Let the mind manage the body
Que l'esprit gère le corps

MAURITIUS EXAMINATIONS SYNDICATE

NCE 2020-2021

Mathematics

Subject code: N510

Examiners' Report

April 2022

Introduction

The Mathematics assessment is spiral in nature and students are assessed mostly on the mathematical skills acquired from Grade 7 to Grade 9. The 2020/2021 NCE assessment was on a de-loaded specification due to the COVID situation.

The following topics/learning objectives under Geometry, and Statistics and Probability were not assessed:

- Geometry: Translation
- Statistics: Use of raw data to construct a frequency table
  Determine the mean, mode and median (using frequency table)
- Probability: Construct and use simple possibility diagram to find probabilities.

Three Assessment Objectives, namely knowledge, application and reasoning underpin the design of this Mathematics paper.

AO1: Knowledge (55%)

Questions assessing *knowl*edge evaluate recall and use of facts, concepts, rules and procedure which learners need to solve problems.

AO2: Application (35%)

Questions assessing *application* focus on learners' ability to apply their mathematical knowledge and skills to solve routine problems.

AO3: Reasoning (10%)

Questions assessing *reasoning* require the candidate to deal with routine and non-routine problems which may be multi-step and may be set in complex contexts.

The NCE Examiners' report for NCE Grade 9 Mathematics offers feedback on the performance of candidates and is meant to guide future candidates for the assessment preparation.

This report is to be read along with the question paper, available on the MES website.

Key messages

To do well in this paper, candidates need to:

- demonstrate good understanding across the whole syllabus.
- be competent in basic numeracy skills (the four basic operations).
- be familiar with whole numbers, decimals and fractions and their conversion from one form to another.
- recall and apply necessary formulae.

General Comments

The performance of candidates is quite encouraging and satisfactory if we consider the overall percentage of 79.5% of candidates obtaining a grade 6 or better. However, after scrutiny of the quality of results, it can be inferred that the expected proficiency level (based on the Teaching and Learning Syllabus) has not been achieved by most.

The mean mark for girls in this paper is 41.08, while the mean mark for boys is 37.92, indicating that girls' performance was slightly better than boys in 2021.

Generally, good skills were shown in basic numeracy, while arithmetic slips were common. Candidates are encouraged to check their working correctly. One-step problems were most of the time well-attempted, while problems involving more than one step proved to be challenging for many candidates. From the scripts in the marking exercise and post-marking exercise, it was clear that many candidates have not developed the necessary mathematical skills to solve complex problems confidently. Questions 1 to 5, 7(b),12(a), 15(a), 20, 21, 24(a) and 27(a) were found to be more scoring while questions 8, 9, 12(b), 16(b) 22, 24(b), 26, 27(b) and 28 were particularly challenging for candidates.

The paper catered for candidates of all abilities. Most of the students could complete the paper in the given time. Many scripts were found to be incomplete with answer spaces left blank mainly due to lack of knowledge of basic mathematical concepts, facts and rules. On the other hand, it was also common to note that some candidates had the necessary skills to devise proper strategies to solve problems, but could not reach the correct solution due to arithmetic errors while dealing with integers, fractions and decimals.

In many cases, candidates were not able to secure partial marks because of omission of necessary workings. Many candidates failed to present their work in a clear and neat manner, resulting in loss of marks.

Paper Overview

The paper consists of 28 questions and the duration of the paper is 2 hours.

The table below shows the types of questions the paper consists of:

Question number	Types pf questions	Marks
1-10	Very short answer questions	1
11 (a-j)	Multiple choice questions	1
12 -21	Short answer questions	≥ 2
22 - 28	Long answer questions/structured questions	3 - 12

The different types of questions allow students of all abilities to demonstrate their mathematical skills and competencies. The paper is graded starting from very simple questions to more complex ones.

The use of calculators is not allowed for this paper.

Comments on Specific questions

Questions 1 – 10 were one-step operation questions assessing mainly knowledge and understanding.

Questions that were found to be problematic to many candidates were questions 6, 7(a), 8 and 9.

