higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

MATHEMATICS
(First Paper)
NQF LEVEL 2

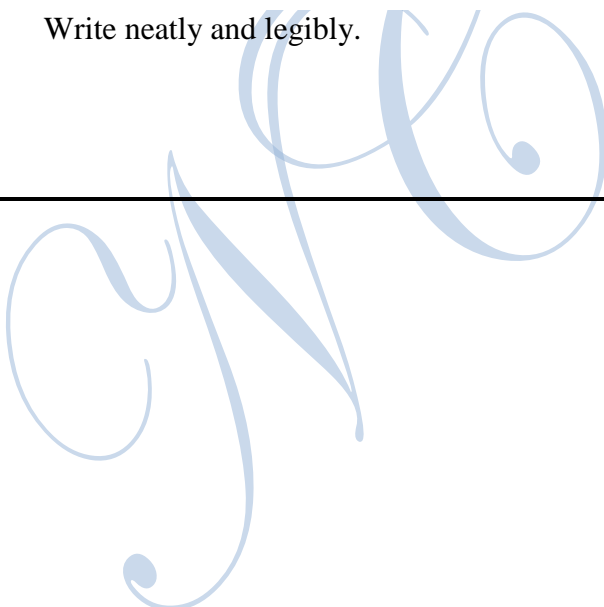(10501042)

2 November 2018 (X-Paper)
09:00–12:00

Nonprogrammable scientific calculators may be used.

This question paper consists of 9 pages, 1 formula sheet and 1 addendum.

| 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 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 to THREE decimals.

7.   Diagrams are NOT drawn to scale.

8.   Write neatly and legibly.

QUESTION 1

1.1 Various possible options are provided as answers to the following questions. Choose the correct 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 Calculate the following:

$$16+4[-8\times(15-7)^2]$$

A   -523
B   -2032
C   -10240
D   -16368

1.1.2 The number $\dfrac{451}{999}$ represents a/an …

A   irrational number.
B   nonrecurring decimal.
C   rational number.
D   terminating decimal.

1.1.3 Which one of the following represents an arithmetic sequence?

A   -4; -2; 2; 8; …
B   13; 10; 7; 4; …
C   1; 2; 4; 8; 16; …
D   270; 90; 30; 15; …

1.1.4 $\sqrt[3]{x^5}$ in exponential form is …
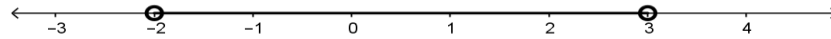
A $x^{\frac{5}{3}}$

B $\dfrac{5}{3x}$

C $x^{\frac{3}{5}}$

D $3x^5$

1.1.5   The set $\{x|x \in R; -2 < x \le 3\}$ represents the number line …

A

B

C

D

(5×1) (5)

1.2   Convert the following decimal fractions to the form $\dfrac{a}{b}$ where a; b∈Z and b≠0.
Express the answer in its simplest form.

$32,4\overset{\bullet}{3}\overset{\bullet}{5}$ (3)

1.3   Simplify the expression below by using surd laws.
Show the expansion of the surds and all the intermediate steps.
Rationalise the denominator.

$$\frac{\sqrt[3]{27} + \sqrt{27} - \sqrt{48}}{-2\sqrt{3}}$$ (5)

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

1.4.1 $3x^2y^3 \times 2x^{-1}y^{-7}$ (1)

1.4.2 $\sqrt[3]{\dfrac{54x^5y^{-3}}{2x^{-1}y^9}}$ (2)

1.4.3 $\left(\dfrac{4x^{-2}y^2}{(2x)^0 y^2}\right)^{-3} \times \sqrt[3]{x^6} \times y^2$ (3)
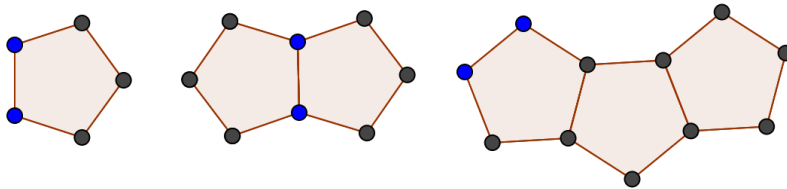
1.5 Given: $A = \pi r^2$

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

    1.5.2 If $A = 28,274$ calculate the value of r . (1)

1.6 In the sequence below matchsticks are used to form the shapes.

    1.6.1 How many matchsticks will be needed to build the fourth pattern? (2)

    1.6.2 One pattern in the sequence consists of 85 matchsticks.

            What is the number of that pattern
            (*Hint*: *first find the values of the first term and the common difference*). (4)

