

KIBABII UNIVERSITY COLLEGE
FIRST YEAR SECOND SEMESTER 2014 EXAMINATION FOR THE
DEGREE OF BACHELOR OF SCIENCE IN MATHEMATICS
COURSE CODE: MAT 122; TIME: 3 HOURS
COURSE TITLE: ELEMENTARY APPLIED MATHEMATICS

Attempt Question ONE and ANY Other TWO questions

QUESTION 1 (30MARKS)

(a) A straight line passes through the point $P(x_1, y_1)$ and $Q(x_2, y_2)$ with co-ordinates. $P(0, 2)$ and $Q(1, 5)$. Find the equation of this straight line.

[3mks]

(b) Two lines are such that the first line has a gradient -1 and passes through $R(2, 1)$. The second line passes through two points with co-ordinates $P(2, 0)$ and $Q(0, 4)$. Find the equation of both lines and the co-ordinates of their intersection.

[4mks]

(c) Find k given that the distance between $(k, 0)$ and $(0, 2k)$ is 20m. [3mks]

(d) A car that has been traveling at 80m/s is brought to rest at constant deceleration 200m from where the brakes were applied. How far has the car moved when its velocity has been reduced by 20m/s

[6mks]

(e) Determine the vector projection of $\mathbf{a} = -\mathbf{i} + 2\mathbf{j} + 3\mathbf{k}$ onto $\mathbf{b} = 3\mathbf{i} + 4\mathbf{j} + \mathbf{k}$

[4mks]

(f) Find the values of θ for which the curve $r = 2(1 - \cos\theta)$ has vertical tangents.

[4mks]

(g) Distinguish between the terms impulse and momentum.

[2mks]

(h) Derive the equation of motion given by $v^2 = u^2 + 2as$.

[4mks]

QUESTION 2 (20MARKS)

(a) A ball is thrown vertically upwards at 20m/s. Find;

(i) The maximum height.

[3mks]

(ii) The time taken to reach maximum height.

[3mks]

(iii) The time of flight.

[2mks]

(b) Show from Newton's law of Motion that $Force = mass \times acceleration$.

[5mks]

- (c) Write the equation of the plane through the points $A(1, 0, 1)$, $B(2, 2, 0)$ and $C(3, 1, 4)$. [5mks]
- (d) Convert $2x+5y = 3-xy$ into polar equation. [2mks]

QUESTION 3 (20MARKS)

- (a) Find the cartesian equation of the curve; $\frac{2}{y} = 1+\cos\theta$. [10mks]
- (b) Find the slope of the tangent line to the curve $r = 4 = 4\cos\theta$ and $\theta = \frac{\pi}{3}$. [10mks]

QUESTION 4 (20MARKS)

- (a) Find the direction cosines and direction angles given the vector, $\mathbf{v} = -2\mathbf{i}+3\mathbf{j}+5\mathbf{k}$ and verify the formula $\cos^2\alpha+\cos^2\beta+\cos^2\gamma$. [10mks]
- (b) Find the equation of the circle passing through the points $P(2, 1)$, $Q(0, 5)$, $R(-1, 2)$ using centre and radius form of the circle. [10mks]

QUESTION 5 (20MARKS)

- (a) Find the the line of intersection of the planes $x-2y+z = 0$; $2x+3y-2z = 0$. [10mks]
- (b) Calculate the length of the spiral $r = e^\theta$ between $\theta = 0$ and $\theta = 1$ [4mks]
- (c) Find the area of the region within the entire cardioid $r = 1 + \cos\theta$. [6mks]