higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

MATHEMATICS

(First Paper)

NQF LEVEL 2

(10501042)

21 February 2018 (X-Paper)
09:00–12:00

Scientific calculators may be used.

This question paper consists of 9 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 the calculations and the intermediary steps. Simplify answers where possible.
5. Questions may be answered in any sequence. Subsections of questions may NOT be separated.
6. ALL final answers must be approximated accurately to THREE decimal places.
7. The list on 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 the following decimal fractions to the form $\frac{a}{b}$; where a; $b \in Z$ and $b \neq 0$.

Express your answer in its simplest form.

1.1.1 1,75 (1)

1.1.2 $0,\dot{3}\dot{6}$ (3)

1.2 Simplify the following by using the laws of exponents: (leave answers with positive exponents and in surd form where applicable.)

1.2.1 $\frac{x^2y \times xy^3}{xy}$ (2)

1.2.2 $\sqrt[3]{8a^{-6}b^{12}}$ (2)

1.2.3 $\frac{(3x^{-2}y^2)^3}{9x^{-2}y^4 \times 3xy}$ (3)

1.3 Simplify the following by using the surd laws: (The expansion of the surd and the intermediate steps must be shown.)

$$\frac{\sqrt{75} - \sqrt{108} + \sqrt{27}}{3\sqrt{12}}$$ (4)

1.4 Rationalise the denominator and write the answer in simplest form:

$$\frac{7}{4+\sqrt{2}}$$ (3)

1.5 Given : $\frac{x}{4} + \frac{y}{3} = 1$

Make y the subject of the formula. Write your answer in simplest form. (3)

1.6 Given: $A = \frac{1}{2}b \times h$

Make h the subject of the formula.
Hence solve for h if A = 60 cm and b = 30 cm (3)

1.7 The three patterns given below forms a sequence and is created by using sticks.
The first pattern uses 6 sticks.

PATTERN A **PATTERN B** **PATTERN C**

1.7.1 Write down the first four terms of this sequence where each term represents the number of sticks in the pattern. (2)

1.7.2 Write down the general term T_n for the sequence in terms of the value of *a* and *d* you have found. (1)

1.7.3 If the pattern continued ten times, determine the total number of sticks used (S_{10}). (3)

[30]

QUESTION 2

2.1 Simplify the following:

2.1.1 $(2x-3)(2x^2-3x-4)$

2.1.2 $\dfrac{5x^2-25x^3}{5x^2}$

(2 × 2) (4)

2.2 Factorise the following:

2.2.1 $6-54a^2$

2.2.2 $8px-6py-12x+9y$

2.2.3 $5x^2-17x+6$

(3 × 2) (6)

2.3 Solve for *x* in the following equations:

2.3.1 $2x+1=-5(-x-5)$ (2)

2.3.2 $x^2+3=\dfrac{7x}{2}$ (3)

2.3.3 $\dfrac{3^x}{5}=45^{-1}$ (3)

2.4 Solve for x and y in the following simultaneous equations:

$$2x - y = -10$$

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

2.5 Given: $-7 < 2x + 1 \leq 3$

2.5.1 Solve the inequality. (2)

2.5.2 Represent the solution on a number line. (1)

[25]

QUESTION 3

3.1 Use ADDENDUM A (attached) to draw the graph of:

$$y = \frac{8}{x} + 2$$

Clearly show the intercepts with the axes as well as any asymptotes.

Detach and hand in the completed ADDENDUM A with the ANSWER BOOK. (3)

3.2 Given: $f(x) = 4 - x^2$

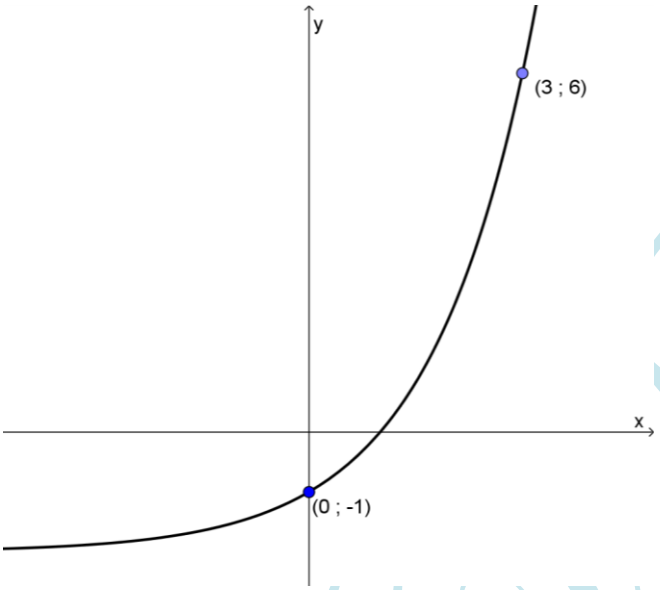
3.2.1 Draw the graph of $f(x) = 4 - x^2$ on ADDENDUM B (attached) where $x \in [-3\ ;\ 3]$ and $x \in R$.
Clearly indicate the x–intercepts, y-intercept and the turning point on the graph. (3)

