Mathematics I

010

20/07/2021 8:30 AM – 11.30 AM

NESA NATIONAL EXAMINATION AND SCHOOL INSPECTION AUTHORITY

ORDINARY LEVEL NATIONAL EXAMINATIONS, 2020-2021

SUBJECT: MATHEMATICS I

DURATION: 3 HOURS

INSTRUCTIONS:

1) Write your names and index number on the answer booklet as they appear on your registration form, and **DO NOT** write your names and index number on additional answer sheets if provided.
2) Do not open this paper until you are told to do so.
3) This paper has **TWO** sections: **A** and **B**.
   SECTION A: Attempt **ALL** questions. **(55 marks)**
   SECTION B: Attempt **ONLY THREE** questions. **(45 marks)**
4) You may use mathematical instruments and a calculator **where necessary.**
5) Use a **blue or black ink pen only** to write your answers and a **pencil** to draw diagrams.
6) Show clearly all the working steps. **Marks will not be awarded for the answer without all working steps.**

SECTION A: ATTEMPT ALL QUESTIONS (55 marks)

1) Workout the value of $\frac{4r^2-t}{5}$ when $r=3$ and $t=1$ **(2 marks)**

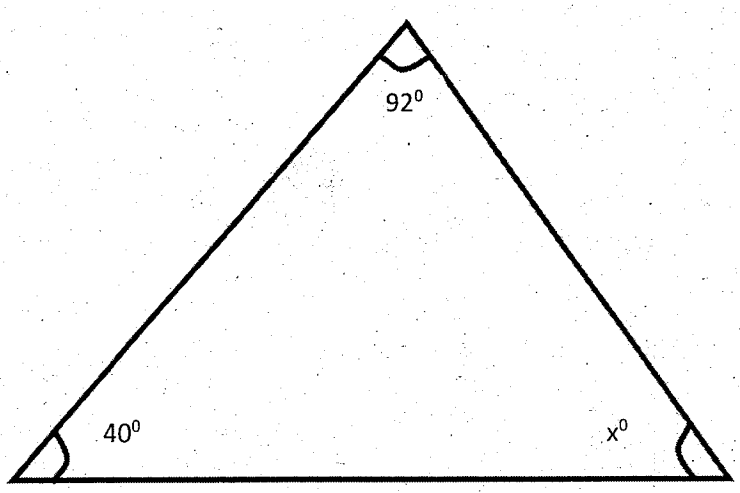
2) When 110 is added to a certain number and the sum is divided by 3, the result is 4 times the original number. What is the original number? **(3 marks)**

3) Find the inverse of $g(x)=2x^2-1$ **(4 marks)**

4) Solve the following equation in $\mathbb{R}$

$$\frac{7+2x}{3}=\frac{7x+1}{4}$$ **(4 marks)**

5) In the figure below calculate the value of angle x. **(3 marks)**



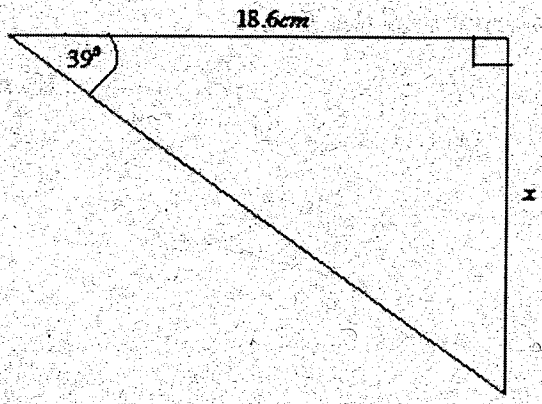
6) Solve the simultaneous equation using substitution method. **(4 marks)**

$$\begin{cases} y-1=2x \\ 3y-4x=13 \end{cases}$$

7) Rationalize the following expression: $\frac{\sqrt{5}}{\sqrt{15}+\sqrt{10}}$ **(3 marks)**