    1.6.3 Determine S_{12}, the sum of matchsticks in the first 12 patterns of the sequence. (2)

[30]

QUESTION 2

2.1 Given: $y = 3x + 2$

    2.1.1 Sketch the graph for the domain $[x|x \in R; -4 \leq x < 2]$ on the ADDENDUM (attached) by using the table method. Clearly show the coordinates of end points and the nature of the points.
            (*Hint: use a scale of 1 block=2 units* on the ADDENDUM). (3)

    2.1.2 Is $y = 3x + 2$ continuous or discontinuous? Give a reason for the answer. (2)

    2.1.3 Write down the range for $y = 3x + 2$. (2)

    2.1.4 What will be the effect on the graph in QUESTION 2.1.1 if the coefficient of x changes to -3? (1)

2.2   Given: $f(x) = \dfrac{4}{x} - 2$

2.2.1   Use ADDENDUM A to draw the graph of $f(x) = \dfrac{4}{x} - 2$ clearly indicating the *x*-intercepts and the asymptotes on the graph.
(*Hint: use a scale of 1 block=2 units* on ADDENDUM A)   (4)

2.2.2   What is the name of the graph $f(x)$?   (1)

2.2.3   Give the range for $f(x)$.   (2)

2.2.4   Determine the equations for the axes of symmetry of the graph $f(x)$.   (2)

2.3   The sketch below shows two graphs, $f(x) = ax^2 + q$ and $g(x) = ab^x + q$. The graph $g(x)$ passes through the origin and has an asymptote at $y = -1$. Point C has the coordinates (-1 ; 1) and the coordinates of the turning point of $f(x)$ is (0 ; -2).
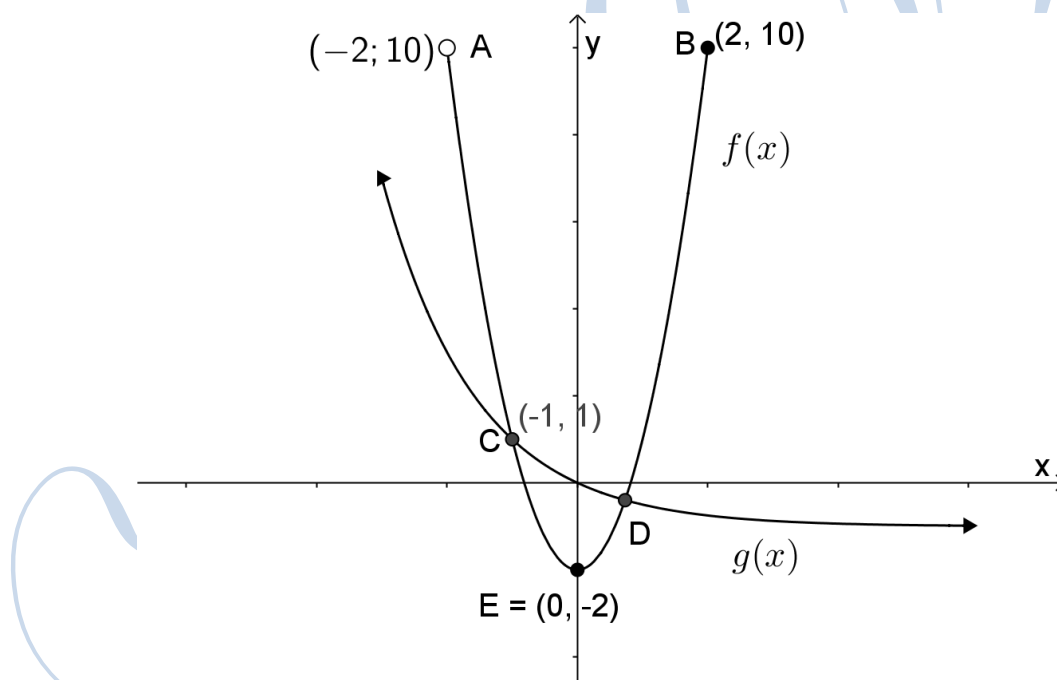
2.3.1   Determine the equation of the parabola $f(x)$.   (3)

2.3.2   The nature of the end points of $f(x)$ at A and B are different.

Explain the difference of the end points.   (2)

2.3.3   Hence, write down the domain for $f(x)$.   (1)

2.3.4   Determine the equation for $g(x)$.   (2)

[25]

