Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 12

JUNE 2024

MATHEMATICS P1 (DEAF)

MARKS: **150**

TIME: **3 hours**

This question paper consists of 11 pages, including 1 information sheet.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 10 questions.

2. Answer ALL the questions.

3. Clearly show ALL calculations, diagrams, graphs, et cetera that you have used in determining your answers.

4. Answers only will NOT necessarily be awarded full marks.

5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.

6. If necessary, round off answers to TWO decimal places, unless stated otherwise.

7. Diagrams are NOT necessarily drawn to scale.

8. An information sheet, with formulae, is included at the end of the question paper.

9. Number the answers correctly according to the numbering system used in this question paper.

10. Write neatly and legibly.

QUESTION 1

1.1 **Solve** for x:

1.1.1 $x^2 - 8(x-2) = 25$ (3)

1.1.2 $-3x^2 + 2x + 2 = 0$ (correct to **TWO decimal places**) (3)

1.1.3 $(x+3)(5-x) \leq 0$ (3)

1.1.4 **Given**: $\frac{x+3}{\sqrt{x+5}} = 1; x \in \mathbb{R}$

(a) For which value(s) of x will $\frac{x+3}{\sqrt{x+5}}$ be undefined? (2)

(b) Solve for x. (4)

1.2 **Solve** at the **same time** for x and y:

$y + 2x = 5$

$2x^2 - xy - 4y^2 = 8$ (6)

1.3 Given that: $M = \frac{108}{x^2 - 4x + 8}; x \in \mathbb{R}$, **determine** the **maximum value of M**. (4)

[25]

QUESTION 2

2.1 Given the following **arithmetic sequence**: $2; -3; -8; \ldots$

2.1.1 **Determine** the **value** of T_{43}. (3)

2.1.2 **Calculate** the **sum** of the **first 43 terms** in the row, i.e. S_{43}. (2)

2.1.3 **Calculate the value of** n for which $T_n = -2023$. (3)

2.2 Given: $2(3x-1) + 2(3x-1)^2 + \ldots$

2.2.1 For which values of x is the series above a convergent geometric series? (3)

2.2.2 **Calculate** $\sum_{k=1}^{\infty} 2(3x-1)^k$; if $x = \frac{1}{2}$ (3)

2.3 The first three terms of a geometric sequence has a sum of 21 and their product is 64. **Determine** the **value** of the first term, if the common ratio is an integer (**whol**e **number)** i.e. $r \in \mathbb{Z}$. (4)

[18]

QUESTION 3

Study the following **quadratic number pattern**: 3 ; 12 ; 33 ; . . .

3.1 **Write** down the **next term** in the **quadratic number pattern**. (1)

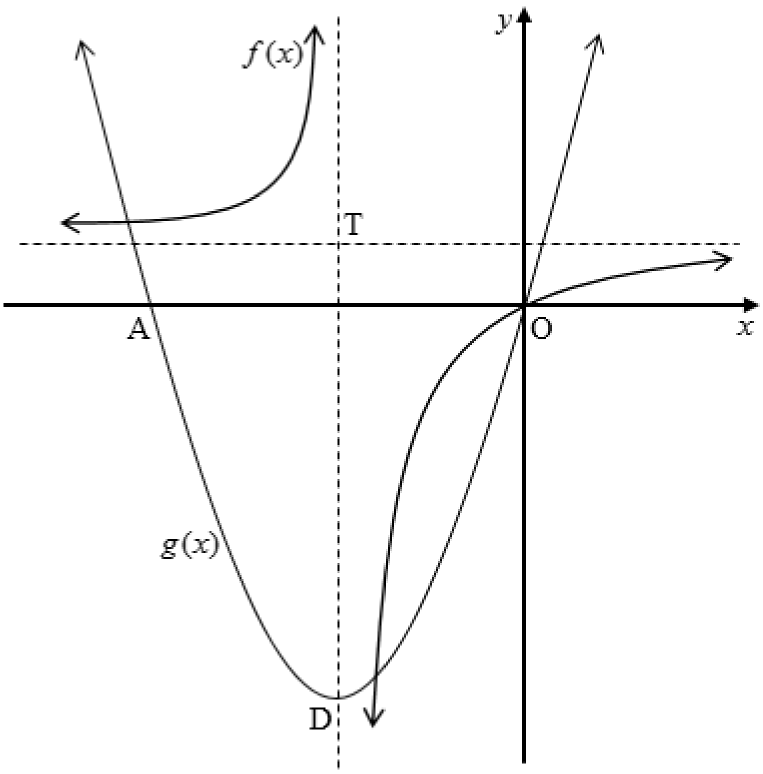
3.2 **Determine** the **general term** of the **quadratic number pattern** in the form $T_n = an^2 + bn + c$. (3)

