**Mathematics I**

**010**

**26/07/2022 8:30 AM – 11.30 AM**

NESA NATIONAL EXAMINATION AND SCHOOL INSPECTION AUTHORITY

## ORDINARY LEVEL NATIONAL EXAMINATIONS, 2021-2022

## 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 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) Rationalize $\frac{3\sqrt{2}+2}{-2\sqrt{2}+5}$ **(3 marks)**

2) Evaluate

$a^4+3a^3-a^2+6$ for $a=-3$ **(3 marks)**

3) a) Simplify $\frac{5^x \times 25^{x+1}}{125^{x-1}}$ **(2 marks)**

b) Solve $64^x = 4$ **(2 marks)**

4) An author earned a royalty of 880, 250 Frw before an advance tax was deducted. If the tax was charged at a rate of 20%, calculate:

a) The tax he was charged. **(2 marks)**

b) His earning after the tax. **(2 marks)**

5) Given that $f(x)=x-2x^2$ and $g(x)=3-x$ find

a) $fog(x)$ **(2 marks)**

b) $gof(-2)$ **(1 mark)**

6) Given that $A=3203_{four}$ and $B=1121_{three}$

Find $(A+B)_{five}$ **(4 marks)**

7) Solve in $\mathbb{R}$ the following inequality **(4 marks)**

$$\frac{x}{2}-\frac{x+1}{3}+\frac{x-2}{4}>0$$

8) Find an equation of a line passing through $(5,4)$ and perpendicular to the line

$$2y=3x-7$$ **(4 marks)**

9) Solve the following system **(4 marks)**

$$\begin{cases}2x+y-5=0\\3x-4y-2=0\end{cases}$$

10) Given vectors $\bar{p}=\begin{pmatrix}-6\\12\end{pmatrix},\bar{q}=\begin{pmatrix}5\\-3\end{pmatrix},\bar{r}=\begin{pmatrix}-2\\1\end{pmatrix}$

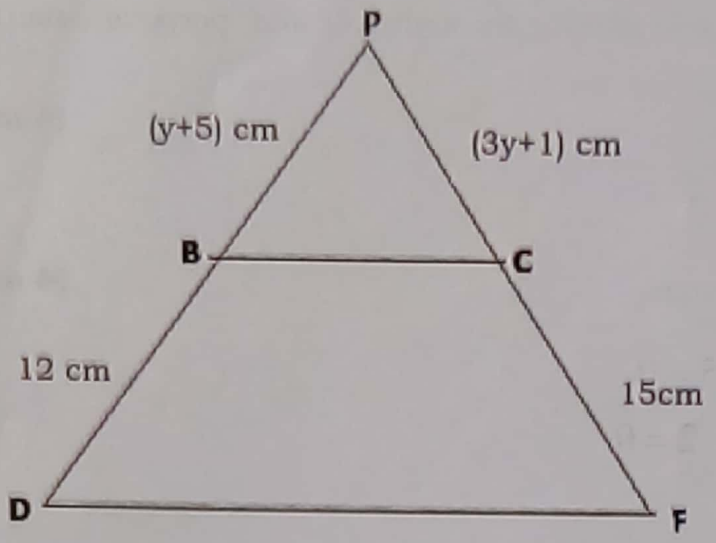
Find:

a) $\bar{k}=2\bar{q}+\frac{2}{3}\bar{p}-4\bar{r}$ **(2 marks)**

b) $\|\bar{k}\|$ **(2 marks)**

11) Determine the value of $y$ given that $BC//DF$ in the figure below, such that $PB=(y+5)\,\text{cm}; \text{BD}=12cm; \text{PC}=(3\,\text{y}+1)\,\text{cm}$ and $CF=15cm$

**(4 marks)**




12) Given that $\begin{pmatrix} 4x-32 \\ 2y+2 \end{pmatrix}$ is a null vector; find the values of $x$ and $y$

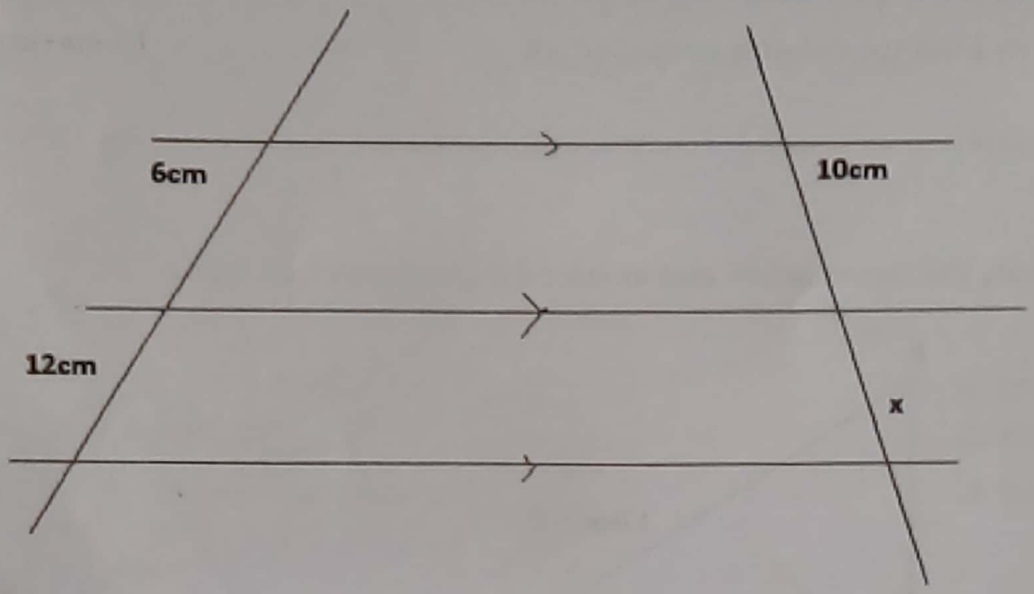
**(4 marks)**

13) The difference of two numbers is 12 and their sum is 20. Find those numbers.