Question 1

A very high proportion of candidates were able to successfully perform the addition of two 3-digit numbers.

Question 2

Most candidates were successful in subtracting fractions with same denominators.

Question 3

Candidates' responses were mostly satisfactory. Laws of indices, more precisely the power law of indices, was familiar to most of the candidates.

Question 4

A vast majority of candidates were able to multiply a decimal number to a whole number.

Question 5

Most candidates were able to convert a fraction to a decimal number.

Question 6

Which of the following is an irrational number ?

5.08 $\sqrt{5}$ $7\frac{2}{5}$ $\sqrt{36}$

Around half of the candidate population had difficulties in identifying the irrational number from the given list and a variety of wrong answers were given showing that they were not able to recall the meaning of an irrational number.

Question 7

(a)

Simplify $5x^2 + 2x^2$

More than half of the candidate population could not attempt this question. The most common incorrect answer given by candidates was $7x^4$.

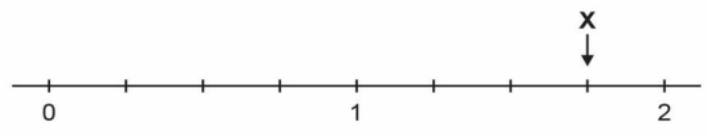
(b)

Evaluate $2 + 3 \times 5$

The majority of candidates could attempt this question successfully. The most common wrong answer noted was 25 coming from 5×5. This reveals that they did not apply the correct order of operations and they performed addition before multiplication.

Question 8

State the value of **x** shown on the number line below.



This was the least well-answered question in the series, where only a minority of candidates scored. Candidates showed difficulty in subdividing the number line to give the correct answer. 1.8 and 1.9 were the most common incorrect answers seen.

[*Ans: 1.75*]

Question 9

Evaluate $(27)^{\frac{1}{3}}$

More than half of the candidate population could not score in this question as they did not figure out that 27 was raised to the power of 1/3 and was simply the cube root of 27. Many worked out $27 \times \frac{1}{3}$ instead.

Question 10

In this question candidates were expected to find the L.C.M of 4, 6 and 9.

From the responses, it was clear that many candidates struggled to find the L.C.M or had problems in differentiating between L.C.M. and H.C.F. The most common incorrect answers were 6 (product of 2 and 3) and 216 (product of the 3 numbers). Some candidates successfully wrote 4, 6 and 9 as the product of prime factors, but did not score any mark.

It is noteworthy that this question carries 1 mark, and here candidates were expected to find the LCM using simple mental calculations or by listing the multiples of each number and concluding that the L.C.M. is 36.

Question 11

Question 11 consisted of 10 multiple choice questions. They were mainly questions assessing knowledge and comprehension.

Part	Key	% of correct answers	Most common distractor
(a)	D	60	B/C
(b)	B	97	-
(c)	C	87	-
(d)	A	45	D
(e)	A	76	C/D
(f)	D	72	-
(g)	B	30	D
(h)	B	62	A
(i)	D	62	A/B
(j)	C	43	A/D

Comments on Specific Parts of Question 11

Part(a) was a knowledge-based question. Though the majority of candidates correctly identified a trapezium, distractors B and C were also chosen by a relatively high number of candidates.

The distractors chosen, 'parallelogram' and 'rhombus' indicate that candidates could not recall that a trapezium has only one pair of parallel line compared to a parallelogram and rhombus which have two pairs of parallel lines.

Part (b)

This part was an application one-step problem. A large majority of candidates were able to answer successfully.

Part (c)

The majority of the candidates responded well to this item.

Part (d)

(d) Express 20 cm as a percentage of 400 cm.

A 5 %
B 8 %
C 50 %
D 80 %

Nearly half of the candidates could not attempt this item. Many candidates opted for distractor D. A few chose option C due to arithmetic slips.

Part (e)

The majority of the candidates were able to simplify the ratio. However, some candidates did not reduce the ratio 16:48 to its simplest form, and chose option C (4:12) option or D (8:24).

Part(f)

Part(f) was satisfactorily answered by most candidates.

