REPUBLIQUE DU CAMEROUN
Paix-Travail-Patrie

MINISTERE DES ENSEIGNEMENTS SECONDAIRES

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TEACHERS' RESOURCE UNIT TRU-RIP-STA MOCK EXAMS CAMP-BAMENDA NORTH WEST REGION

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REPUBLIC OF CAMEROON
Peace-Work-Fatherland

MINISTRY OF SECONDARY EDUCATION

TEACHERS' RESOURCE UNIT
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MARCH 2023

The Teachers' Resource Unit and the Regional Inspectorate of Pedagogy in collaboration with MTA	SUBJECT CODE NUMBER 0775	PAPER NUMBER 3
GENERAL CERTIFICATE OF EDUCATION REGIONAL MOCK EXAMINATION	SUBJECT TITLE FURTHER MATHEMATICS	
ADVANCED LEVEL		

Time Allowed: TWO and a half hours

INSTRUCTIONS TO CANDIDATES

Mobile phones are **NOT ALLOWED** in the examination room.

Full marks may be obtained for answers to **ALL** questions.
In calculations, you are advised to show all the steps in your working, giving your answer at each stage.
Non programmable electronic calculators, Mathematical formulae and tables are allowed.

You are reminded of the necessity for good English and orderly presentation in your answers.

1. (a) The probability density function of a continuous random variable X is given by

$$f(x)=\begin{cases}\frac{1}{4}+ax, 0\le x\le 1\\ 0\ ,\ elsewhere\end{cases}$$

Find

(i). the value of the constant a (3mks)

(ii) the mean of X (2mks)

(b) 10 percent of the students in a certain college study on scholarship.

(i) Given that 8 students are selected at random from this college, find the probability that at least 3 of them study on scholarship.

(ii) Given that 400 students are selected at random from this college, use the normal approximation to find the probability that more than 34 of them study on scholarship. (7mks)

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2. The forces $\mathbf{F}_1, \mathbf{F}_2, \mathbf{F}_3$ and $\vec{F}_4$ acts through the points A, B, C and D with position vectors $\mathbf{r}_1, \mathbf{r}_2, \mathbf{r}_3$ and $\mathbf{r}_4$, respectively, where

$\mathbf{F}_1=(\mathbf{i}+\mathbf{j}-2\mathbf{k})N$, $\mathbf{F}_2=(3\mathbf{i}-\mathbf{j}+2\mathbf{k})N$, $\mathbf{F}_3=(-5\mathbf{i}+4\mathbf{j}-\mathbf{k})N$, $\mathbf{r}_2=(2\mathbf{i}-\mathbf{j}+\mathbf{k})m$,

$\mathbf{r}_2=(-3\mathbf{i}+2\mathbf{j}-5\mathbf{k})m$, $\mathbf{r}_3=(6\mathbf{i}-4\mathbf{j})m$ and $\mathbf{r}_4=(\lambda\mathbf{i}-8\mathbf{j}+\mathbf{k})m$. Given that the system of the 4 forces is in equilibrium, find

(i) the magnitude of $\mathbf{F}_4$ (4mks)

(ii) the value of λ (6mks)

Find, also,

(iii) the work done by $\mathbf{F}_3$ in moving a particle from C to B (3mks)

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3. (a) Given that:

$$(1+x)\frac{d^2y}{dx^2}+(2+x)\frac{dy}{dx}-3y=0$$

and that: y = 1 and $\frac{dy}{dx}=\frac{1}{2}$ when $x=0$, find a cubic function of x that approximates to the solution of this differential equation. (5mks)

Using this solution, find, correct to 3 decimal places, the value of y when $x = -0.1$

(b) The speed (vms^{-1}) of a particle at half-second intervals are given in the table below.

t(s)	0	0.5	1	1.5	2
Vms^{1}	0	2.3	3.4	5.1	6.5

Using Simpson's rule with 5 ordinates, estimate, correct to 2 decimal places, the distance covered by the particle after 2 seconds. (4mks)

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4. A light elastic string of natural length 2a is fastened at one end to a fixed point. It hangs vertically and carries at its other end, a particle of mass $\frac{3}{2}m$. In the position of equilibrium, the length of the string is $\frac{5}{2}a$

(i) Find the modulus of elasticity of the string (3mks)

The particle is pulled down through a distance below its equilibrium position and then released from rest.

(ii) Show that it begins to move with simple harmonic motion of period $2\pi\sqrt{\frac{a}{2g}}$ (6mks)

(iii) Find the time that elapses before the string first becomes slack. (3mks)

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5. A particle Q moves with constant angular velocity w round the curve with polar equation $r=a(1-\cos\theta)$, $a>0$

(i) Find the radial component of the acceleration of Q. (5mks)

(ii) Show that the speed of the particle is $2aw\sin\left(\frac{\theta}{2}\right)$ (5mks)

6. A ball is thrown vertically downward with speed u in a medium in which the resistance to motion is KV per unit mass, where K is positive constant and V is the speed. Find the speed of the ball when $t = \frac{1}{k}\ln 2$ (7mks)

7. A uniform rod AB of mass 4m and length $2a$ has a particle of mass $2m$ attached to the end B. The system is free to rotate in a vertical plane about a smooth horizontal axis through A.

(i) Show that the moment of inertia of the system about this axis is $\frac{40}{3}ma^2$. (4mks)

The rod is released from rest when AB is horizontal

(ii) Show that when AB makes an angle θ with the horizontal, $5a\left(\frac{d\theta}{dt}\right) = 6g\sin\theta$ (4mks)

(iii) Find the component, perpendicular to AB, of the reaction force exerted at the axis (7mks)

8. Two particles A and B of masses 2m and 3m are moving on a smooth horizontal floor with velocities $(2i+4j)ms^{-1}$ and $(3i+j)ms^{-1}$, respectively. A and B collide when the line joining their centres is parallel to the vector i. Given that the coefficient of restitution between A and B is …. Find:

(i) the speed of A and B after collision

(ii) the loss in kinetic energy due to the collision

(iii) the tangent of the angle through which B is deflected as a result of the collision.

End