8) In a right-angled triangle ABC, AD is the altitude from vertex A to the hypotenuse. If AD = 12cm and DC = 18 cm, find the length named x of segment BD. **(4 marks)**

9) Calculate the length marked x in the triangle below: **(4 marks)**



10) Given that $\begin{pmatrix} x-8 \\ 2y+1 \end{pmatrix}$ is a null vector, find the values of x and y. **(4 marks)**

11) Calculate an arithmetic mean of a Junior student's marks in five subjects:
Mathematics 20 marks;
Kinyarwanda 15 marks;
English 12 marks;
Chemistry 16 marks;
Physics 10 marks. **(4 marks)**

12) Find the equation of the straight line passing through the points (1,2) and (-2, 6) **(4 marks)**

13) Find the value of a in the following: $a^2 = 71_{nine}$ **(4 marks)**

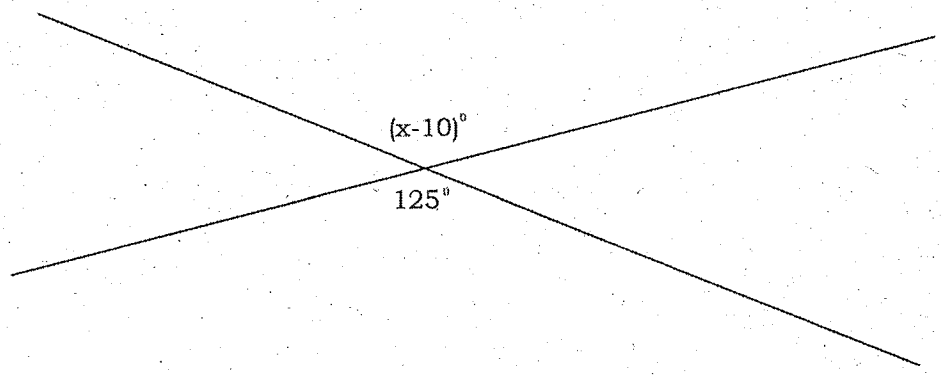
14) If $\vec{u}$ and $\vec{v}$ are two vectors such that $\vec{u} = \begin{pmatrix} 2 \\ -3 \end{pmatrix}$ and $\vec{v} = \begin{pmatrix} -1 \\ 2 \end{pmatrix}$

Find $-\vec{v} + 2\vec{u}$ **(4 marks)**

15) Observe the figure below and answer the following questions:

(a) Explain the relationship between angles in the figure. **(2 marks)**

(b) Find the value of x in the figure. **(2 marks)**



SECTION B: ATTEMPT ONLY THREE QUESTIONS (45 marks)

16) (a) All the 240 students at a certain school learn Kinyarwanda or English or both. 150 Learn Kinyarwanda and 120 Learn English.

(i) How many students learn both languages? **(5 marks)**

(ii) How many students learn English only? **(3 marks)**

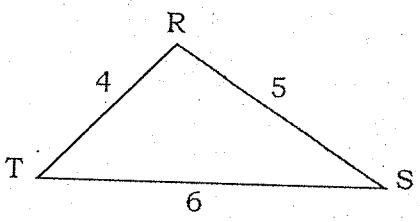
(iii) How many students learn Kinyarwanda only? **(3 marks)**

