THE UNITED REPUBLIC OF TANZANIA

PRESIDENT'S OFFICE

REGIONAL ADMINISTRATION AND LOCAL GOVERNMENT

RUVUMA REGION

FORM SIX REGIONAL MOCK EXAMINATION

142/1 ADVANCED MATHEMATICS 1

Time: 3 hours **Wednesday 02nd October, 2024 a.m.**

Instructions

1. This paper consists of **ten (10) questions**
2. Answer **all** questions
3. All work done and answers of each question must be shown clearly
4. NECTA'S Mathematical tables and non – programmable calculators may be used
5. All writing must be in black or blue ink, except drawings which must be in pencil
6. All communication devices and any unauthorized materials are not allowed in the examination room.
7. Write your **Examination Number** on every page of your answer sheet(s) provided.

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1. Use scientific calculator to find the following

   (a) If $S = \frac{e^{-\left(\frac{x-m}{2s^2}\right)^2}}{y\sqrt{2p}}$ find y if $x = m, s = 3.08$ and $p = 8$

   (b) Find the mean and variance of the following data in four decimal places
   $14.3, 8, 4\tan^{-1}(1),\ 4C_2,\ 3!,\ 5P_2,\ 4\log(7P_2)$

   (c) $\int_2^3 \frac{2x-3}{\sqrt{4x-x^2}}dx$

2. (a) (i) Express Sinh3x in terms of sinhx

   (ii) Solve for Real value of x, the equation $2Cosh2x - Sinh2x = 2$

   (b) (i) Prove that $\tanh^{-1}\left(\frac{x^2-a^2}{x^2+a^2}\right) = \text{In}\left(\frac{x}{a}\right)$

   (ii) If $\text{Coshx} = \text{Sec}\theta$, Prove that $\tanh\left(\frac{x}{2}\right) = \tan\left(\frac{\theta}{2}\right)$

3. (a) The value of the objective function at these points are given in the following table

Corner points	Value : $f(x,y) = ax + by + c$
A (4500, 2500)	5550/=
B (4000, 3000)	5450/=
C (500, 3000)	4400/=

   Obtain the objective function used to minimize the cost

   (b) A merchant plans to sell the two types of personal computers, a desktop model and a portable model that will cost 25,000/=Tsh and 40,000 Tsh respectively. He estimates that the total monthly demand of computers will not exceed 250 units. Determine the number of units of each type of computer which the merchant should stock to get the maximum profit. If he does not want to invest more than 7,000,000/=Tsh and if his profit on desktop model is 45,000/= Tsh and portable model is 5,000/= Tsh.

4. (a) The mean of 200 numbers was 50. On rechecking it was found that 92 and 8 were incorrect. Find the correct mean if the wrong numbers were replaced by correct numbers 192 and 88

   (b) Use the coding method and assumed mean (A=21) to calculate the mean and standard deviation for the following data

Marks	0-6	6-12	12-18	18-24	24-30	20-36	36-42
Frequency	2	3	5	10	3	5	2

5. (a) Use the laws of algebra to simplify

   (i) $[A \cap (B \cap C')] \cup C$

   (ii) $(X \cap Y') \cup (X \cap Y) \cup (Y \cap X')$

   (b) Out of group of 17 girl guides and 15 boy scouts, 22 play handball, 16 play basketball, 12 of the boy scouts play handball, 11 of the boy scouts play basketball, 10 of the boy scouts play both and 3 of the girls play neither of the two.

   i. How many of girls play both handball and basketball?

   ii. How many in the group play handball only and basketball only

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6. (a) The function $f(x) = y$ is defined as $f(x) = \frac{x^2+3}{x-1}$, find
   (i) Turning point
   (ii) Equation of asymptotes
   (iii) Intercepts on the axes
   (iv) Sketch the graph
   (b) Given that $f = [(3,6),(5,7),(9,0)]$ and $g = [(2,3),(4,5),(6,7)]$. Find the composite function $fog(x)$ using the f and g given above
   (c) Draw the graph of $f(x) = log_2 x$ and state the domain and range

7. (a) The value $A = \int_a^b f(x)dx$ represents the area under the graph of $y = f(x)$ between $x = a$ and $x = b$. Derive the trapezium rule with 6 coordinates to find an approximation of
   $A = \int_a^b f(x)dx$
   (b) Using the trapezium rule obtained in art 7(a) above, approximate $\int_1^7 \frac{x^3}{1+x^4}dx$ correct to three decimal places
   (c) Evaluate the actual integral of $\int_1^7 \frac{x^3}{1+x^4}dx$ and then calculate the relative error in the approximation obtained in (b) above. (give your answer to three decimal places)

8. (a) If the perpendicular distance of the point (m,3) from the line $x - 2y + 1 = 0$ is $\frac{3\sqrt{5}}{5}$ units. Find the value of m
   (b) The four points $A(-2,-1), B(4,3), C(x,y)$ and $D(0,-4)$ are the vertex of parallelogram ABCD. Find the value of x and y
   (c) Find the equation of the circle whose centre is at the point $(5,4)$ and which touches the line joining the points $(0,5)$ and $(4,1)$

9. (a) Find $\int \frac{5}{x^2+x-6}dx$
   (b) Evaluate $\int_0^{\frac{\pi}{2}} \text{Sin}^2 x dx$ correct to four decimal places
   (c) Find the length of the curve given by $x = 2\text{Cos}^3\vartheta$ and $=y = 2\text{Sin}^3\theta$ between $\theta = 0$ and $\theta = \frac{\pi}{2}$

10. (a) If $x^3y + y^3x = -2y$, find $\frac{dy}{dx}$ at $(-1,1)$
    (b) An object starts from rest and moves a distance of $g = \frac{1}{8}t^4 + \frac{1}{2}t^2$cm in t seconds. By using this information, find
       i. The velocity of the object after two seconds.
       ii. The initial acceleration of the object.
    (c) Differentiate $y = \tan^{-1}\left(\frac{(\text{aSinx+bCosx})}{\text{aCosx-bSinx}}\right)$ with respect to x

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