3.2.2 Write down the name of the graph of $f(x)$. (1)

3.2.3 Determine the range of the graph of $f(x)$. (2)

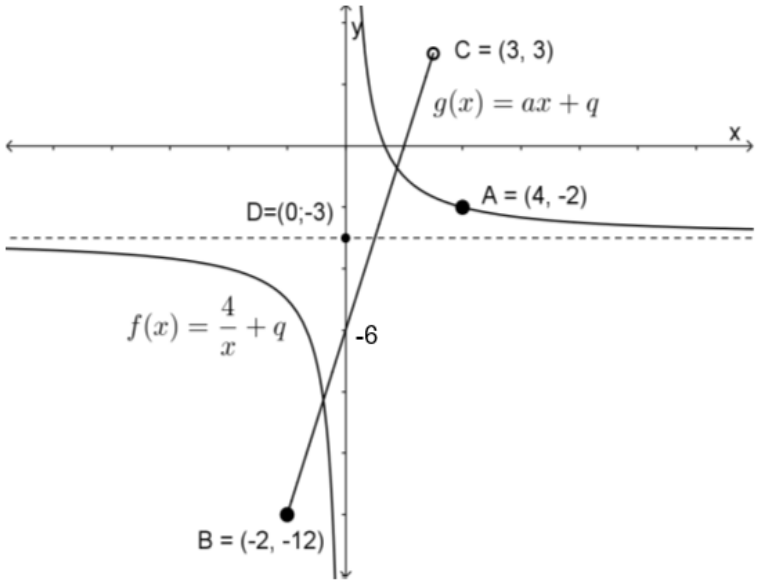
3.2.4 How will a change in the sign of the coefficient of x^2 in $f(x) = 4 - x^2$ effect the graph? (1)

3.3 Determine the equation of the following exponential function in the form: $y = b^x + q$



(3)

3.4 The sketch below shows two graphs: $f(x) = \frac{4}{x} + q$ and $g(x) = ax + q$



3.4.1 Determine the values for a and q in $g(x) = ax + q$. (3)

3.4.2 Write down the domain for $g(x) = ax + q$. (2)

3.4.3 Write down the range for $g(x) = ax + q$. (2)

3.4.4 Is $y = ax + q$ continuous or discontinuous. Give a reason for your answer. (2)

3.4.5 Write down the equation(s) of the asymptote(s) for $f(x) = \frac{4}{x} + q$. (2)

3.4.6 At what value for x is $f(x) = \frac{4}{x} + q$ discontinuous? (1)

[25]

QUESTION 4

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

COLUMN A		COLUMN B	
4.1.1	Mashonisa	A	a contract sold by an insurance company designed to provide payments to the holder at specified intervals, usually after retirement
4.1.2	Medium-term investment	B	is a method of buying goods through making installment payments over time; the seller retains ownership until the final installment is paid
4.1.3	Retirement annuities	C	it is a form of collective investment constituted under a trust deed; a pooled resource, which means that it allows a group of investors to combine their cash and invest it
4.1.4	Unit trusts	D	an investment maturing in a short period of time
4.1.5	Hire-purchase agreement	E	an investment maturing within a period of five to ten years
		F	a money lender who lends out his/her own money for profit

(5 × 1) (5)

4.2 The following is the budget statement for Mpho who is studying at a TVET College.

- She rents a flat for R800 a month.
- She also sublets the flat and charges a friend R350 for staying in one of the rooms.
- She works part time as a waitress and earns R3 500 per month excluding any tips.

Study her budget below and answer the questions.

Income				**Expenses**			
Details	**Budget**	**Actual**	**Variance**	**Details**	**Budget**	**Actual**	**Variance**
Salary	R3 500	R3 500	R0	**Transport**	R800	R905	-R105
Rent	R350	R350	R0	**Stationery**	R350	R130	R220
Tips	R570	R350	-R220	**Housing**	R800	R800	0
				Cell phone	R270	R540	-R270
				Food	R600	R870	-R270
				Clothing	R250	R420	-R170
				Electricity	R150	R345	-R195
				Water	R100	R250	-R150
				Entertainment	***B***	R450	-R300
				Savings	R200	R0	R200
Total income	**R4 420**	**R4 200**	***A***	**Total expenses**	**R3 670**	**R4 710**	**-R1040**

4.2.1 Determine the values of A and B. (2)

4.2.2 Consider Mpho's financial position at the end of the month.

(a) Will Mpho have a surplus or a deficit at the end of the month? (1)

(b) How much is this surplus or deficit? (1)

4.2.3 Mpho has three incomes. Name the income that is a variable income. (1)

4.2.4 Which of her expenses had the biggest impact on the state of her finances at the end of the month? (1)

4.3 Grace received a gift of R5 000 from a rich relative. She decides to invest the money at a bank for 4 years. She has the option of investing at two banks.

