



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

MATHEMATICS

(First paper)

NQF LEVEL 2

(10501042)

23 November 2020 (Y-paper)

13:00–16:00

Nonprogrammable scientific calculators may be used.

This question paper consists of 11 pages, 1 formula sheet and 1 answer sheet.

027Q1N2023

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. Answer question 2.3.1 on the attached answer sheet. Write your examination number on the answer sheet, detach it from the question paper and hand it in with the answer book.
 5. Leave at least THREE lines after each question.
 6. Diagrams are not drawn to scale.
 7. Where necessary, answers should be rounded off to THREE decimal places, unless otherwise stated.
 8. Use only a black or blue pen.
 9. Write neatly and legibly.
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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 $\sqrt{2}$ is ...

- A an integer.
- B a natural number.
- C real and rational number.
- D an irrational and real number.

1.1.2 $\frac{2^3 a^{-5}}{(-3)^2 b^2}$ simplified and in exponential form, with a positive exponent, is ...

A $\frac{8}{-9a^5b^2}$

B $\frac{8}{9a^5b^2}$



C $\frac{6a^5}{-6b^2}$

D $\frac{6a^5}{9b^2}$

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

A $\frac{2}{3}x^{\frac{3}{2}}$

B $\frac{-2}{3\sqrt[3]{x^2}}$

C $-\frac{2}{3}\sqrt{x^3}$

D $\frac{3}{2x^{\frac{2}{3}}}$



1.1.4 The domain of $y = \frac{3}{x} - 2$ is:

- A Domain = $\{x; x \neq 0; x \in E\}$
- B Domain = $\{y; y \neq -2; y \in R\}$
- C Domain = $\{x; x \neq 3; x \in R\}$
- D Domain = $\{x; x \neq -2; x \in R\}$



1.1.5 Which ONE of the following represents the inequality $-5 < x \leq -2$ where $x \in R$?

- A
- B
- C
- D



(5 × 1) (5)

1.2 Convert the following decimal number to the form $\frac{a}{b}$ where $a, b \in Z$ and $b \neq 0$.
Give the answer as a mixed number.

4,413413 ... (2)

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

1.3.1 $\frac{\sqrt{10} - \sqrt{5}}{\sqrt{10}}$ (2)

1.3.2 $\frac{\sqrt{48}x + \sqrt{27x^2}}{\sqrt{48x^2}}$ (3)



- 1.4 Simplify the following by using the laws of exponents.
(Leave the answers with POSITIVE exponents and in SURD form where applicable.)

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

$$1.4.2 \quad \frac{x^2y^3 \times x^3y^4}{(2x^{-3}y)^2} \div \frac{x^5y^7}{\sqrt{4x^2y^3}} \quad (3)$$

$$1.4.3 \quad \frac{6^x \cdot 2^{x+2}}{4^x \cdot 3^{x-2}} \quad \text{🏆} \quad (3)$$

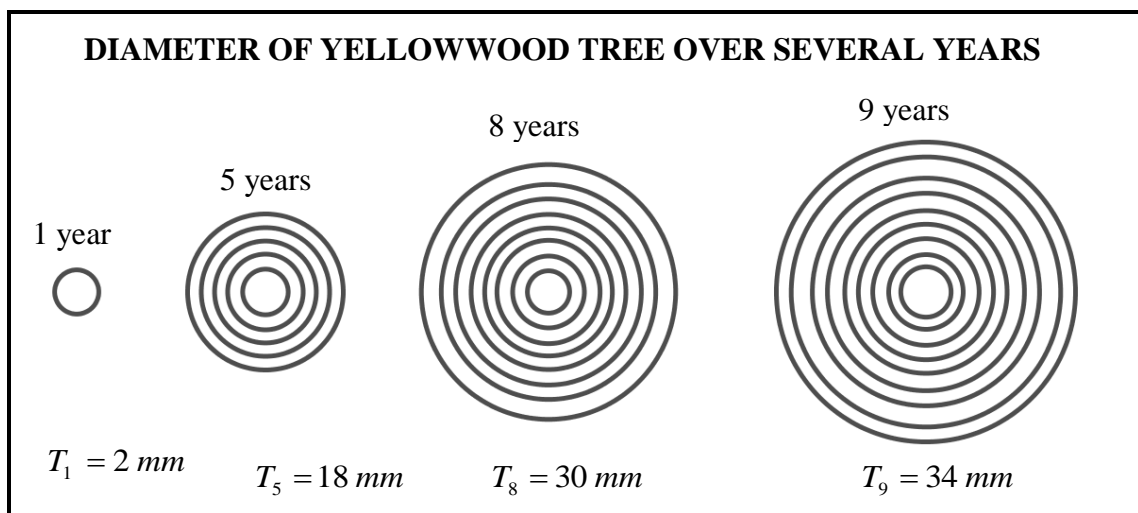
1.5 Given: $A_t = A_o(1 + rt)$

1.5.1 Make t the subject of the formula. (2)

1.5.2 If t is the time period and given $r = \frac{15}{100}$, $A_t = 2\,625$, $A_o = 1\,500$,
determine the time period t of the investment. (1)

