higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

MATHEMATICS

(First paper)

NQF LEVEL 2

(10501042)

1 November 2022 (Y-paper)
13:00–16:00

Calculators may be used.

This question paper consists of 8 pages, 1 formula sheet and 2 addenda.

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. Show all calculations and intermediate steps. Simplify answers where possible.
5. Answer questions in any order but keep subsections of questions together.
6. Approximate all final answers accurately to THREE decimal places.
7. The formula sheet is not necessarily complete. Any other applicable formulae may be used.
8. Diagrams are not drawn to scale.
9. Write neatly and legibly.

QUESTION 1

1.1 Convert each of the following decimal fractions to the form $\frac{a}{b}$ where $a = b \in Z$ and $b \neq 0$. Express the answer in its simplest form.

1.1.1 $0{,}14$ (1)

1.1.2 $4{,}2\dot{3}$ (3)

1.2 Simplify each of the following using the laws of exponents. Leave the answer with positive exponents and in surd form where applicable.

1.2.1 $2^{1-n}.2^{n+2}.2^{0}$ (2)

1.2.2 $\left(4.\sqrt[3]{x^{15}y^{30}}\right)^{2} \times \frac{x^{5}y^{3}}{2x^{-6}y^{4}}$ (3)

1.3 Simplify the following using surd laws. Show all calculations.

$$\frac{2\sqrt{24} - 2\sqrt{6} + \sqrt{54}}{\sqrt{96} + \sqrt{6}}$$ (3)

1.4 Simplify the following expression by rationalising the denominator. Show all steps:

$$\frac{\sqrt{6}}{\sqrt{6} - \sqrt{5}}$$ (3)

1.5 Given: $T = \frac{pr^{2}}{q}$

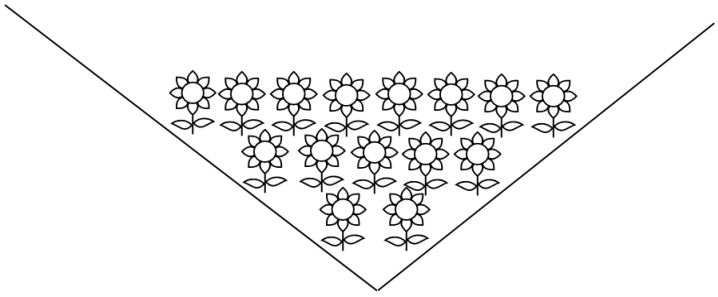
1.5.1 Manipulate the given formula and make *r* the subject of the formula. (3)

1.5.2 Find the value of *r* if $p = 12$, $T = 20$ and $q = 14$. (2)

1.6 The sum of the first 52 terms of an arithmetic sequence is 8 788.

Calculate the constant difference if the first term is 16. (4)

1.7 A sunflower field is planted in a triangle. The first three rows of the field are shown in the diagram below, where the first row contains 2 sunflowers, the second row contains 5 sunflowers, and the third row contains 8 sunflowers.

