higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

MATHEMATICS

(First Paper)

NQF LEVEL 2

(10501042)

5 November 2019 (Y-Paper)
13:00–16:00

Non-programmable scientific calculators may be used.

This question paper consists of 12 pages, 1 addendum and 1 formula sheet.

TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
2. Read ALL the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Start each section on a NEW page.
5. Use only a BLACK or BLUE pen.
6. Leave at least THREE lines after each question.
7. Diagrams are NOT drawn to scale.
8. Where necessary, answers should be rounded off to TWO decimal places, unless stated otherwise.
9. Write neatly and legibly.

QUESTION 1

1.1 Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (1.1.1–1.1.5) in the ANSWER BOOK.

1.1.1 $\sqrt{16}$ is … .

A the square root of an irrational number
B a rational number and an irrational number
C a real and rational number
D not a natural number

1.1.2 $\frac{2a^{-5}}{-3b^2}$ simplified and in exponential form:

A $\frac{2}{-3a^5b^2}$
B $\frac{2(3)}{a^5b^2}$
C $\frac{2a^5}{3b^2}$
D $\frac{2(3)a^5}{b^2}$

1.1.3 $\frac{2}{5}x^{\frac{-2}{3}}$ expressed in surd form, with a positive exponent, is equal to … .

A $\frac{2}{5}x^{\frac{2}{3}}$
B $\frac{2}{5\sqrt[3]{x^2}}$
C $\frac{2}{5}\sqrt{x^3}$
D $\frac{2}{5x^{\frac{2}{3}}}$

1.1.4 $\frac{130}{99}$ written as a recurring decimal:

A $1,3$
B $1,3131$
C $1,\dot{3}1\dot{3}$
D $1,\overline{31}$

1.1.5 $-3 < x \leq 5$ written in interval notation:

A $x \in (-3;5]$
B $x \in (-3;5)$
C $x \in [-3;5)$
D $x \in [-5;3]$

(5 × 1) (5)

1.2 Convert the following decimal number to the form $\frac{a}{b}; where\ a,b \in Z\ and\ b \neq 0$. Write the final answer in its simplest form.

321,515151.... (2)

1.3 Apply surd rules to simplify surds without the use of a calculator and give the answer with a rational denominator. Show ALL the steps.

1.3.1 $\frac{5\sqrt{2}\ x + \sqrt{32}.\sqrt{x^2}}{\sqrt{81}\ x}$ (3)

1.3.2 $\frac{\sqrt{36x^2}}{x - \sqrt{5x^2}}$ (3)

1.4 Simplify the following by using exponential laws.

(Leave the answers with positive exponents and in surd form where applicable.)

1.4.1 $(2x^{-3} \times 4x^3)^2 \times x^0$ (2)

1.4.2 $\frac{2^x + 2^{x+3}}{2^x}$ (2)

1.4.3 $\frac{(a^4)^{n+1} \times (a^2 b)^{-3n}}{(a\ b)^{-2n} \times b^{-n}}$ (3)