Part (g)

(g) Simplify $4x^{-2}$

A $-\frac{x^2}{4}$

B $\frac{4}{x^2}$

C $-4x^2$

D $\frac{1}{4x^2}$

This was the least well-answered multiple-choice question. Only around one third of the candidates were able to score in this part. The most common distractor chosen was option D.

It appears that candidates had the misconception that the integer 4 was also raised to the power of -2.

Part (h)

(h) The point where the lines $y = -1$ and $x = 3$ meet is .....

A (-1, 3)

B (3, -1)

C (3, 1)

D (1, 3)

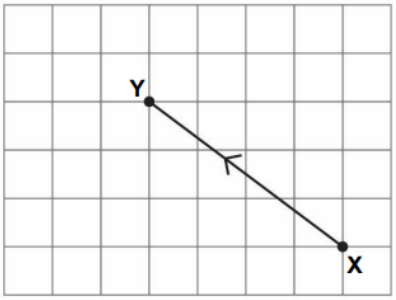
Most of the candidates successfully answered this item, but for those who were not able to score, option A was often favoured. Those candidates were probably not careful in reading the question and did not notice that the y-coordinate was given before the x-coordinate or they were not able to recall that coordinates are written as (x, y).

Part (i)

Many candidates could recall the number of lines of symmetry of a regular pentagon and gave the correct answer. For those who were unsuccessful option B was a common choice.

Part (j)

(j) Which of the following represents vector $\overrightarrow{XY}$?



A $\begin{pmatrix} 4 \\ -3 \end{pmatrix}$

B $\begin{pmatrix} -4 \\ -3 \end{pmatrix}$

C $\begin{pmatrix} -4 \\ 3 \end{pmatrix}$

D $\begin{pmatrix} 3 \\ -4 \end{pmatrix}$

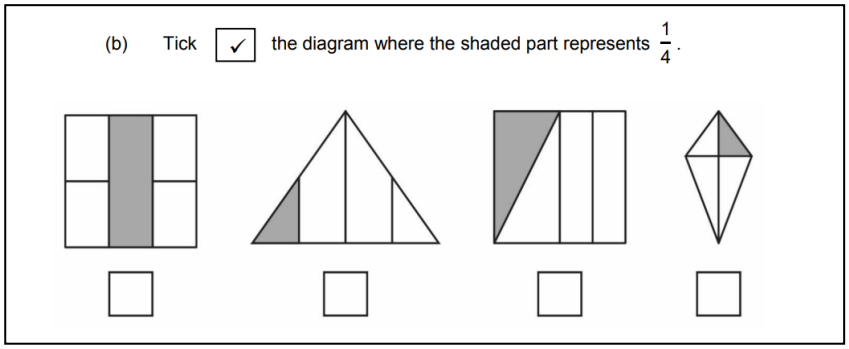
In this part candidates were expected to identify which vector was represented in the given diagram. Some were unable to write the vector correctly and reversed signs and digits. They found vector YX instead of vector XY.

Question 12

(a) Most of the candidates could successfully complete the sequence of numbers.

(b) This item required some level of reasoning by candidates.

Only a minority of the candidates were able to correctly identify the required diagram.



Many chose the second or fourth diagram. Some selected the second, the third and the fourth diagrams as they were not sure in which one ¼ of the shape was shaded and credit was in this case not awarded. It seems that candidates did not realise that in the second and fourth diagrams the regions were not equally divided. Low performance of candidates in this question also reveals that they had not developed basic knowledge of fractions.

[*Ans: 3rd diagram ticked*]

Question 13

In this question candidates were required to find $\sqrt{2000}$ when the numerical values $\sqrt{2}$ and $\sqrt{20}$ were given

One third of the candidate population were able to score full marks in this question. Many candidates were able to earn a partial mark for writing $\sqrt{2000}$ as $\sqrt{20} \times \sqrt{100}$.

In some scripts, it was common for candidates to reach the incorrect answer of 447.2 coming from $\sqrt{20} \times 100$.

Question 14

(a)

Solve $5x + 3 > 28$

Only half of the candidates obtained full marks in solving the inequality.

