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**OFFICE OF THE DEPUTY PRINCIPAL**
**ACADEMICS, STUDENT AFFAIRS AND RESEARCH**

# UNIVERSITY EXAMINATIONS

# 2020 /2021 ACADEMIC YEAR

**FIRST YEAR SECOND SEMESTER REGULAREXAMINATION**

## FOR THE DEGREE OF BACHELOR OF EDUCATION ARTS

**COURSE CODE:** **MAT 111**

**COURSE TITLE:** **GEOMETRY AND ELEMENTARY APPLIED MATHEMATICS**

**DATE:** **TIME:**

## INSTRUCTION TO CANDIDATES

- **SEE INSIDE**

**THIS PAPER CONSISTS OF 6PRINTED PAGES** **PLEASE TURN OVER**

**REGULAR – MAIN EXAM**

**MAT111: GEOMETRY AND ELEMENTARY APPLIED MATHEMATICS**

**STREAM: BSc (CS)** **DURATION: 3 Hours**

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**INSTRUCTION TO CANDIDATES**

i. *Answer **ALL** questions from **section A** and any **THREE** from **section B***

ii. *Do not write on the question paper.*

**SECTION A (31 MARKS): ANSWER ALL QUESTIONS IN THIS SECTION.**

**QUESTION ONE[16MARKS]**

a) Find the distance between $A(2,-3)$ and the line $L: 3x-4y+2=0$ L:*3x - 4y + 2 = 0*.[4mks]

b) Convert $2x-5x^3=1+xy$ into polar coordinates.[4mks]

c) Find the distance between the points $P_1(3,-1,5), P_2(2,1,-1)$ [4mks]

d) Find the distance from the point $(-1,2,1)$ to the line $(1,1,1)+t(2,3,-1)$. [4mks]

**QUESTION TWO[15MARKS]**

a) Seagull can fly at a velocity of 9.00 m/s in still air.If

i. it takes the bird 20.0 min to travel 6.00 km straight into an oncoming wind, what is the velocity of the wind? [3mks]

ii. the bird turns around and flies with the wind, how long will it take the bird to return 6.00 km? [3mks]

b) A car of mass 1.2tonnes is travelling along a straight horizontal road at a speed of $20ms^{-1}$ when it brakes sharply then skids. Friction brings the car to rest. If the coefficient of friction between the tyres and road is 0.8, calculate the:

i. deceleration. [3mks]

ii. distance travelled by the car before it comes to rest. [3mks]

c) A particle A, of mass 2 kg, collides with a particle B, of mass 3kg. The velocity of particle A before the collision was $(4i-3j)ms^{-1}$ and the velocity of particle B before the collision was $(4i+4j)ms^{-1}$. Given the velocity of particle A after the collision was $(3i+2j)ms^{-1}$, what was the velocityof B after the collision? [3mks]

**SECTION B:ANSWERANY THREE QUESTIONS [39MARKS]**

**QUESTION THREE[13MARKS]**

a) Find the area of a triangle with vertices: $A(0,-3), B(5,0), C(0,3)$ [4mks]

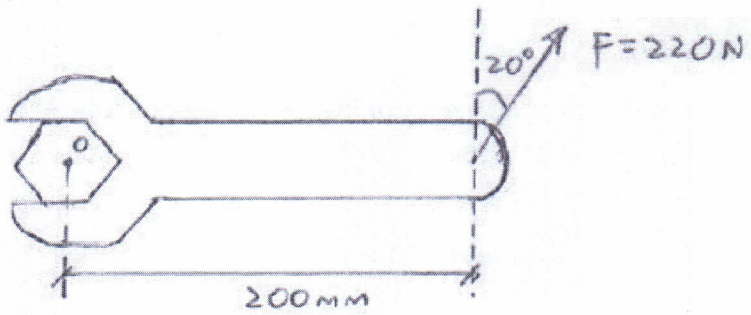
b) Convert $r=-8\cos\theta$ into Cartesian coordinates [4mks]

c) Find the standard equation of the spherewith center $(10,7,4),(-1,3,-2)$ [5mks]

**QUESTION FOUR[13MARKS]**

a) Find the distance from the point $(1,2,3)$ to the plane $2x - y + 3z = 5$ [5mks]

b) Find the equivalent force –couple system about O. [8mks]




**QUESTION FIVE[13MARKS]**

a) Find the equation of the line passing through $(5,-1,3)$ having direction $\vec{v} = (1,0,-2)$ .Express your answer in

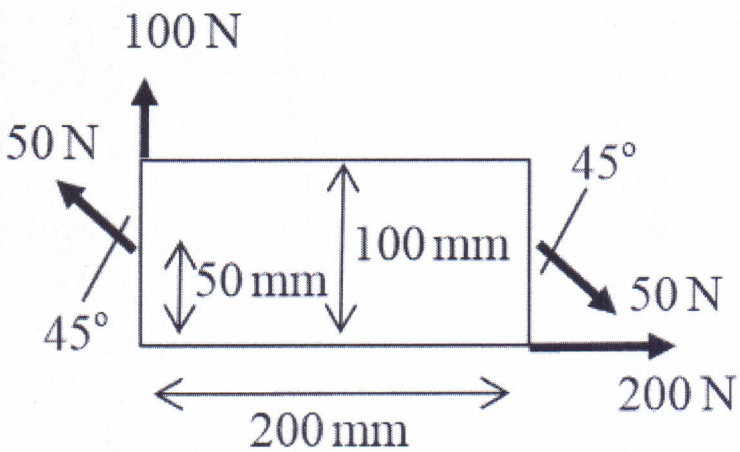
i. Symmetric form [1mk]

ii. Vector form [2mks]

iii. Parametric form [2mks]