- BANK A: Offers 10% interest at simple interest for the period.
- BANK B: Offers 9% interest compounded yearly for the period.

4.3.1 Calculate the value of her investment if she chose BANK A. (2)

4.3.2 Calculate the value of her investment if she chose BANK B. (2)

4.3.3 Calculate the difference in the two investments. (1)

4.3.4 Which bank would you advise her to use? (1)

4.4 James wants to study at Capricorn TVET.

- In 3 years' time he needs to accumulate R6 475 for his studies.
- He insists on compound interest and has R5 000 to invest.
- What is the minimum interest that he must bargain for if he wants to study after 3 years?

(3)
[20]

TOTAL: 100

FORMULA SHEET

MATHEMATICS L2

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** $A_t = P(1 + i\,n)$

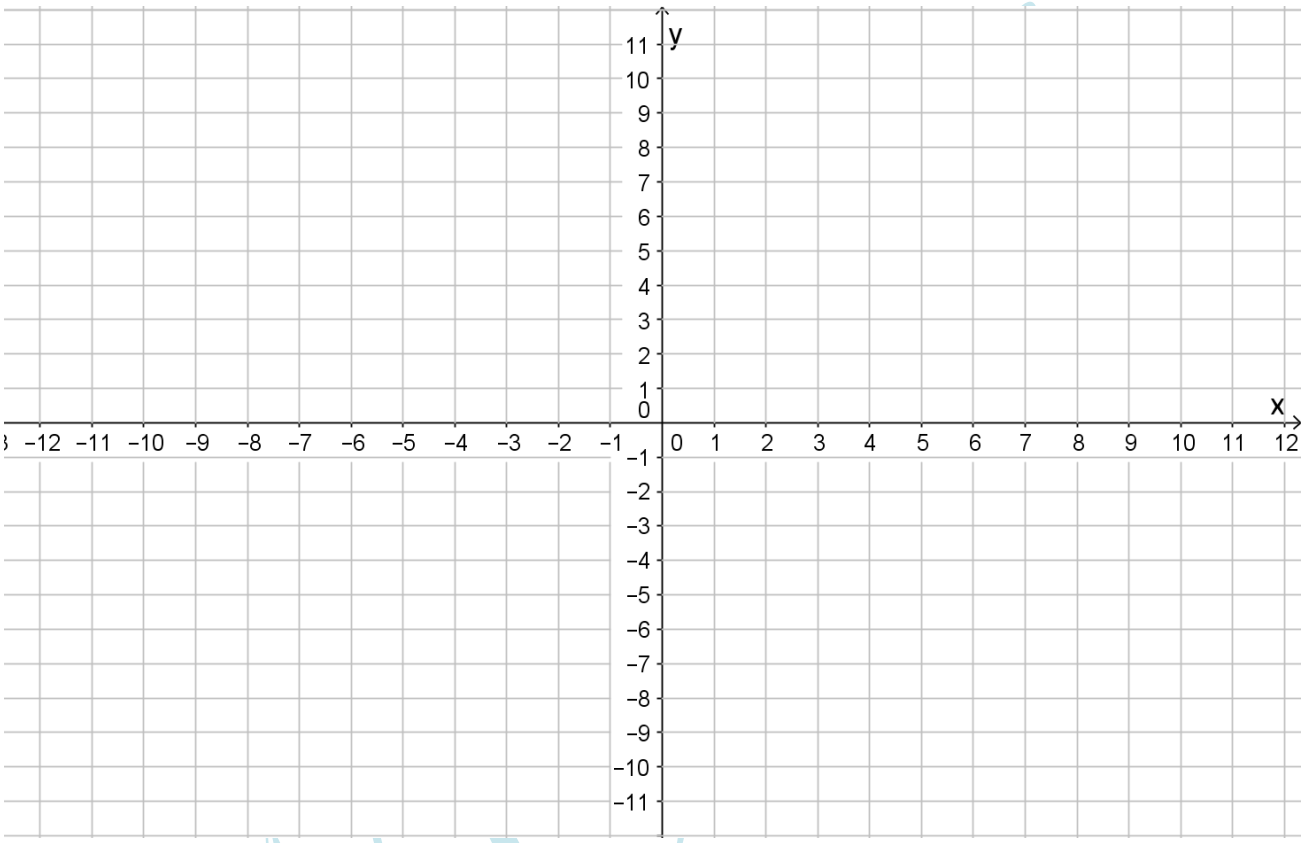
13. $A_t = A_o(1 + \frac{r}{100 \times m})^{t \times m}$ **OR** $A_t = P(1 + i)^n$