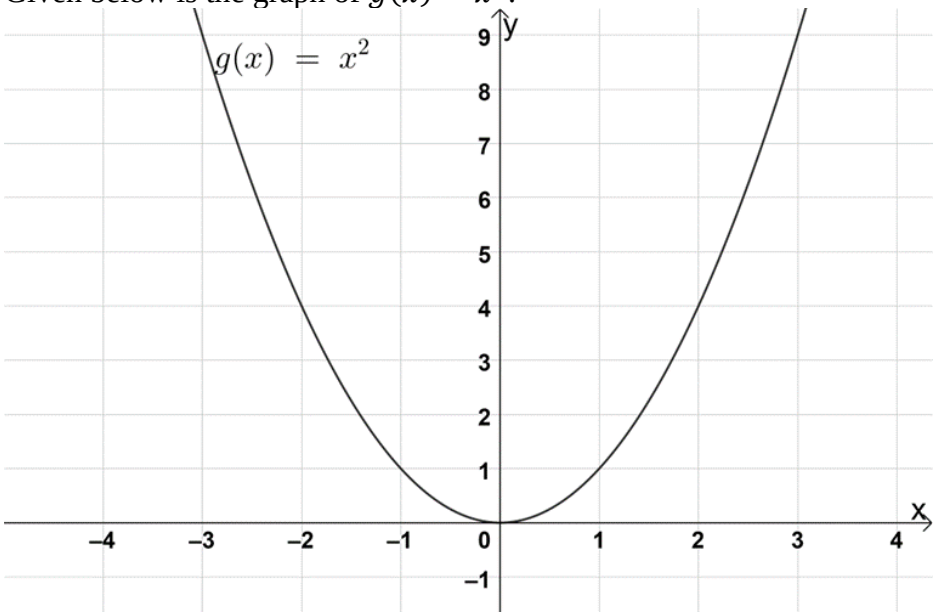


1.7.1 If the consecutive rows of the field continue increasing in the same pattern, how many sunflowers will there be in the 10^{th} row? (3)

1.7.2 If the field has 25 rows, how many sunflowers will there be in the field? (3)
[30]

QUESTION 2

2.1 Given below is the graph of $g(x) = x^2$.



2.1.1 What is the mathematical name for the graph of $g(x)$? (1)

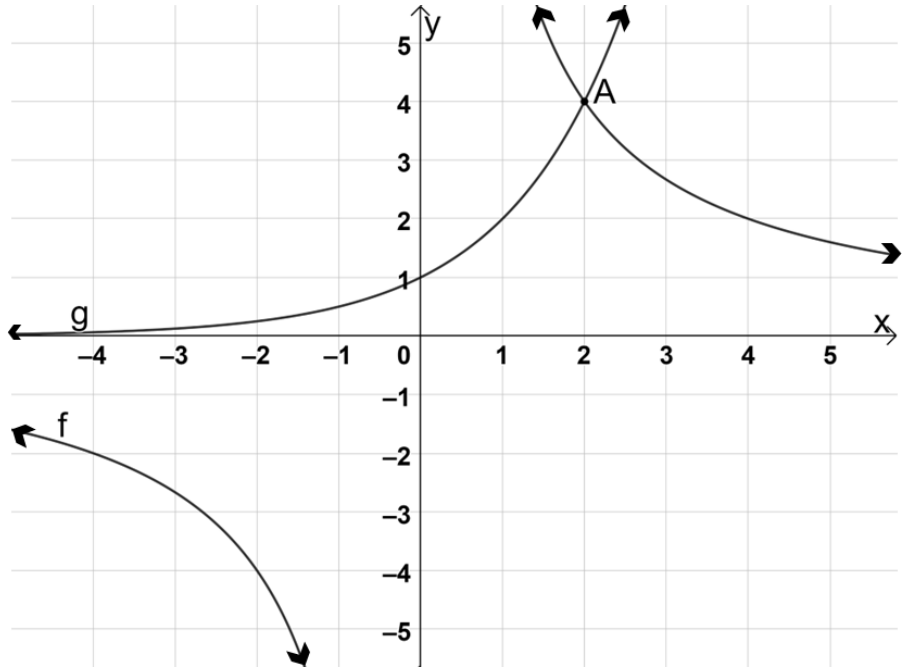
2.1.2 Write down the coordinates of the turning point for $g(x)$. (1)

2.1.3 What is the axis of symmetry for the graph of $g(x)$? (1)

2.1.4 Is the graph of $g(x)$ a function or nonfunction? Give a reason. (2)

2.1.5 Write down the equation of y if the graph is shifted down 2, so that the turning point is $(0; -2)$. (1)

2.2 Sketched below are the graphs of $f(x) = \frac{k}{x}$ and $g(x) = 2^x$ with coordinates of A(2;4).



2.2.1 What is the mathematical name for the graph of $f(x)$? (1)

2.2.2 Determine the equation of $f(x)$. (3)

2.2.3 What is the mathematical name for the graph of $g(x)$? (1)

2.2.4 Determine the *y*-intercept, the domain and the range of $g(x)$. (3)

2.3 Use ADDENDUM A (attached) to answer the following questions:

2.3.1 Complete the table for the function $f(x) = 2x^2 + 3$ by determining the $y-$values for the corresponding $x-$values. (2)

