



*(Knowledge for Development)*

**KIBABII UNIVERSITY**  
**UNIVERSITY EXAMINATIONS**  
**2020/2021 ACADEMIC YEAR**  
**FIRST YEAR SECOND SEMESTER**  
**MAIN EXAMINATION**  
**FOR THE DEGREE OF BACHELOR OF EDUCATION AND**  
**BACHELOR OF SCIENCE**

**COURSE CODE:** MAA 122

**COURSE TITLE:** ELEMENTARY APPLIED MATHEMATICS

**DATE:** 16/07/21

**TIME:** 2 PM -4 PM

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**INSTRUCTIONS TO CANDIDATES**

Answer Question One and Any other TWO Questions

TIME: 2 Hours

KIBABII UNIVERSITY EXAMINATIONS

2020/2021 SEMESTER TWO

MAA 122. ELEMENTARY APPLIED MATHEMATICS: TIME 2 HRS

Attempt question one and any other two questions

QUESTION ONE

(30 mks)

(a) Define the coefficient of elastic restitution. What is the total distance travelled by a

Body of mass 2kg and with a coefficient of elastic restitution of  $\frac{1}{5}$  if it is dropped from a height of 15m when it reaches the ground the second time? What is its energy loss after first impact?

(5 mks)

(b) The equation of a circle is given as  $x^2 + y^2 + 4(x - y) + 4 = 0$ . Find:

(i) The Centre of the circle

(3 mks)

(ii) The radius of the circle and

(1 mk)

(iii) The equation of the tangent to the circle from the point  $(-2,0)$

(2 mks)

(c) A man drags a packing case of mass 80kg across a rough horizontal floor with coefficient of 0.3. What power is he exerting?

(3 mks)

(d) Write the vector equation of a plane through the points  $A(2,1,1)$ ,  $B(0,4,1)$  and  $C(-2,1,4)$ .

State the vector normal to this plane.

(5 mks)

(e) A body is projected from a point on a horizontal ground with a velocity of  $100 \text{ ms}^{-1}$  at an angle of  $\tan^{-1} \frac{3}{4}$ . Find:

(i) The velocity of the body when its height is 55m.

(4 mks)

(ii) The time when the body is 55m above the ground

(3 mks)

(iii) The distance between the two points when the body is 55m above the ground(4 mks)

QUESTION TWO

(20 mks)

(a) Sketch and identify the curve  $r = 3 - 2 \cos \theta$ ,  $0 \leq \theta \leq 2\pi$

(7 mks)

(b) The position of a vector is given by the equation  $s = f(t) = t^3 - 6t^2 + 9t$  where t is measured in seconds and s in metres.

(13 mks)

(i) Find the velocity at time t?

(ii) What is the velocity after two seconds?

(iii) When is the body at rest?

(iv) When is the body moving forward?

(v) Find the total distance travelled by the body during the first five seconds?

(vi) Find the acceleration at the time t and after 4s?

The point A(9,-2) — — —

**QUESTION THREE**

(20 mks)

- (a) A(9,-2) lies on the circumference of the circle with Centre at C(17,12), and the line AB is diameter of the circle. Find the co-ordinates of B. (6 mks)
- (b) Find the tangent lines to the parametric curve given by  $x = t^5 - 4t^3$ ,  $y = t^2$  at (0,4) hence sketch the curve. (5 mks)
- (c) An object is moving so that its K.E=150J and the absolute value of its momentum is 30kgm/s. What is the mass of the object and at what velocity is it moving? (5 mks)
- (c) Find the direction cosines, the direction angles and the unit vector for the vector  $V = -8i + 3j + 2k$  and verify the formula  $\cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma = 1$  (5 mks)

**QUESTION FOUR**

(20mks)

- (a) A ball is thrown vertically upwards at 20m/s. Find: (6 mks)
- (i) The maximum height reached .
  - (ii) The time taken to reach the maximum height
  - (iii) The time of flight ( take  $g = 10\text{m/s}^2$  )
- (b) A body of mass 2kg moving with speed 5 m/s collides directly with another of mass 3kg moving with speed 4m/s in the same direction. The coefficient of restitution is  $2/3$ . Find the velocities after collision. (5 mks)
- (c) Find the area enclosed by one loop of the four leaved rose  $r = \cos 2\theta$  (6 mks)
- (d) State the newton's Laws of motion. (3 mks)

**QUESTION FIVE**

(20mks)

- a) A tennis player receives a shot with the ball (0.0600kg) travelling horizontally at 50.0m/s and returns the shot with the ball travelling horizontally at 40.0m/s in the opposite direction. What is the impulse delivered to the ball by the racquet. What work does the racquet do on the ball. (6mks)
- b) A car of mass 500kg is travelling along a horizontal road. The engine of the car is working at a constant rate of 5Kw. The total resistance to the motion is constant and is 250N. What is the acceleration of the car when its velocity is 5m/s. (5mks)
- c) If P is (2, 6, 3) find the equation to the plane through P at right angles to  $OP$ , O being the origin. (5mks)
- d) Let A(1,1,8), B(4,-3,-4), C(-3,1,5) be a triangle. Find the angle formed at A. (4mks)