- 1.6 The figure below represents the diameter of yellowwood trees over a given number of years. The diameter of a 1-year-old tree is 2 mm, a 5-year-old tree is 18 mm, an 8-year-old tree is 30 mm and a 9-year-old tree is 34 mm.

Hence $T_1 = 2\text{ mm}$, $T_5 = 18\text{ mm}$, $T_8 = 30\text{ mm}$ and $T_9 = 34\text{ mm}$. 🏆



1.6.1 Complete the sequence 2; ...; ...; ...; 18; 22; ... 30; 34 (2)

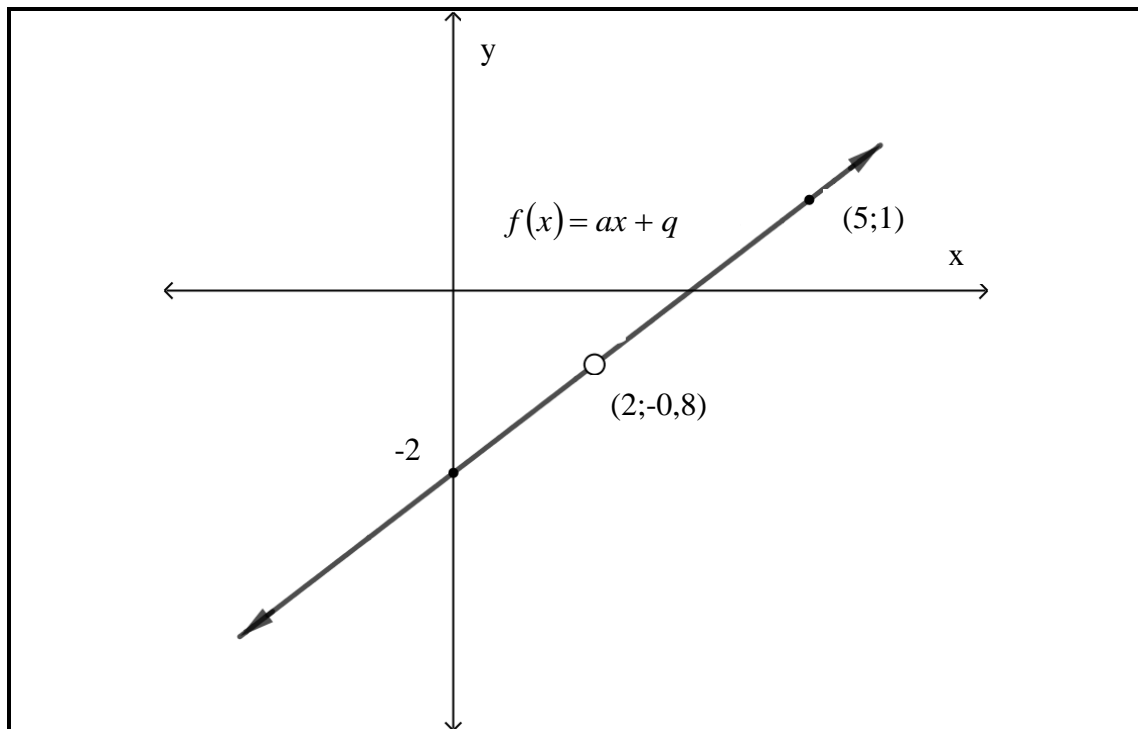
1.6.2 Calculate T_{50} in the sequence, which will give you the diameter of a tree after 50 years. 🏆 (2)

1.6.3 If the growing pattern continues, what is the age (n) of the biggest yellowwood tree, if the tree has a diameter of 2 862 mm? Determine the answer by calculating the value of ' n '. (3)

[30]