**(4 marks)**

14) a) State Thale's theorem for a trapezium. **(1 mark)**

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




15) A bag contains 6 red balls and 4 green balls. Find the probability of selecting at random:

a) A red ball. $P(R) = \frac{6}{10}$ **(2 marks)**

b) A green ball. $P(G) = \frac{4}{10}$ **(1 mark )**

**SECTION B: ATTEMPT ONLY THREE QUESTIONS (45 marks)**

16) (a) In Cartesian plane, $P(-5,2)$ is translated such that its image is $P'(1,-2)$

i) Find the vector of translation. **(4 marks)**

ii) Determine the coordinates of the image of M(3,1) under the translation in (i). **(2 marks)**

iii) What are the coordinates of the point whose image is $Q'(4,-3)$ under the same translation? **(2 marks)**

(b) Point $A$ has coordinates $(4,6)$ and $B$ has coordinates $(14,10)$

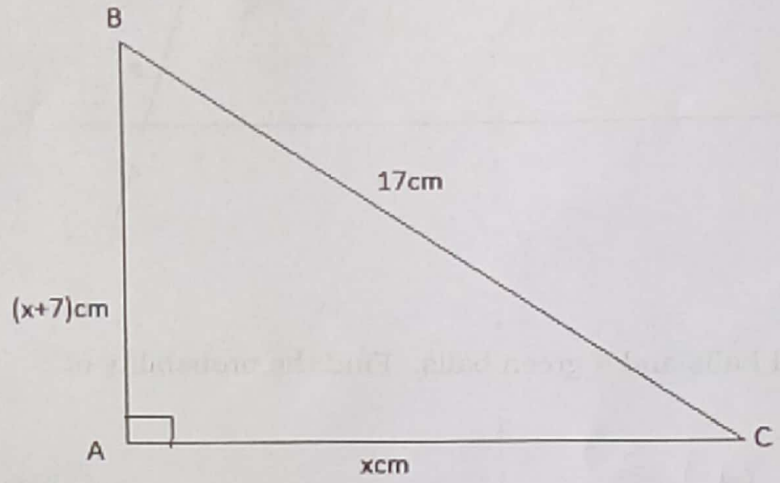
i) Find the position vector of $A$ **(1 mark)**

ii) Find the position vector of $B$ **(1 mark)**

iii) State the column vector for $A0$ **(2 marks)**

iv) Find the column vector for $AB$ **(3 marks)**

17) (a) Study the figure below and answer the questions that follow.




Find:

i) The value of $x$ **(4 marks)**

ii) The perimeter of triangle ABC **(3 marks)**

iii) The area of the triangle. **(3 marks)**

b) Find the equation of a perpendicular bisector of a straight line joining the points $A(-4,1)$ and $B(2,7)$. **(5 marks)**

18) A school has a teaching staff of 22 teachers. 8 of them teach Mathematics, 7 teach Physics and 4 teach Chemistry. Three teach both Mathematics and Physics and one teaches Mathematics and Chemistry. No teacher teaches all the three subjects. The number of teachers who teach Physics and Chemistry is equal to that of those who teach Chemistry but not Physics.

a) Represent the above information on a venn diagram. **(9 marks)**

b) Find the number of teachers who teach:

i) Mathematics only **(2 marks)**

ii) Physics only **(2 marks)**

iii) None of the three subjects **(2 marks)**

19) a) A function is defined as $f(x)=x^3+5x^2-4x-20$

i) Show that $x-2$ is a factor of the function $f(x)$. **(3 marks)**

ii) Factorise completely $f(x)$ **(3 marks)**

iii) Solve the equation $f(x)=0$ **(4 marks)**

b) Solve the equation $1+\frac{1}{x+2}-\frac{2x}{x^2-4}=0$ **(5 marks)**

20) The table below shows the marks scored by students in a competition marked out of 100

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 72 | 70 | 66 | 74 | 81 | 70 | 74 | 53 | 57 | 62 |
| 58 | 92 | 74 | 67 | 62 | 91 | 73 | 68 | 65 | 80 |
| 78 | 67 | 75 | 80 | 84 | 61 | 72 | 72 | 69 | 70 |
| 76 | 74 | 65 | 84 | 79 | 80 | 76 | 72 | 68 | 63 |
| 82 | 79 | 71 | 86 | 77 | 69 | 72 | 56 | 70 | 67 |
| 76 | 56 | 86 | 63 | 73 | 70 | 75 | 73 | 81 | 64 |

a) Complete the following frequency table using the data in the table.

**(12 marks)**

| Class | Mid class (x) | f | x.f | Cumulative frequency |
|---|---|---|---|---|
| 41-49 | 45 | 10 | 450 | 10 |
| 50-58 | | | | |
| ...-... | | | | |
| ..... | | | | |
| ...... | | | | |
| 86-94 | | | | |
| | | $\sum f =$ | $\sum fx =$ | |

b) What is the class width of the distribution? **(1 mark)**

c) Calculate the mean marks of the distribution. **(2 marks)**