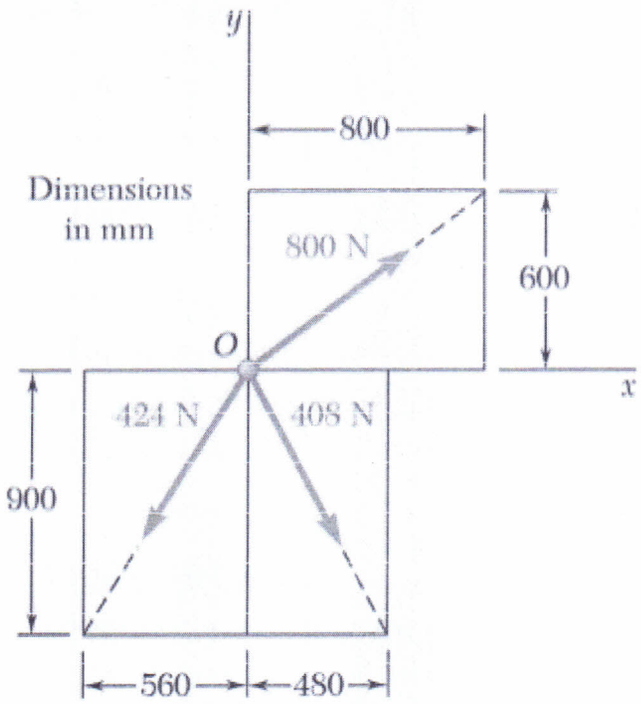
iv. Find two other points on the line [2mks]

b) Consider the plate subjected to the four external loads shown in the figures below. An equivalent force-couple system F-M, with the force acting at the centre of the plate, can be calculated through? [6mks]

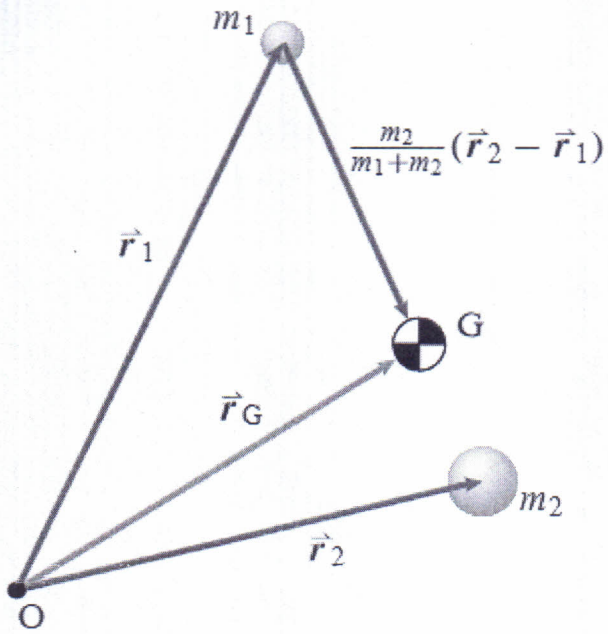


**QUESTION SIX[13MARKS]**

a) Determine the x, y components of the 3 forces. [8mks]




b) Derive an equation for center of mass $r_{CM}$ of a systemconsisting of two points as shown below. [5mks]




**QUESTION SEVEN[13MARKS]**

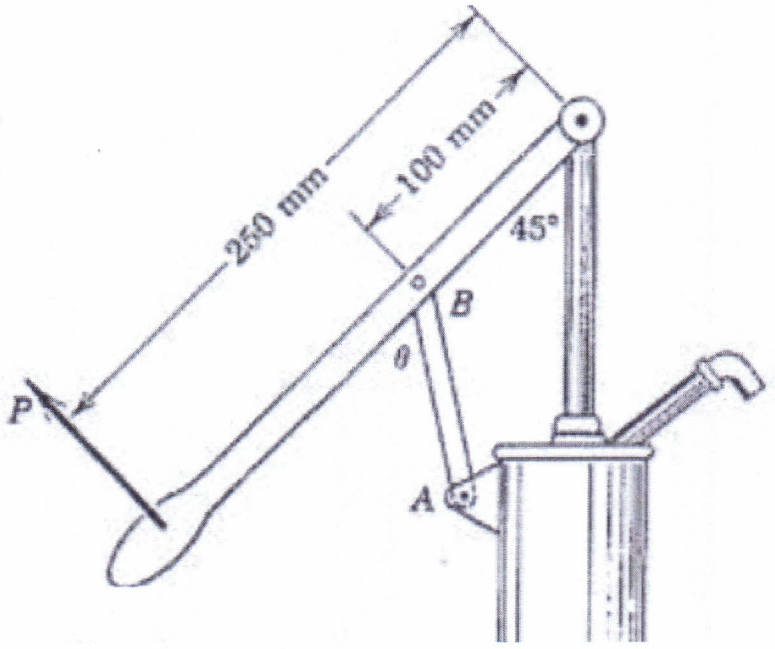
a) A pitcher tosses a baseball straight up, with an initial speed of 25 m/s.

i. How long does it take to reach its highest point? [3mks]

ii. How high does the ball rise above its release point? [3mks]

iii. How long will it take for the ball to reach a point 25 m above its release point. [3mks]

b) For the $45^0$ position of the pump handle with force P perpendicular to the handle, determine graphically the angle $\theta$ between the handle and the compensating link AB which enables the force transmitted to the plunger to be along its vertical axis. [4mks]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