QUESTION 2

2.1 The diagram given below represents the graph of $f(x) = ax + q$.

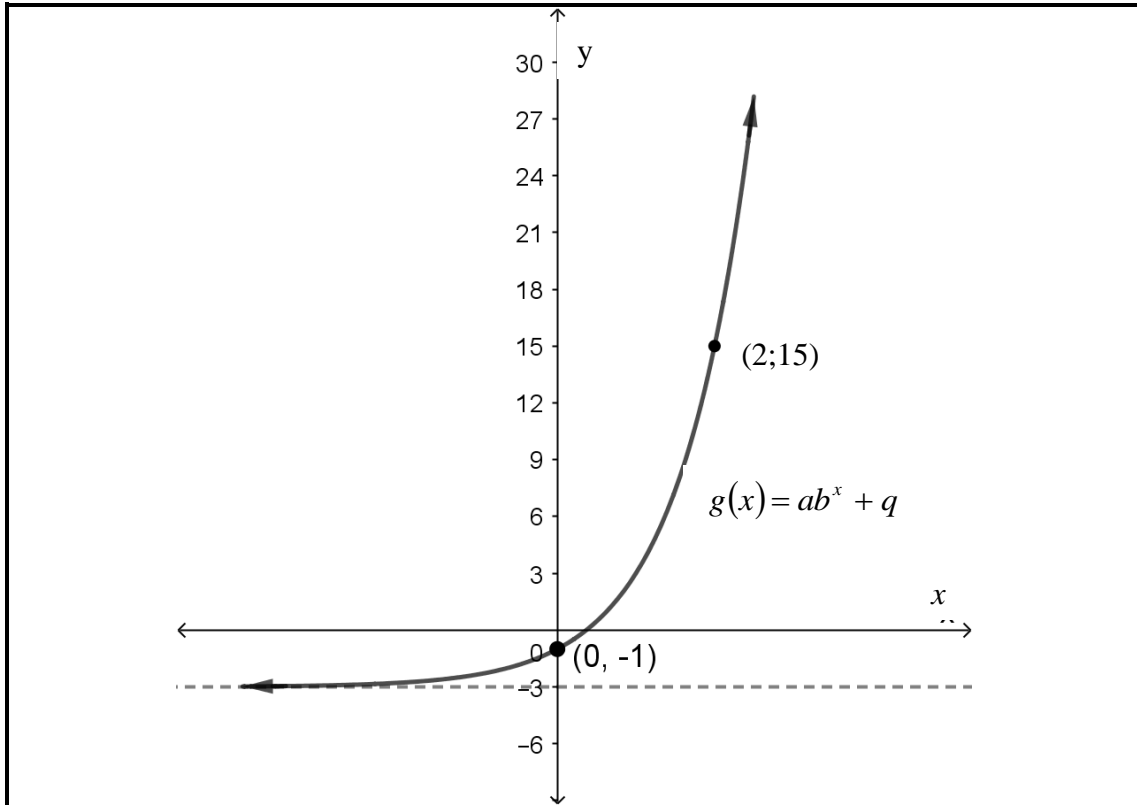


- 2.1.1 Determine the equation for $f(x)$. (2)
- 2.1.2 What is the name of the graph $f(x)$ (1)
- 2.1.3 Write down the domain for $f(x)$ (2)
- 2.1.4 Is $f(x)$ continuous or discontinuous? Give a reason for the answer. (2)



2.2 Study the graph below to answer the questions.

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 (2.2.1–2.2.7) in the ANSWER BOOK.



2.2.1 Which statement correctly describes the horizontal asymptote for the given graph?

- A $y = 0$
- B $y = -3$
- C $x = -3$
- D $y = -x$



2.2.2 Which ONE of the following sets describe the range the best?


- A $y \in R$
- B $y \in [-3; +\infty]$ where $y \in R$
- C $x \in (-\infty; +\infty)$ where $x \in R$
- D $y \in (-3; +\infty)$ where $y \in R$

2.2.3 Which ONE of the following statements are true with reference to the above graph?

- A $g(x)$ has an asymptote at $x = 2$
- B $g(x)$ is discontinuous
- C $g(x)$ has an amplitude of 3
- D The name of $g(x)$ is an exponential graph



2.2.4 The graph of $g(x) = ab^x + q$ is ...

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


2.2.5 The equation of $g(x)$ is ...

- A $g(x) = 4^x - 1$
- B $g(x) = 8x - 1$
- C $g(x) = 2.3^x - 3$
- D $g(x) = \frac{1}{8}x - 1$

2.2.6 What is the input value, x , for which $g(x) = -3$ for the graph of $g(x)$?

- A $x = 0$
- B $x = -3$
- C $y = 0$
- D Does not exist

2.2.7 If given the graph $y = ab^x + q$, the a -value will determine the ...


- A horizontal transformation in the graph. 
- B steepness and direction of the graph.
- C range and domain of the graph.
- D vertical transformation.