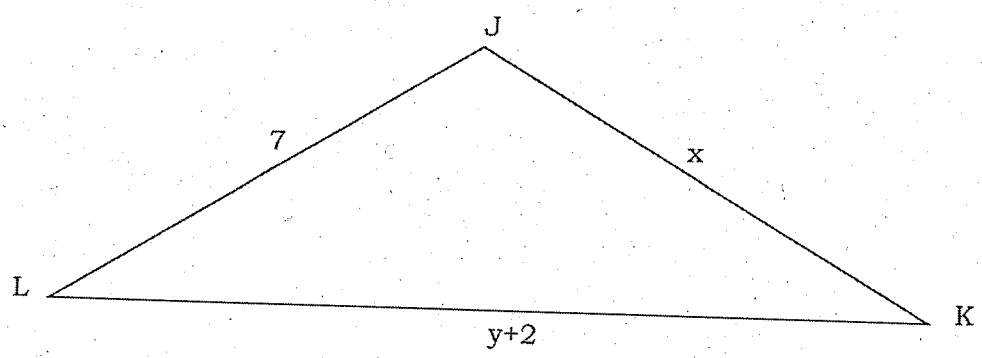
(b) An open cylinder has a radius of 1.4cm and a height of 30cm. Calculate its total surface area. **(4 marks)**

17) (a) A triangle ABC has vertices $A(0,0)$; B(10,2) and C(2,6). Find the coordinates of the points A'; B' and C', the images of A, B and C respectively, under a translation with displacement vector $\begin{pmatrix}2\\3\end{pmatrix}$ **(9 marks)**

(b) Find the value of x in the equation $31_x - 17_x = 16_x$ **(6 marks)**

18) Suppose that two triangles below ΔRST and ΔJKL are similar.





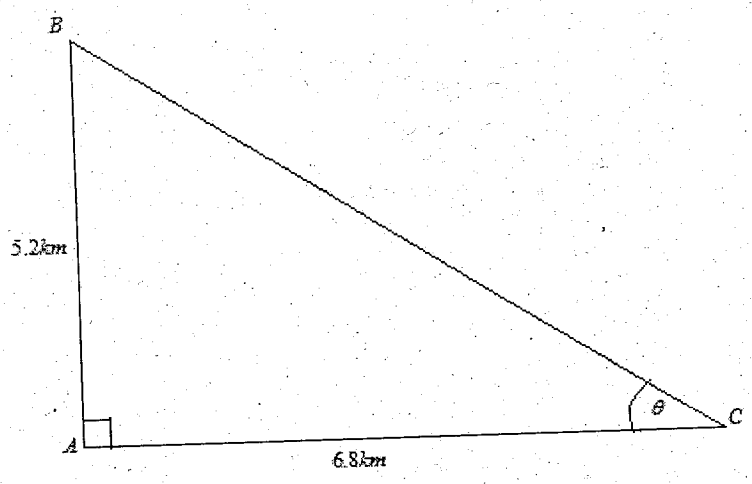
(a) Find the value of x **(5 marks)**

(b) Find the value of y **(5 marks)**

(c) Determine the length of $\overline{LK}$ (Give your answer in cm) **(3 marks)**

(d) Determine the length of $\overline{JK}$ (Give your answer in cm) **(2 marks)**

19) The diagram below shows three places: City A, City B and City C which are on the same horizontal plane. Suppose that City B is 5.2km due North of City A and City C is 6.8km due East of City A



From this diagram answer the following questions:

(a) Calculate the distance from City C to City B

(Give your correct answer to 1 decimal place) **(7 marks)**

(b) Calculate the size of the angle marked θ in the diagram

(Give your correct answer to 1 decimal place) **(8 marks)**

20) The data below shows the heights of students (in cm) at a certain school taken by a tailor in order to make their school uniform.

Height (in cm)	**Frequency, f**
150-154	5
155-159	2
160-164	6
165-169	8
170-174	9
175-179	11
180-184	6
185-189	3

(a) Complete the following table: **(10 marks)**

Height (in cm)	Midpoint, x	Frequency, f	fx	Cumulative frequency
150-154		5		
155-159		2		
160-164		6		
165-169		8		
170-174		9		
175-179		11		
180-184		6		
185-189		3		
		$\sum f =$	$\sum fx =$	

(b) Calculate the mean height. **(2 marks)**

(c) Calculate the median class height. **(2 marks)**

(d) What is the modal class? Explain why. **(1 mark)**