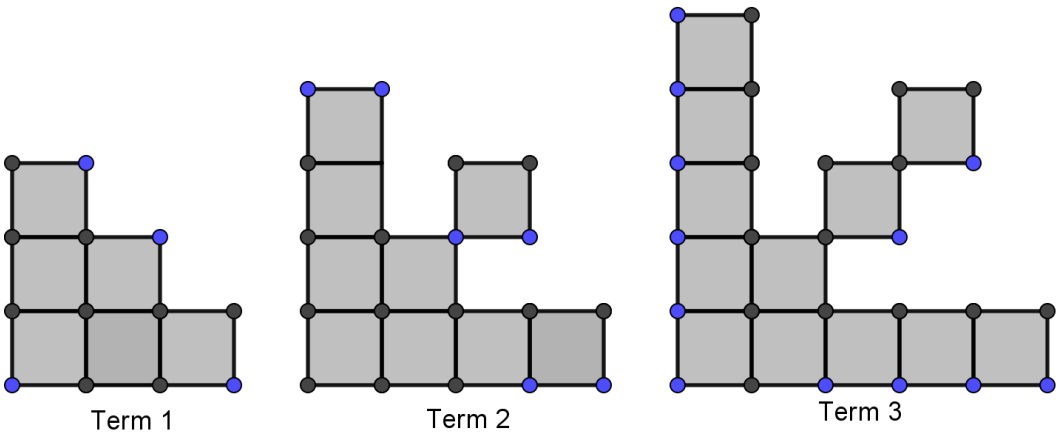
1.5 Given: $y = \frac{3}{x} + 5$

1.5.1 Make x the subject of the formula (2)

1.5.2 Determine the value for x if $y = 10$ (1)

1.6 Jabu is playing with building blocks and starts a design. She has placed the blocks to form three patterns and aims to continue with that pattern. The number of blocks used per pattern is shown in the digram below. Each pattern represents a term in an arithemtic sequence with the first two terms being 6 and 9.

Building block structure growing in pattern of an arithmetric sequence



1.6.1 Calculate the number of blocks used in the 15^{th} pattern (T_{15}) of the sequence. (2)

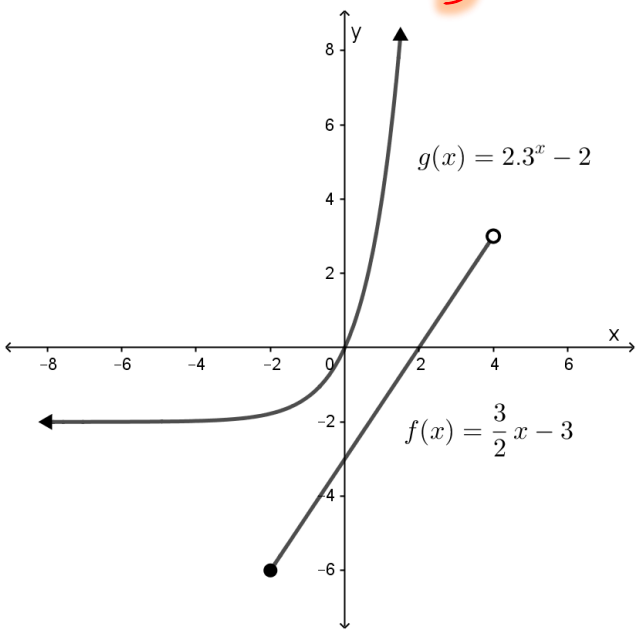
1.6.2 Determine the total number of blocks used if she builds 100 patterns (sum of the first 100 terms of this sequence). (2)

1.6.3 If Jabu continues with her pattern, for which pattern (term) will she use 138 blocks? (3)

[30]

QUESTION 2

2.1 Study the graph below. Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (2.1.1–2.1.7) in the ANSWER BOOK.



2.1.1 Which statement correctly describes the horizontal asymptote for the graph of $g(x)$ above?

A $y = 0$
B $y = -2$
C $x = -2$
D $x = 0$

2.1.2 Which of the following sets describe the range the best in graph of $g(x)$ above?

A $y \in \mathrm{R}$
B $y \in [-2; +\infty)$where $y \in \mathrm{R}$
C $x \in (-\infty; +\infty)$where $x \in \mathrm{R}$
D $y \in (-2; +\infty)$where $y \in \mathrm{R}$

2.1.3 Which of the following statements are true regarding graph of $g(x)$ above?

A The graph of $g(x)$ has an asymptote at $x = -2$
B The graph of $g(x)$ is discontinuous
C The graph of $g(x)$ has an amplitude of 2
D The name of $g(x)$ is an exponential graph

2.1.4 Consider graph $f(x)$ above. The graph is …

A increasing.
B decreasing.
C discontinuous.
D a non-function.