It was common to note that candidates reversed the inequality or simply replaced the inequality sign by an equal to sign. This revealed that many of our candidates are not

confident about solving inequalities. They could however, isolate the unknown x and obtain 5 on the RHS.

(b)

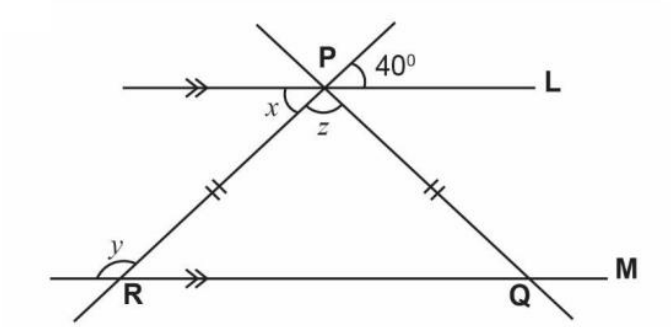
In this part candidates were required to find the smallest integer that satisfied the inequality which they had solved in part (a).

This part of the question proved to be challenging for most candidates. Around 75% could not solve this problem. It was also noticed that one of the predominant wrong answer was 5. Some candidates solved the inequality again. It seems they had no hint of what had been asked of them.

Question 15

In this question, candidates were required to find angles labelled *x*, *y* and *z*.

PQR is an isosceles triangle with **PQ** = **PR**. Line **L** is parallel to line **M.**



(a)

This part was well-answered by most of the candidates.

Common wrong answers were 50^o resulting from $(90^o - 40^o)$ and 140^o resulting from $(180^o - 40^o)$.

(b)

Many of the candidates scored full marks. They were well-acquainted with angle properties involving parallel lines.

(c)

This part proved to be challenging to many candidates. More than half of the candidates could not find angle *z.* Many candidates did not use the fact that the triangle **PQR** was isosceles, and thus did not consider angles at vertex **P** and **Q** to be 40^o. It was common to find candidates attempting the use of the sum of angles at the point **P** being 360^o, which did not lead to the correct answer.

Question 16

(a)

Using the expansion $a^2 - b^2 = (a + b)(a - b)$, evaluate $22^2 - 18^2$.

Only a minority of candidates were able to gain a full score. Most candidates were able to express $22^2 - 18^2$ in the form (22+18) (22 - 18), but did not continue to reach the correct answer. Candidates should be encouraged to read carefully and understand command words such as 'evaluate'. It was common to have candidates expanding (22+18) (22-18) obtaining 484 – 396 + 396 – 324 to reach 160.

It was also noted that some candidates did not use the given expansion but calculated the difference of 22^2 and 18^2. Credit was not earned in this case.

(b)

Given $a^2 + b^2 = 79$ and $ab = 24$, find $(a - b)^2$.

This part was very challenging for the vast majority of the candidates.

Many candidates expanded $(a - b)^2$ leading to $a^2 - 2ab + b^2$. Some reached 55 as final answer by taking 79 – 24, ignoring the co-efficient 2 in the term -2ab.

[Ans: 31]

Question 17

This question was a knowledge-based question on operating matrices.

(a)

This part required students to evaluate 3**P** + **Q** and was mostly well-answered. In some cases, candidates were successful in finding 3**P** but could not score fully because of arithmetic slips while performing 3**P** + **Q.**

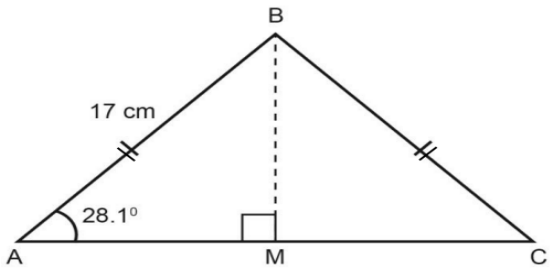
(b)

Candidates were required to perform matrix multiplication. This was poorly answered. Only a quarter of the candidates earned full marks. Many candidates produced the incorrect answer $\begin{pmatrix} 6 & 12 \\ 0 & -14 \end{pmatrix}$ which resulted from multiplication of corresponding elements of the 2 matrices.

