car that has been travelling at 60m/s is brought to a stop at constant deceleration, 180m from where the brakes have been applied. How far has the car moved when its velocity has been reduced by 10m/s? (3mks)

(e) Determine the value of α for which the vectors $\mathbf{a} = 4\alpha\mathbf{i} + \alpha\mathbf{j} - \mathbf{k}$ and $\mathbf{b} = \alpha\mathbf{i} + 2\mathbf{j} + 2\mathbf{k}$ are orthogonal (3mks)

(f) Determine if the pointe P(4, -1, 3), Q(-1, 9, 8) and R(2, 3, 5) are collinear. (5mks)