2.1.5 Which domain and range given below corresponds to the given constraints as illustrated on graph $f(x)$ above?

A Domain: $\{x|-2 < x \leq 4; x \in \mathrm{R}\}$ and range: $\{y|-6 < y \leq 3; y \in \mathrm{R}\}$
B Domain:$\{x|-2 \leq x < 4; x \in \mathrm{R}\}$ and range: $\{y|-6 \leq y < 3; y \in \mathrm{R}\}$
C Domain:$\{x|x > -2; x \in \mathrm{R}\}$ and range: $\{y|-6 < y < -3; y \in \mathrm{R}\}$
D Domain:$\{x|x > -6; x \in \mathrm{N}\}$ and range: $\{y|-6 \leq y < 3; y \in \mathrm{N}\}$

2.1.6 What is the input value for which $f(x) = -3$ in the graph of $f(x)$.

A $y = -7,5$
B $y = 1,5$
C $y = 0$
D $x = 0$

2.1.7 If we were given the graph of $y = ab^x + q$, an increase in the q-value would cause a …

A horizontal transformation in the graph to the left.
B horizontal transformation in the graph to the right.
C vertical transformation in the graph upwards.
D vertical transformation in the graph downwards.

(7 × 1) (7)

2.2 Given $f(x) = \frac{2}{x} + 3$ and $g(x) = x + 3$

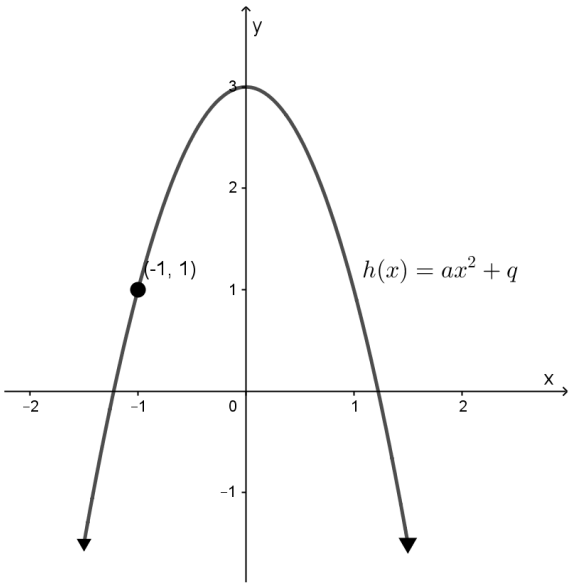
2.2.1 Sketch the graph of $f(x)$ for the domain $x \in \mathrm{R}$ by using the table method.
Sketch the graph of $g(x)$ for the domain:$\{x|-2 \leq x < 4; x \in \mathrm{R}\}$on the same set of axes, clearly showing coordinates of endpoints and their nature. Answer the question on ADDENDUM A. (5)

2.2.2 Graphically determine the simultaneous solution for the two graphs. Indicate the points by marking them as A and B on the graph in ADDENDUM A. (2)

2.2.3 The graph of $f(x) = \frac{2}{x} + 3$ has two lines of symmetry. Write down the equations for the lines of symmetry. (2)

2.2.4 What will be the effect on the graph if in $f(x)=\frac{a}{x}+q$, the sign of the a changes to a negative, therefore, $-a$. (1)

2.3 The graph given below represents the graph of $h(x)=ax^2+q$, which passes through the point (-1; 1) and cuts the *y*-axis at (0; 3).



2.3.1 Determine the values for *a* and *q* and give an equation for $h(x)$. (3)

2.3.2 What is the name of the graph of $h(x)$? (1)

2.3.3 Give the range for $h(x)$. (2)

2.3.4 Is $h(x)$ a function or a non-function? Give a reason for your answer. (2)

[25]

QUESTION 3

3.1 Simplify each of the following expressions:

3.1.1 $(2x-3)^2$

3.1.2 $(2x-y)(4x^2+2xy+y^2)$

(2 × 2) (4)

3.2 Factorise the following expressions:

3.2.1 $12a^2 - 3b^2$

3.2.2 $14 - 5p - p^2$

3.2.3 $2x^3 - 2 - 4x^2 + x$

(3 × 2) (6)

3.3 Simplify the following expression to its simplest form:

$$\frac{4(2a+1)-5(4a-2)}{20a}$$

(2)

3.4 Solve for x in each of the following equations:

3.4.1 $x^2 + 6x = 16$

3.4.2 $\frac{2}{x} = \frac{-4}{x+5}$

3.4.3 $2^{x-4} = 1$

(3 × 2) (6)