Question 18

(a)

18. Triangle ABC is isosceles with AB = BC. Angle BAC = 28.1°, angle AMB = 90° and AB = 17 cm.



(a) Using the information given below, show that BM = 8 cm, correct to the nearest whole number.

[sin 28.1° = 0.471 cos 28.1° = 0.882 tan 28.1° = 0.534]

Only one out of 5 candidates scored full marks in this part while many managed to score partial marks. The majority of the candidate population applied the correct trigonometric ratio, but could not proceed with the multiplication to reach 8.007.

It was also common to see final answers in decimal and not to the nearest whole number, resulting in loss of marks.

Some candidates did not show an understanding of the command verb 'show' and $\sin 28.1^0 = 8/17$ was commonly seen in scripts.

(b)

(b) Using BM = 8 cm and Pythagoras' theorem, find AC.

This part proved to be challenging for many candidates and most of them earned only partial marks.

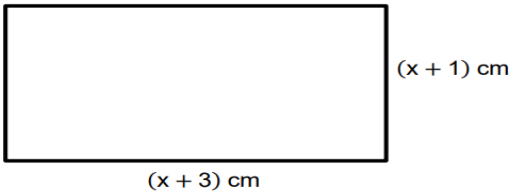
Most candidates made use of Pythagoras' theorem and obtained 15 cm for the length of AM. However, since they could not conclude that AC = 2 × AM, they were unable proceed successfully to the solution.

In some cases, despite having being instructed to use the Pythagoras' Theorem candidates chose to use simple trigonometry to calculate AM and consequently could not score.

Question 19

(a)

A rectangle has length $(x + 3)$ cm and width $(x + 1)$ cm.



Given that the area of the rectangle is 24 cm^2,

(a) form an equation in terms of x and show that it simplifies to $x^2 + 4x - 21 = 0$.

Many candidates were successful in formulating the correct equation to reach the given answer.

However, in some cases, it was noted that candidates fiddled to reach the required equation. At times, necessary workings were missing, while at other times the '+' sign was omitted while applying distributive law.
Some candidates started with (x+3) (x+1) = 0 to finally reach the correct equation.

(b)

Solve the equation $x^2 + 4x - 21 = 0$.

Most candidates showed good skills in solving quadratic equations.
Some candidates showed difficulty at the factorising stage and reached 3 and 7 or -3 and 7 or -3 and -7 as final answer.

(c)

Hence, find the perimeter of the rectangle.

This part was two-fold requiring candidates to identify the correct value of 'x' which was 3. This would lead to the correct value for the perimeter. Many candidates did not show confidence and necessary skills to choose the correct value of 'x'. Some left their final answers in algebraic form.

Question 20

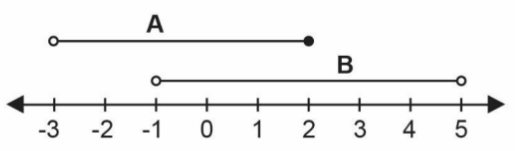
In this question, candidates were required to draw the image of a triangle under a reflection in an inclined line.
A noticeable number of candidates gained credit for this number. Some gained a partial mark for identifying that the point B was invariant.

Question 21

The knowledge of simple probability was assessed in this question and most candidates gained full marks in both parts.

Question 22(a,b)

The number line below shows the values of sets A and B.



Write down the following in set-builder notation.

(a) **A**

(b) **A** ∩ **B**

The performance for both parts of this question was relatively low for the majority of candidates. They did not seem to be familiar with representation of inequalities on number lines and set-builder notation. Few students listed the integers in sets rather than writing their answers in set-builder notation.

Question 23
(a)

If the vector $\overrightarrow{\mathbf{CD}}$ is given by $\begin{pmatrix}12\\-5\end{pmatrix}$, find

(a) $\overrightarrow{\mathbf{DC}}$

In general, the overall performance for this part was satisfactory. Inverting the x and y components was a common mistake among those who made unsuccessful attempts.

