Mathematics I

010

20/07/2021 08.30 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 of paper if provided.

2) Do not open this paper until you are told to do so.

3) This paper consists of **TWO** sections **A** and **B.**

   SECTION A: Attempt **ALL** questions   **(55 marks)**

   **SECTION B:** Answer any **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. **Marks will not be awarded for answers 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 R
$\frac{7+2x}{3} = \frac{7x+1}{4}$ **(4 marks)**

5. In the figure below calculate the value of angle x.
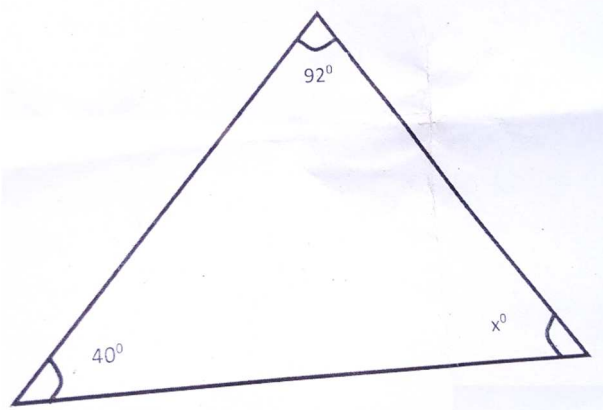
6. Solve the simultaneous equation using substitution method. **(4 marks)**
$\begin{cases} y - 1 = 2x \\ 3y - 4x = 13 \end{cases}$

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 hypothenuse. If AD = 12cm and DC = 18cm, find the length named x of segment BD. **(4 marks)**

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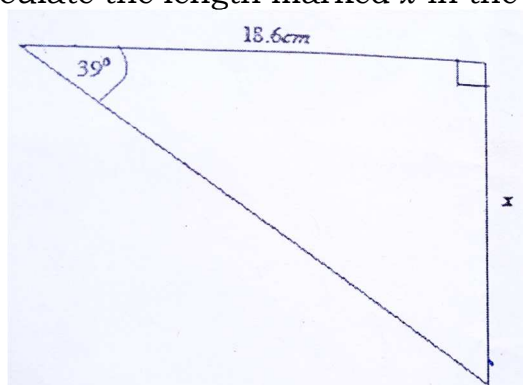
10. Given that $\begin{pmatrix} x-8 \\ 2y+1 \end{pmatrix}$ is a null vector, find the values of x and y.   **(4 marks)**

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)**
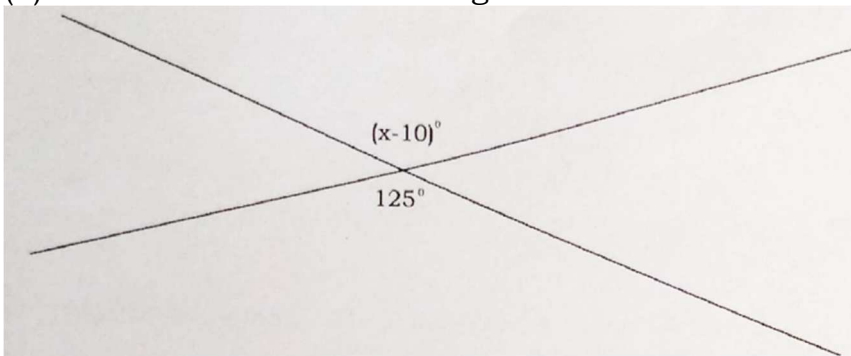
SECTION B: Attempt only three questions (45 marks)

