UGANDA ADVANCED CERTIFICATE OF EDUCATION (UACE)

P425/1 PRINCIPAL MATHEMATICS (Paper 1)

S.6 PRACTICE TEST SET 1 2026

Time: 2 Hrs 20 minutes

STUDENT NAME: ....

SCHOOL: ....

PERSONAL NUMBER: .... SIGNATURE: ....

INSTRUCTIONS TO CANDIDATES:

1. This paper consists of **three (3)** sections; **A, B** and **C** with a total of **five** examination items.
2. Section **A** has one compulsory item while section **B** and **C** each have two items. Attempt only one item in each section i.e. One item in section B and one item in section C.
3. All in all, a total of **3 items** should be attempted. Any additional item(s) answered will not be given any score(s).
4. Begin each item on a fresh page and clearly number them as they appear in the examinations paper.
5. Silent, non-programmable calculators and mathematical tables are allowed. Where necessary, graph paper is provided.
6. Tidy handwriting, clear presentation of work and meaningful mathematical judgements or conclusions will increase your chances of excelling.

FOR SCORER'S USE ONLY

SECTION	A	B		C	
ITEM	1	2	3	4	5
SCORE					
GRADE					
INITIAL					

SECTION A (GEOMETRY)

This item is compulsory

Item 1

Stephen is a well-known agriculturalist in Mbale and the entire Bugisu sub-region. He mainly grows arabica coffee in his land located at the slopes of Mt. Elgon and as well has a huge herd of cattle. In the recent years, he has been facing a challenge of cattle rustling(theft) and now intends to build a circular kraal that passes through point $P(2,9), Q(5,0)$ and $R(-1,8)$ but he is struggling to know the centre and radius of the circular kraal and as well the equation described by the kraal. One evening when he was driving, a straight light ray struck tangentially to his parabolic mirror at point $(ap^2, 2ap)$ and it was also noted that the parabolic mirror could be represented by the equation $y^2 = 4ax$. In order to ease movement in his arabica coffee farm, a straight road, $\mathbf{R_1}$ is to be constructed passing through point $A(2,2)$ and point $B(3,3)$ while another, $\mathbf{R_2}$ will be constructed passing through $C(2,0)$ and $D(-1,-1)$ and at the point of intersection of these two roads will be a simple navigation round about yet they need to know the acute angle that one has to turn to access road R_1 if he was originally passing in road $\mathbf{R_2}$ or vice versa. Similarly, there is a new company that is purchasing coffee and they transport it from Entebbe located in space at place $E(1,0,-1)$ and moves directly to South Africa located at $S(2,-4,-3)$ and their transport plane usually tunes to signals at angles θ satisfying the equation $12\cos\theta + 5\sin\theta = 2$ whose working range is $-360^0 \leq \theta \leq 360^0$.

Stephen now faces a big challenge of knowing the radius, centre and equation of the circular kraal. He is as well interested in knowing the equation of the straight light ray that struck his parabolic mirror, the point to put a simple round about and the acute angle to turn to locate a given line. He also needs to know cartesian equation that the plane moves strictly from Entebbe to South Africa and the angles satisfying the signal equation.

Task

Help Stephen to determine;

a) The radius and centre of the kraal hence deduce its equation (expand and simplify your response)
b) The equation of the light ray that struck his mirror
c) By mathematical calculations where exactly the simple round about in the coffee farm should be placed and as well determine the acute angle one turns to locate road $\mathbf{R_1}$ if he/she was originally passing in road $\mathbf{R_2}$
d) The cartesian equation of the direct path taken by the plane from Entebbe to South Africa and as well the values of θ satisfying the signal equation.

SECTION B (ALGEBRA)

Attempt any ONE item in this section

Item 2

At Namanve industrial park, trucks move following a particular road pattern described by the quadratic equation $2x^2 - 3x + 4 = 0$ whose roots are $\propto$ and β which are obtained without solving the equation. However, when the minister of works and transport went for inspection, he realised that there was congestion and opted to construct a new road of the same nature as the existing one but with its roots being $\frac{1-\propto}{\beta}$ and $\frac{1-\beta}{\propto}$.

Later on, the minister also wanted to estimate the value of $\sqrt[3]{24}$ and he had been directed to begin by expanding $(1-x)^{\frac{1}{3}}$ up to the term in x^3 and then substitute $x = \frac{1}{9}$ in the result to obtain the $\sqrt[3]{24}$ correct to 4 decimal places. After this inspection, a team of 10 members went for a dinner and had to sit in a round table but they were interested in knowing how many possible ways they could sit in the table. In order to make their party colourful, they had to withdraw some money but the pin was written as **113r** where r is a value satisfying the equation $\log_3 r + \log_9 3r = 2$ and had to look for r to get the actual PIN.

During another analysis conducted by the minister of works and transport, a certain road M was found to be $\frac{2\sqrt{2}}{3-\sqrt{2}} + \frac{4+\sqrt{2}}{3+\sqrt{2}}$ kilometres and he was interested in the exact value in the form $a + b\sqrt{2}$ where a and b are integers.