(b)

(b) $|\overrightarrow{CD}|$

Only some candidates could find the magnitude successfully.
Students should be encouraged to use brackets where necessary to avoid arithmetic errors. In this case, $\sqrt{12^2 + -5^2}$ was often seen to lead to $\sqrt{144 - 25}$.

Question 24
(a)

The following set of values represents the number of marbles that 6 different children bring in a game.

4 4 7 6 4 5

(a) Find the mean number of marbles.

The vast majority of the candidates could find the mean of the given set of data without difficulty. The correct answer was not reached mostly due to arithmetic slips.

(b)

Alan joins the game later with x marbles. The mean number of marbles is now 6. Find the value of x.

Only few candidates who knew the concept of combined means and those who could calculate the total number of marbles of the six children together with Alan could reach the correct answer. Some candidates seem to have understood the concept but considered 6 children instead of 7 and therefore reaching x = 6 (resulting from 6 × 6 - 30).

In some scripts, $\frac{4+ 4+ 7+ 6+ 4+ 5+ x}{7}$ without equating to 6 (new mean) was seen.

Question 25

Solve the simultaneous equations.

$$2x + y = 5$$
$$3x + 2y = 7$$

Many correct answers to the simultaneous equations were seen. Most candidates favoured the elimination method to the substitution method.
Arithmetic errors were however commonly seen, for e.g. -y = 1 leading to y = 1.
Candidates who could not find their first variable were often successful in following through to their second variable by substitution. Partial marks were obtained in this case.

Candidates should be encouraged to perform a solution check after having found their two unknown variables.

Question 26

The relatively low performance of candidates in this question reveals that many students do not have an in depth understanding of line equations.

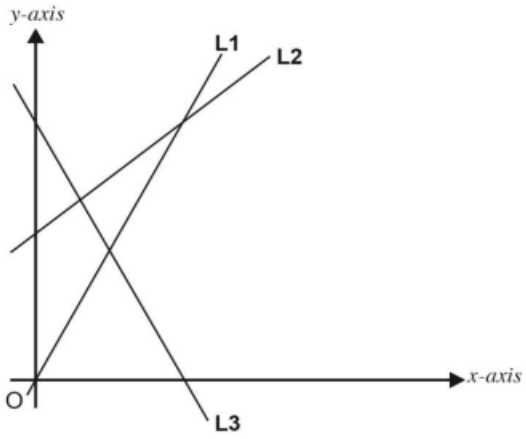
(a)

(a) Find the equation of the line passing through the point (0, 4) and parallel to the line $2y = -6x$.

Many candidates succeeded in making *y* the subject of the formula reaching *y* = -3*x,* without stating that the gradient is – 3 and they did not continue to reach the required equation.
For those who reached to the correct equation of *y* = -3 *x* + 4, it was noted that they did read the value of 'c' from the given point (0,4), but went on to calculate the value of 'c'.

(b)

(b) Study the graph below carefully.



The equations of the lines **L1**, **L2**, and **L3** are given in the list below.

$y = -2$ $y = 2x$ $y = 3$ $y = 8 - 2x$ $y = x + 5$

From the list, write down the equations of lines **L1**, **L2** and **L3** in the spaces provided.

L1: .....

L2: .....

L3: .....

Only candidates of higher abilities were able to answer correctly. Candidates in general could not associate the orientation of lines with the gradient.

Question 27.

(a)

Dev decides to buy a TV set on hire purchase under the following conditions:

Cash price: Rs 18 000

No deposit

Time of repayment: 3 years, payable in equal monthly instalments

Rate of interest: 15 % per annum

Calculate

(a) the simple interest that Dev pays over the 3 years

Only a handful of candidates could obtain full marks in this part of the question. Most managed to substitute correctly the values in the formula $I = \frac{PRT}{100}$, but could not reach the final answer due to arithmetic errors while performing $\frac{18000 \times 3 \times 15}{100}$.

(b)

the monthly instalment that Dev pays

A minority of the candidates were able to reach the correct answer. Some earned partial marks.
Most candidates could not figure out that the total sum of money to be paid by Dev should be the Interest + the cash price.