(7 × 1) (7)

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

2.3.1 On the ANSWER SHEET (attached), and on the same system of axis clearly sketch the graphs (by using the table method) of
 $f(x)$ for the domain $x \in R, x \neq 0$ and
 $g(x)$ for the domain: $\{x \mid -2 \leq x < 4; x \in R\}$..
 Clearly show the coordinates of the end points and their nature. (5)

2.3.2 Write down the range for $f(x)$. (2)

2.3.3 Write down the equations for the asymptotes of $f(x) = \frac{-2}{x} + 3$  (2)

2.3.4 What will be the effect on the graph of $f(x) = \frac{a}{x} + q$, if the sign for the variable a changes to a positive. (1)

[24]

QUESTION 3

3.1 Simplify the following:

3.1.1 $(2x - 3)(2x + 3)$  (1)

3.1.2 $(x^2 + y)(4x + 3xy + x^{-1}y^2)$ (2)


3.2 Factorise the following expressions:

3.2.1 $20x^2 - 45y^2$ (2)

3.2.2 $2x^2 - 5x - 3$ (2)

3.2.3 $5x^2 - 15x + 12y - 4xy$ (3)

3.3 Simplify the following expression to its simplest form:


$$\frac{6x^3y^2 + 21x^2y^2 + 18xy^2}{18xy^2}$$
 (3)

3.4 Solve for x .


3.4.1 $\frac{2}{x} = \frac{-4}{x+5}$ (2)

3.4.2 $x^2 - 6x + 9 = x - 1$ (2)

3.4.3 $27^{x+1} = 9^{x-2}$ (3)

3.5 Given: $6 - 5x \geq 4x - 9$; where $x \in R$

3.5.1 Solve the inequality $6 - 5x \geq 4x - 9$; where $x \in R$ (2)

3.5.2 Show the answer on a number line.  (1)

3.6 Solve the following system of linear equations algebraically:


$$\begin{aligned} 2x - y &= 7 \\ 3x + 2y &= 28 \end{aligned} \quad (3)$$

[26]

QUESTION 4



- 4.1 When Liesl was about to get married, she drew up a budget for her wedding. After the wedding she completed the budget by adding all the actual incomes and expenses. Consider the information below and answer the questions.

INCOME		
	Planned	Actual
Parents' Contribution	R60 000,00	R60 000,00
Savings	R7 000,00	R4 500,00
Loan	R23 000,00	R23 000,00
Cash gifts	R6 000,00	R4 560,00
TOTALS	R96 000,00	R92 060,00
Variance in the total income		A
EXPENSES		
	Estimated	Actual
Wedding and accessories(bride and groom)	R18 000,00	R22 000,00
Ceremony	R5 000,00	R4 600,00
Reception	R38 000,00	R41 000,00
Flowers and decorations	R3 500,00	R3 500,00
PA, audio visual	R2 000,00	R3 000,00
Photos and videos	R16 000,00	R13 350,00
Candles and fairy lights	R7 500,00	R8 000,00
Equipment hire	R1 500,00	R2 040,00
TOTALS	R91 500,00	R97 490,00
Variance in total expenses		B

- 4.1.1 Calculate the values for A of B in the budget.  (2)
- 4.1.2 Would Liesl have a surplus or deficit after she had done the reconciliation (balancing) of her finances? How much was the surplus/deficit? (1)
- 4.1.3 Consider the cost for the photos and videos in the expenses table.
- (a) Determine the variance in the cost for the photos and videos.
- (b) Was this a favourable or unfavourable scenario when considering the variance? (2 × 1) (2)



- 4.2 Choose a term from COLUMN B that matches the description in COLUMN A. Write only the letter (A–H) next to the question number (4.2.1–4.2.5) in the ANSWER BOOK.


COLUMN A		COLUMN B	
4.2.1	Expenses that stay the same and are paid regularly 	A	bank fees
4.2.2	Money put in a business enterprise or a financial institution	B	variance
4.2.3	The difference between the actual and projected amounts in a budget	C	credit card
4.2.4	A card issued by a bank to enable the holder to pay for purchases, where the money is transferred directly from the holder's account to the seller	D	debit card
4.2.5	The fees normally associated with services rendered by banks	E	investment
		F	savings
		G	fixed expenses
		H	stokvel 

(5 × 1)

(5)

- 4.3 The wedding dress that Liesl wanted to purchase, cost R15 000. She could purchase it using her credit card or she could pay it off over 3 years if she made use of a hire purchase agreement.