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.
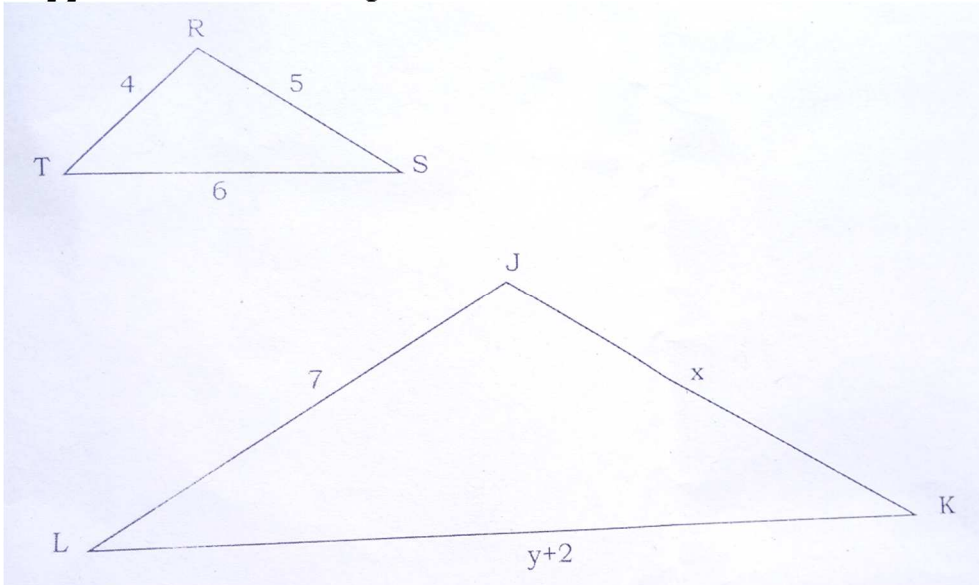
(a) Find the value of x **(5 marks)**
(b) Find the value of x **(5 marks)**
(c) Determine the length of $\overline{LK}$ (Give your answer in cm) **(3 marks)**
(d) Determine the length of $\overline{JK}$ (Give your answer in cm) **(2 marks)**

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.
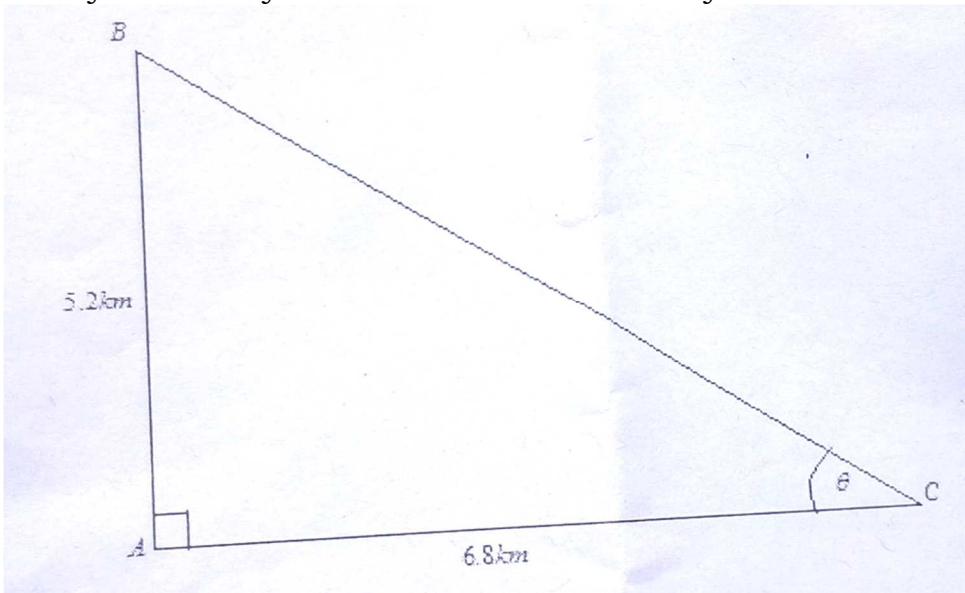
From this diagram answer the following questions:
(a) Calculate the distance from City C to City B. **(7 marks)**
(Give your correct answer to 1 decimal place)

(b) Calculate the size of the angle marked θ in the diagram. **(8 marks)**
(Give your correct answer to 1 decimal place)

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	8
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		8		
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)**