2.3.2 Sketch the graph of $f(x) = 2x^2 + 3$. (3)

2.3.3 Complete the table for the function $g(x) = -2x^2 + 3$ by determining the $y-$values for the corresponding $x-$values. (2)

2.3.4 Draw the graph of $g(x) = -2x^2 + 3$ on the same system of axes used in the previous questions. Clearly label the graphs. (3)

[24]

QUESTION 3

3.1 Simplify each of the following:

3.1.1 $(p+q-1)(p+q)$ (3)

3.1.2 $(a^3-1)^2-3a^3(a^3+2)-6a^6$ (3)

3.1.3 $(x^3)^2 \times x^4$ (2)

3.2 Factorise each of the following:

3.2.1 $2-32a^2$ (2)

3.2.2 $6(a-b)+9a(b-a)$ (4)

3.3 Solve for *x* in each of the following equations:

3.3.1 $a^x = 1$ (2)

3.3.2 $\frac{x}{2} = \frac{x-3}{4}$ (3)

3.4 Solve the following inequality:

$3x-2 \leq 2x+6$ (2)

3.5 Solve the following simultaneous linear equations algebraically:

$x+2y-1=0$
$x-2y+3=0$ (4)

[25]

QUESTION 4

4.1 Match each of the following definitions to their terms. Give your answer in your answer booklet by writing the letter attached to the term next to the question number.

	Term	Definition
4.1.1	Saving account	A. Money paid to the bank for the services it renders.
4.1.2	Fixed deposit	B. An interest-bearing account held at a bank or other financial institution.
4.1.3	Unit trust	C. Financial investments that can easily be converted to cash, typically within 5 years
4.1.4	Short-term investment	D. Used to make payments for purchases so that money is immediately deducted from the consumer's account.
4.1.5	Debit card	E. A collective investment fund that is bought and sold in units.
4.1.6	Bank fees	F. Money invested in a bank for a specific period.

(6 × 1) (6)

4.2 Mamashele is a farm worker who works 23 days per month. He works for 170 hours per month and earns a net wage of R50 per hour. He works away from home and rents a small flat. His monthly expenses are as follows:

Rental of flat (including water and electricity):	R2 200
Transport:	R18 per day
Cellphone contract:	R147
Groceries:	R1 800
Clothing account:	R460
Entertainment:	R400
Laundry service:	R250

Use the given information to fill in the income and expenditure sheet on ADDENDUM B (attached). (6)

4.3 Sejeng invested R12 000 at 16% simple interest per annum for five years. Masese invested the same amount at 16% compound interest per annum for five years.

Calculate:

4.3.1 The total amount Sejeng will receive after five years. (2)

4.3.2 The interest Sejeng will have earned after five years. (2)

4.3.3 The total amount Masese will receive after five years. (2)

4.3.4 The interest Masese will have earned after four years. (2)

4.3.5 Explain which investment is better. (1)

[21]

TOTAL: 100

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

13) $A_t = Ao(1 + \frac{r}{100\times m})^{tm}$ **OR** $A_t = P(1 + i)^n$

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

ADDENDUM A

EXAMINATION NUMBER:

Detach ADDENDUM A and hand it in with the ANSWER BOOK.