4.3.1 Determine how much Liesl would eventually pay if she decided to use the hire purchase agreement at a rate of 18% per annum simple interest over 3 years. (3)

4.3.2 Determine how much Liesl would eventually pay if she decided to use her credit card where the rate was 18% compound interest per annum over 3 years.  (3)

4.3.3 The original cash price for the dress was R15 000. In 3 years' time, due to inflation, the cost of the same dress would be R18 017,36.

What would be the average inflation rate (as a percentage) for that period? (4)

[20]**TOTAL: 100**

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 $I = \frac{Prt}{100}$ OR $A_t = P(1+in)$

13) $A_t = A_0 \left(1 + \frac{r}{100 \times m}\right)^{t \times m}$ OR $A_t = P(1+i)^n$

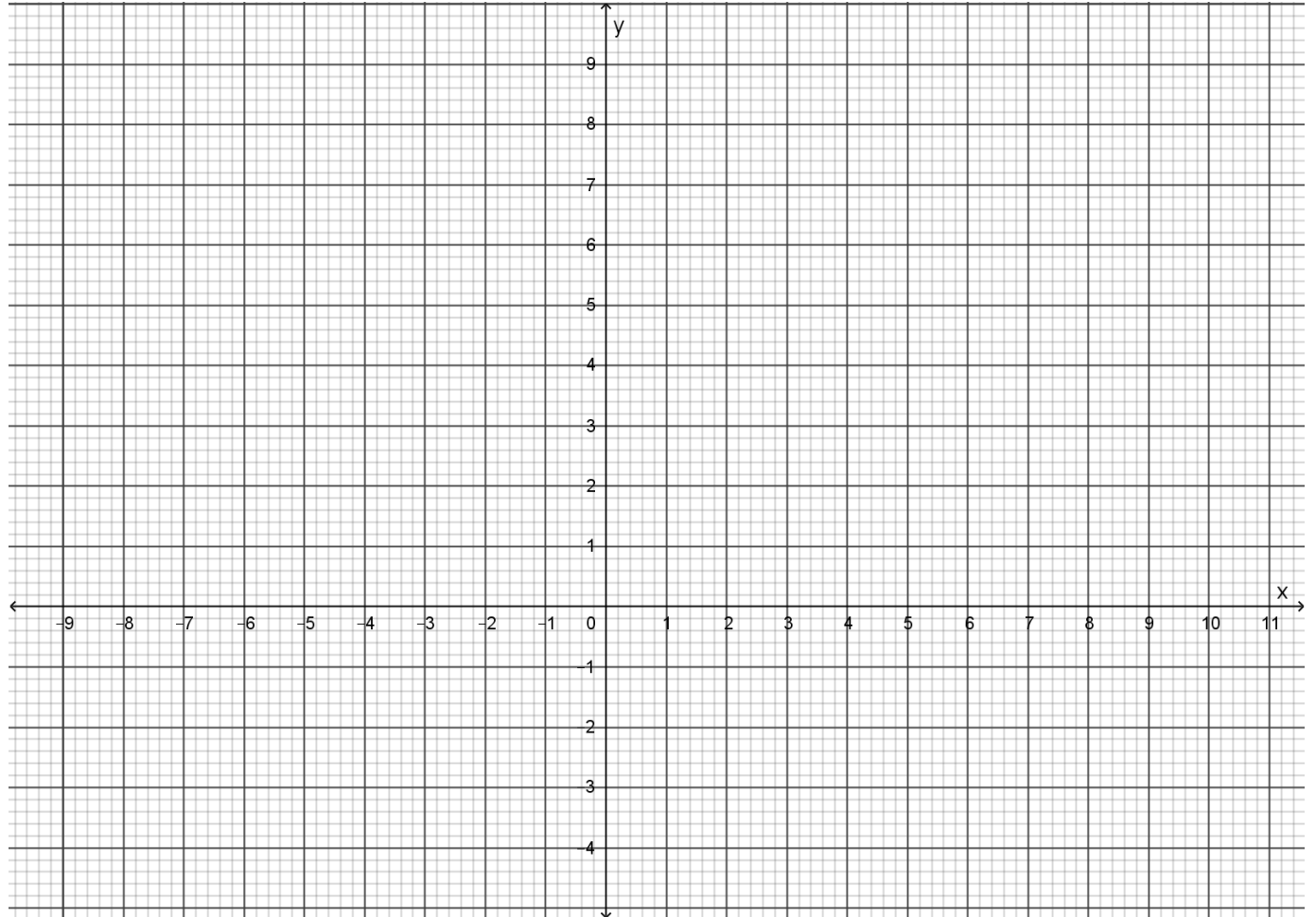
14) $i = \frac{r}{100}$

(10501042)

ANSWER SHEET EXAMINATION NUMBER:

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QUESTION 2.3.1



(5)