QUESTION 3

3.1 Simplify the following:

    3.1.1 $(a+b)(a+b-1)$ (2)

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

3.2 Factorise the following:

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

    3.2.2 $6(x-y)+9x(y-x)$ (3)

    3.2.3 $20x^2-7x-6$ (2)

3.3 Express the following in its simplest form, leaving the answer with positive exponents:

$$\frac{12x^3y^4-6x^3y^2}{6x^3y^2}$$ (2)

3.4 Solve for x in each of the following equations:

    3.4.1 $\dfrac{x}{2}=\dfrac{x-3}{4}$ (2)

    3.4.2 $x^2+6x-14=13$ (2)

    3.4.3 $3.5^x-75=0$ (2)

3.5 Given: $-6<\dfrac{x+2}{2}\leq 8$

    3.5.1 Solve the inequality. (2)

    3.5.2 Represent the solution in set builder notation. (1)

3.6 Solve for x and y in each of the following equations:

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

[25]

QUESTION 4

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

COLUMN A		COLUMN B	
4.1.1	Variance	A	expense that varies from month to month
4.1.2	Stokvel	B	difference between the actual and projected amounts
4.1.3	Compound interest	C	fees normally associated with services rendered by banks
4.1.4	Bank fees		
4.1.5	Variable expenses	D	money savings club where each person contributes a specific amount over a period. At the end of the month each person takes a turn to be the recipient of the money
		E	itemised summary of expected income and expenses over a specified period
		F	interest calculated on both the principle and its accrued interest
		G	amount of money spent in order to buy or do something.

(5 × 1)   (5)

4.2   Below is Joseph's budget.

BUDGET JAN-JUN 2018							
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**TOTAL**
INCOME							
Salary	R 1 300	R 1 300	R 1 300	R 1 300	R 1 300	R 1 300	**R 7 800**
Interest	R 500	R 500	R 500	R 500	R 500	R 500	**R 3 000**
TOTAL	**R 1 800**	**R 1 800**	**R 1 800**	**R 1 800**	**R 1 800**	**R 1 800**	**R 10 800**
EXPENSES							
Rent	R 850	R 850	R 850	R 850	R 850	R 850	**R 5 100**
Taxi	R 280	R 370	R 370	R 370	R 380	R 280	**R 2 050**
Food	R 450	R 520	R 290	R 630	R 450	R 280	**R 2 620**
Cellphone	R 220	R 220	R 220	R 220	R 220	R 220	**R 1 320**
TOTAL	R 1 800	R 1 960	R 1 730	R 2 070	R 1 900	R 1 630	**R 11 090**
Variance	**R 0**	**-R 160**	**A**	**-R 270**	**-R 100**	**R 170**	**B**

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

4.2.2   Name the variable expenses in the budget.   (1)

4.2.3   Will Joseph have a surplus or deficit of the beginning of July?   (1)

4.2.4   During which month did Joseph manage his expenses the best? Why?   (2)

4.3   Stemmer wants to buy a bicycle 5 years from now.

4.3.1   Stemmer decided to invest R4 000 at 9% simple interest for the 5-year period.

How much money will he have at the end of the period?   (2)

4.3.2   The inflation rate is 5,34% compounded yearly.

If the current price of the bicycle is R5 600, what will the price be in 5 years' time?   (3)

4.3.3   How much money must Stemmer invest if he wants to buy a bicycle in cash after 5 years? The bank offers him an interest rate of 8,8% compounded yearly. He needs R6 600 at the end of the period to buy the bicycle.   (4)

[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. $\left(\dfrac{a^m}{b^n}\right)^p = \dfrac{a^{mp}}{b^{np}}$

6. $a^{-n} = \dfrac{1}{a^n}$

7. $a^0 = 1$

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

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

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

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

12. $I = A_0 \times \dfrac{r}{100} \times t$ or $I = \dfrac{Prt}{100}$ or $A_t = P(1+in)$