Task

a) Determine the equation of the new road to be constructed
b) Expand $(1-x)^{\frac{1}{3}}$ up to the term in x^3 hence by substituting $x = \frac{1}{9}$, estimate the value of $\sqrt[3]{24}$ correct to 4 decimal places
c) Determine the actual PIN by first finding the value of r in the logarithmic equation
d) What is the actual length of road M in the form $a + b\sqrt{2}$ where a and b are integers, state the values of a and b

Item 3

At St. Lawrence SSS Sonde, the security team was tasked to install cameras in all major school premises including the library. The technical team realised that a certain plane had an equation $x - y + z = 1$, another had $2x + y - z = 5$ and the last one had $x + 3y + 2z = 5$. They came up with a plan that the camera in the library be installed at the point on intersection of the above planes.

In order to make this plan come to a success, they decided to collect school fees using a geometric pattern. In week 2, they collected 60 million, in week 4 they collected 240 million. Their intentions are to use 1% of the total amount collected in the first 5 weeks for installing cameras and are interested in knowing how much it is.

The school has also planned that a team of 13 non-teaching staff be chosen to help in the process but since they have a total of 20 non teaching staff, they need to know how many ways they can choose the required staff.

When they contacted the headteacher, she added that they were to build b bathrooms such that the value b satisfies the equation $25^b - 5^b - 600 = 0$ but now they are confused on how many bathrooms were to be built. Meanwhile, the headteacher also proposed that the school should also invest in a solar power back up system and upon consulting the school engineer, he modelled the current as $I = \frac{3+4i}{1-2i}$ in amperes. They need to express this current in the form $a + bi$ and determine its modulus, principal argument and its polar form for proper tuning.

Task

Help the school to determine;

a) Where the camera in the library should be placed hence determine how much money is needed for installing cameras in the school.
b) How many possible ways the 13 non-teaching staff can be chosen from the total of 20 non-teaching staff
c) The number of bathrooms that are to be built as seen by the headteacher.
d) Express the current in the form $a + bi$, determine its modulus and principal argument hence write it in polar form for proper tuning.

SECTION C (CALCULUS)

Attempt any ONE item in this section

Item 4

Mama Jennifer's daily cost of producing x batches of mandazi is given by $C(x) = \frac{2x^2+5x+7}{(x+1)(x+2)^2}$ and her accountant explains to her that this cost function can be broken down into simpler parts for better analysis. Motivated by her success in the Mandazi business, Mama Jennifer has started a juice business on the side. She uses conical disposable cups that are popular with her customers. These cups are of height, h cm and radius r cm which are related by $r = \frac{h}{2}$. While filling the cups, the juice is pumped at a rate of 10π cm^3s^{-1} and she wants to use this to analyse the rate at which the height of the juice rises in the cups when the height of the juice is 6cm. Mama Jennifer having received a lot of customers would like construct a good restaurant on an area of land enclosed by the curve $y = xe^x$ from $x = 0$ to $x = 1$. She tries to estimate the area by using trapezium rule with 6 ordinates correct to 3 decimal places and later performed an integration to get the actual value but needs to know the percentage deviation of the area calculated from the actual area

Task

Help Mama Jennifer to determine;

a) The equivalence of the cost function after breaking down into simpler parts for better analysis
b) The rate at which the height of the juice rises in the cups when the height of the juice is 6cm
c) Estimate the area of the land where the restaurant will be set up using trapezium rule with 6 ordinates hence perform integration to determine the percentage deviation from the exact area

Item 5

Mr. Kamau is a farmer who has built a new fish pond. He needs to understand several mathematical concepts to manage his pond efficiency.

Mr. Kamau's fish population follows a growth pattern modelled by the function $P(t) = e^{2t}cost$ where P(t) represents the population (in hundreds of fish) after t months. He needs to know the rate of change of the fish population, $\frac{dP}{dt}$ and hence or otherwise, show that this growth function satisfies the fish model given by $\frac{d^2P}{dt^2} - 4\frac{dP}{dt} + 5P = 0$.

He later analyses the quantity of food(x) to give to his fish and realised it satisfied the model $q(x) = x^3 - 2x^2 - 4x + 10$ and he was told by an expert that the root of $q(x) = 0$ lies between $x = 3$ and $x = 4$ which he had to confirm such that the exact root (correct to 4 decimal places) is determined by using the Newton Raphson Method taking the initial approximation $x_0 = 3.5$

Later in a certain month, he measured some parameters w, x, y and each of them was rounded of to the given number of decimal places to obtain $w = 1.2, x = 2.35$ and $y = 0.001$. Since he had no instrument to directly measure some parameter, Z, he used the equation $Z = \frac{2w+x}{x-y}$ but he was interested in finding the exact range of values where Z lies correct to 3 decimal places

Task

Help Mr. Kamau to;

a) Determine the rate of change of the fish population, $\frac{dP}{dt}$ and hence or otherwise, show that the growth function P(t) satisfies the fish model given by $\frac{d^2P}{dt^2} - 4\frac{dP}{dt} + 5P = 0$
b) Show that the root of the quantity of food, $q(x)$ lies between $x = 3$ and $x = 4$ hence by using Newton Raphson Method and taking initial approximation, $x_0 = 3.5$, determine the exact root correct to 4 decimal places
c) Find the exact range of values where Z lies correct to 3 decimal places

THE END

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