The most common incorrect values seen were:

- Rs 500 resulting from $\frac{18000}{3\times12}$ (cash price / 36).
- Rs 225 resulting from $\frac{8100}{3\times12}$ (interest /36).

This reveals that many candidates knew and understood that the TV set had to be repaid in 36 instalments.

Question 28
(a)(i)

28. **Diagram 1** shows an open rectangular tank with a base 20 cm by 15 cm and height 18 cm. This tank contains water to a height of 14 cm.
Diagram 2 shows a solid metal cylinder of diameter 10 cm and height 7 cm.

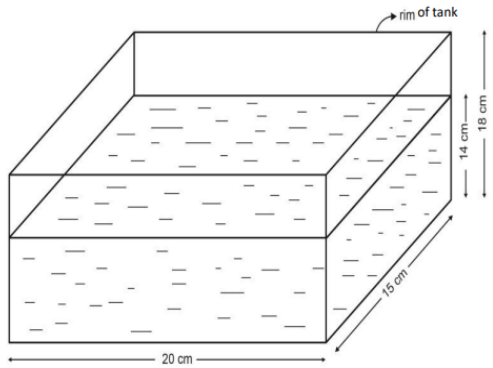


Diagram 1

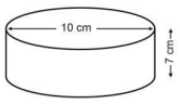


Diagram 2

(a) Calculate

(i) the volume of water in the tank,

Most of the candidates could recall the formula for volume of cuboid. They correctly substituted the values to reach the correct answer.
However, it was noted that some candidates calculated the volume of the tank rather than the water in the tank. In this cases, credit was not awarded.
[*Ans:4200*]

(a)(ii)

the total surface area of the tank that is in contact with water.

Most candidates understood the procedure to reach the solution. However, the correct final answer was rarely seen due to mistakes in calculations.
It was common to note that candidates included the area of the top surface of the water. This led to the wrong answer of 1580 cm^2.

It appears that many candidates do not read questions carefully.
[*Ans:1280*]

(b)

The solid metal cylinder, shown in **Diagram 2**, is completely immersed in the tank. (b) Calculate the rise in the water level in the tank. [Take $\pi = \frac{22}{7}$]

This part proved to be challenging for most candidates. The large majority of candidates did not earn any mark.
The quickest approach to this question was to appreciate that the rise is due to the immersion of the cylinder leading to $15 \times 20 \times h$ = volume of cylinder.
Most candidates could not reach the correct answer. The common mistakes noted were:

- Inability to recall the correct formula for volume of cylinder (e.g. $volume = 2\pi r^2 h$)
- Taking radius to be 10 cm instead of 5 cm
- Finding new height of the water level rather than finding the rise of water level

[*Ans :1* $\frac{5}{6}$]

(c)

A second **identical** cylinder is now completely immersed in the tank. Find the distance between the new level of water and the rim of the tank.

This part of the question was meant to assess reasoning and logical thinking.
Candidates were expected to conclude that when a second identical cylinder was immersed in the tank, the rise in height would be twice the rise resulting from the immersion of one cylinder. [*Ans: 1/3*]

Few candidates were able to score full credit.
In many scripts the answer space was left blank or incomplete attempts seen.

Conclusions and Recommendations

This first series of the NCE assessment serves as an eye opener as far as the performance of our candidates is concerned. The percentage pass rate of the Mathematics assessment is encouraging. Most candidates demonstrated good skills in carrying out standard mathematical procedures competently.

On the other hand, it was apparent that many candidates lacked confidence in solving problems, particularly when they were exposed to new contexts. Knowing the mathematical procedures but not gaining full score due to arithmetic errors was common in scripts of candidates.

Candidates are advised to:

- read and interpret information/instructions and command words carefully.
- to read questions till the end before attempting them to avoid missing out on any key information.
- Show all necessary workings clearly in the appropriate space. Neat, clear and concise work presentation helps candidates to remain focused, ensures that the number of arithmetic mistakes is reduced and consequently increases candidates' chances to score marks.
- Reinforce the learning of Mathematical fundamental concepts and operations on numbers including fractions and decimals through constant practice to build confidence.