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

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

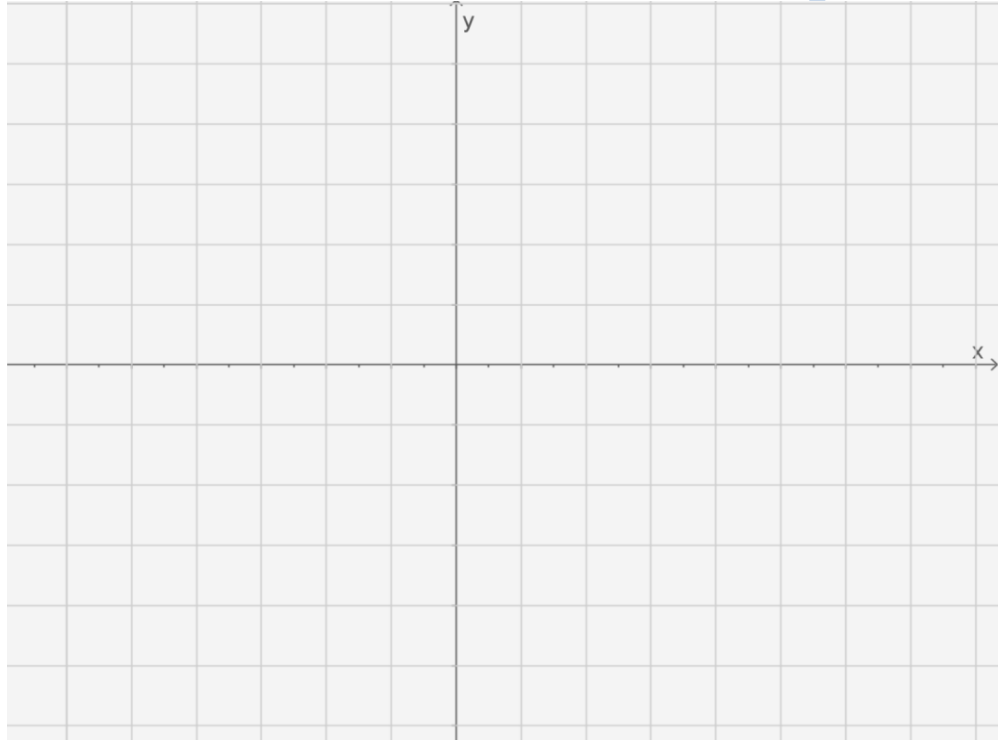**ADDENDUM**   **EXAMINATION NUMBER:**

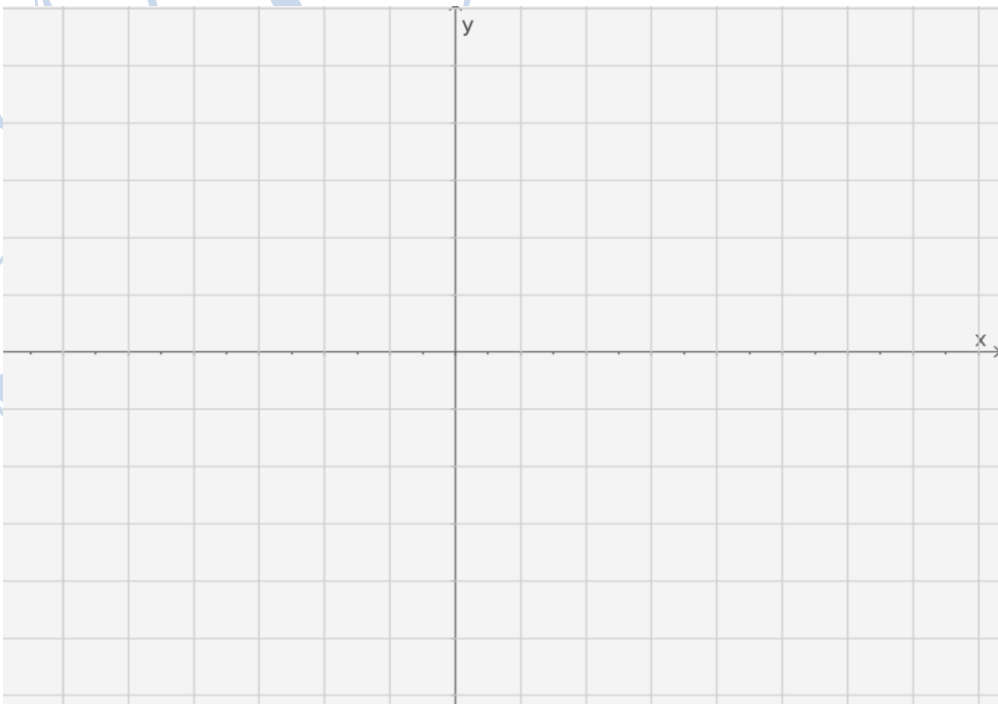Detach ADDENDUM and hand it in with the ANSWER BOOK

QUESTION 2.1.1

2.1   2.1.1

(3)

QUESTION 2.2.1

2.2   2.2.1

(4)