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

ADDENDUM A **EXAMINATION NUMBER:**

QUESTION 3

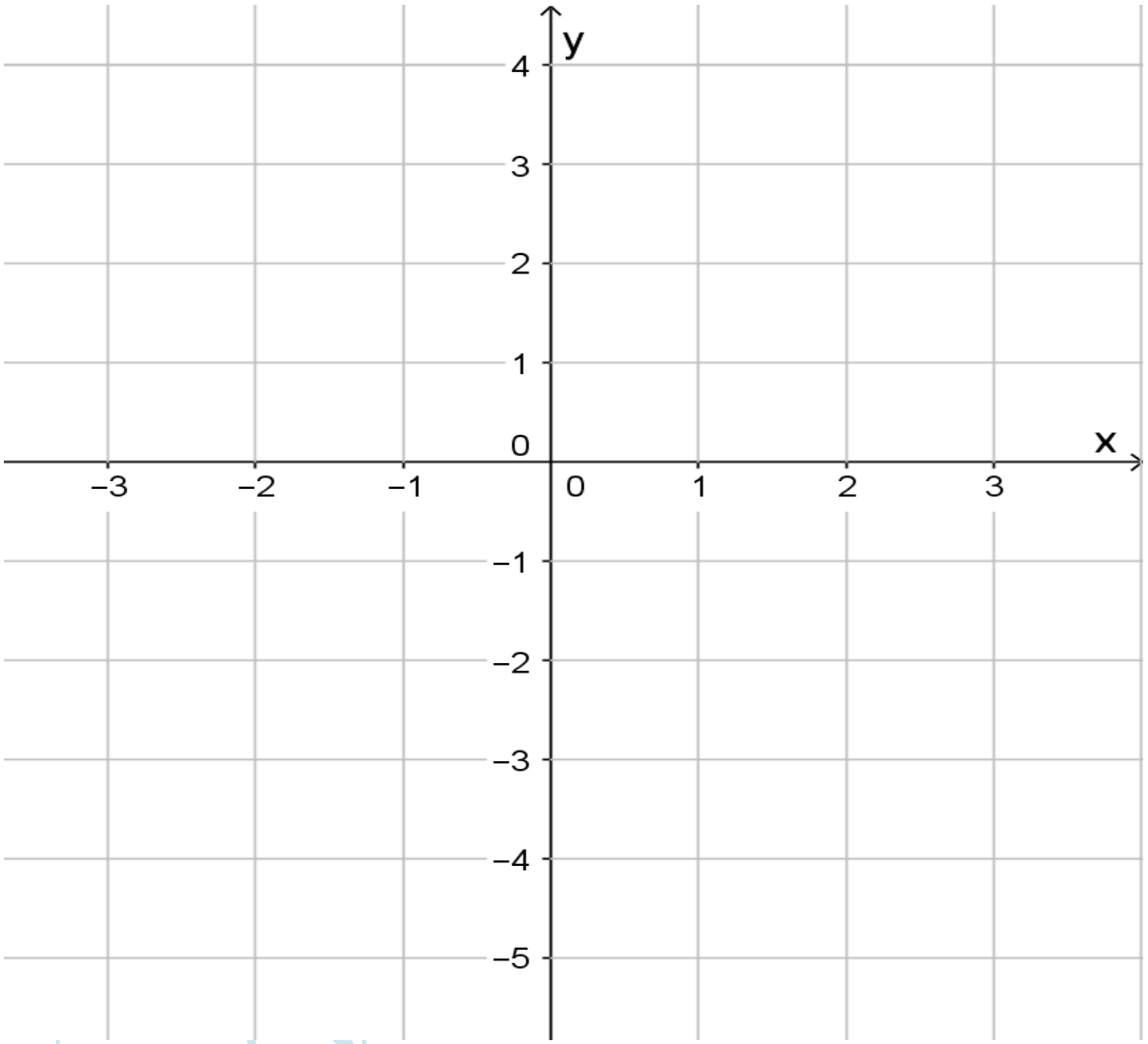
3.1 Detach ADDENDUM A and hand it in with the ANSWER BOOK.



(4)

ADDENDUM B EXAMINATION NUMBER:

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



(2)