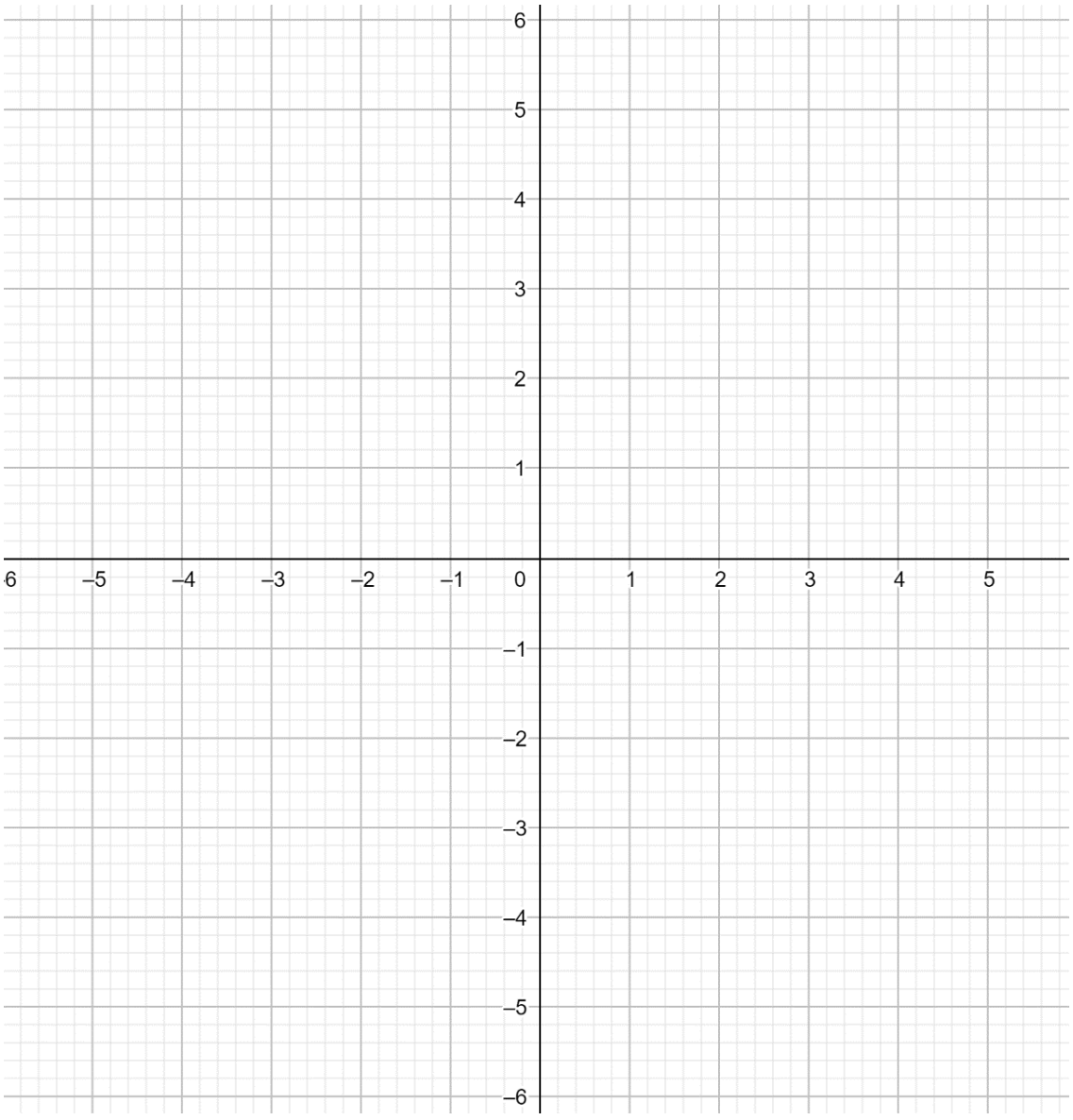
2.3.1

x	-2	-1	0	1	2
$f(x) = 2x^2 + 3$	11				

2.3.3

x	-2	-1	0	1	2
$g(x) = -2x^2 + 3$					-5

2.3.2 &
2.3.4



ADDENDUM B

EXAMINATION NUMBER: | | | | | | | | | | | | | |

Detach ADDENDUM B and hand it in with the ANSWER BOOK.

4.2

INCOME AND EXPENDITURE STATEMENT

INCOME & EXPENDITURE: MAMASHELE A FARM WORKER	
INCOME	**AMOUNT**
Nett wage	
170 hours @ R50 per hour	
Nett monthly earnings	
EXPENDITURE	**AMOUNT**
Rental of flat	
Transport	
Cellphone	
Groceries	
Clothing	
Entertainment	
Laundry service	
TOTAL MONTHLY EXPENDITURE	
Amount left after all the expenses have been paid.	

(6)