3.5 Given: $-2 < -x + 3 \leq 10$; where $x \in Z$

3.5.1 Solve the inequality $-2 < -x + 3 \leq 10$; $x \in Z$ (2)

3.5.2 Represent the solution on a number line. (2)

3.6 Solve the following system of linear equations algebraically.

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

(3)

[25]

QUESTION 4

4.1 Choose a/an word/item from COLUMN B that matches a description in COLUMN A. Write only the letter (A–H) next to the question number (4.1.1–4.1.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
4.1.1	Things you desire that are not necessities	A	bank fees
4.1.2	Money savings club where each person contributes a specific amount over a period and at the end of the month each person takes a turn to be the recipient of the money	B	variance
4.1.3	Deposit account held at a retail bank that pays interest	C	credit card
4.1.4	Method of buying goods through making instalment payments over time where the seller retains ownership until the final instalment has been paid	D	needs
4.1.5	Fees usually associated with services rendered by banks	E	hire purchase agreement
		F	savings account
		G	wants
		H	stokvels

(5 × 1) (5)

4.2 Yvette studies at a TVET college. She has drawn up her own budget. Consider ALL the information below and answer the questions.

Financial statement for May			
INCOME	Proposed	Actual	Variance
Allowance	R6 500,00	R6 500,00	R0,00
Tips	R500,00	R725,00	R225,00
Bonus (R100 per distinction)	R300,00	R100,00	-R200,00
TOTAL	**A**	R7 325,00	R25,00
EXPENSES	Proposed	Actual	Variance
Housing	R1 750,00	R1750,00	R 0,00
Transport	R950,00	R100,00	**B**
Personal hygiene	R265,00	R165,00	R100,00
Clothing	R455,00	R455,00	R0,00
Entertainment	R255,00	R120,00	R135,00
Food	R1 900,00	R2 450,00	-R550,00
Books and stationery	R750,00	R450,00	R300,00
Gym membership	R135,00	R135,00	R0,00
Long-term investment	R25,00	R25,00	R0,00
TOTAL	R6 460,00	R5 650,00	R810,00

4.2.1 Yvette's accountant told her that having a variance of −R 200 in her income is unfavourable.

Explain why the accountant says this. (1)

4.2.2 Calculate the values for A and B in the budget above. (2)

4.2.3 Will Yvette have a surplus or deficit at the end of the month? How much is it? Compare actual income and expenses to determine this. (2)

4.2.4 Gym membership and long-term investment have a zero variance.

Give a term to describe these types of expenses. (1)

4.3 Yvette wants to save some money.

Determine how much she will have after three years if she invests R1700 for a period of three years …

4.3.1 at 7% simple interest for the period. (2)

4.3.2 at 7% compound interest for the period. (3)

4.3.3 What type of interest is the better for her to use? (1)

4.4 The current cash price for a television set is R1 730.

What will the price of the same television set be if the inflation rate is 6,3% over three years? (3)

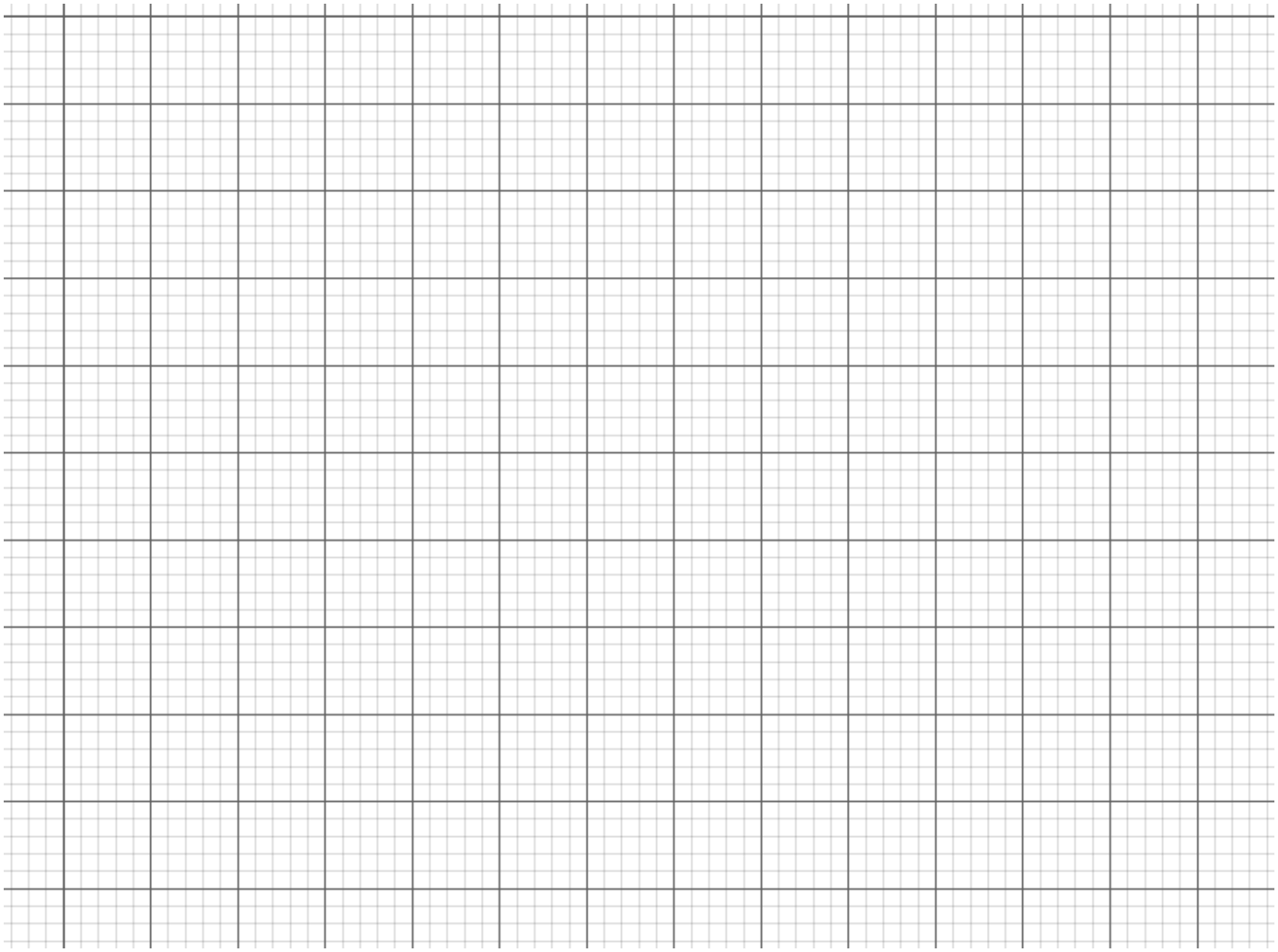
[20]

TOTAL: 100

ADDENDUM A

EXAMINATION NUMBER:

2.2



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MATHEMATICS L2

FORMULA SHEET

1) $a^m \times a^n = a^{m+n}$

2) $a^m \div a^n = a^{m-n}$

3) $(a^m)^n = a^{m \times n}$

4) $(a^m b^n)^p = a^{mp} . b^{np}$

5) $\left(\frac{a^m}{b^n}\right)^p = \frac{a^{mp}}{b^{np}}$

6) $a^{-n} = \frac{1}{a^n}$

7) $a^0 = 1$

8) $\sqrt[n]{a^m} = a^{\frac{m}{n}}$

9) $T_n = a + (n-1)d$

10) $S_n = \frac{n}{2}[2a + (n-1)d]$

11) $S_n = \frac{n}{2}(a + l)$

12) $I = A_0 \times \frac{r}{100} \times t$ or $I = \frac{P\,r\,t}{100}$ or $A_t = P(1 + i\,n)$

13) $A_t = A_o(1 + \frac{r}{100 \times m})^{t \times m}$ or $A_t = P(1 + i)^n$

14) $i = \frac{r}{100}$