3.3 Which TWO **terms** in the **quadratic number pattern** will have a difference of 345? (3)

[7]

QUESTION 4

The drawing below shows the **graphs** of $f(x)=\dfrac{2}{x+2}+1$ and $g(x)=a(x+2)^2-8$.
Both graphs pass through the origin, O. The **vertical asymptote** of f passes through D, the turning point of g. The **asymptotes** of f crosses at T. A is the other x-intercept of g.



4.1 **Write** down the **coordinates** of D, the turning point of g. (1)

4.2 Write down the **equations** of the **asymptotes** of f. (2)

4.3 **Determine**:

4.3.1 The **value** of a (2)

4.3.2 The l**ength** OA (3)

4.3.3 The r**ange** of f (1)

4.3.4 The equation of the axis of symmetry of f with a negative gradient (2)

4.4 For which **values** of x will:

4.4.1 $g(x)<0$? (2)

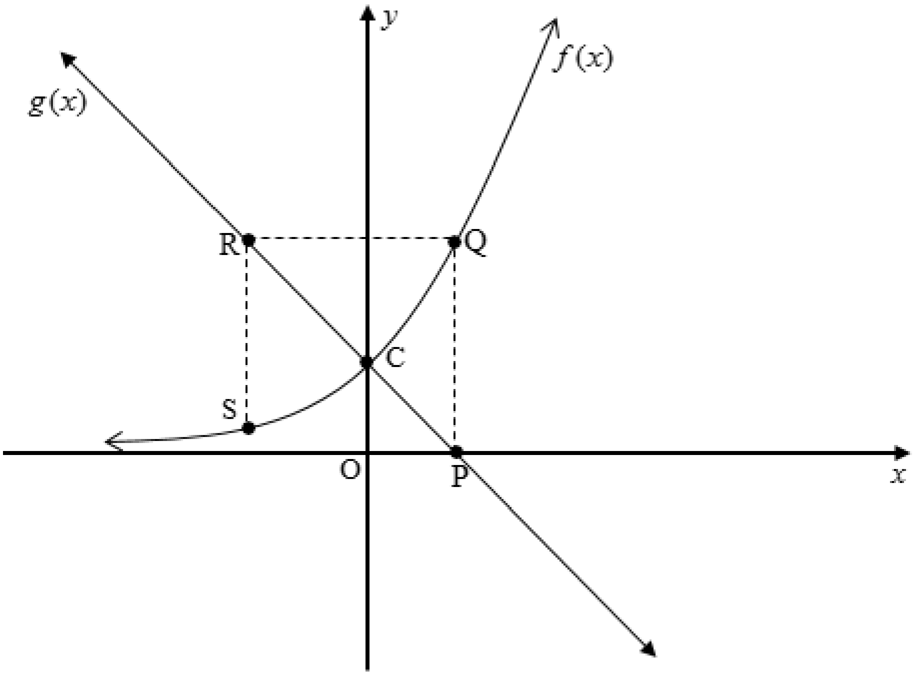
4.4.2 $g(x).f(x)\geq 0$? (2)

4.5 **Determine** the **value(s)** of k, for which $h(x)=-g(x)+k$ will have **two different roots** with the **same sign**. (3)

[18]

QUESTION 5

In the diagram below, the **graphs** of $f(x) = 3^x$ and $g(x) = -x + 1$ are given.



5.1 Write down the **coordinates** of C. (1)

5.2 Write down the **range** of $f(x)$. (1)

5.3 **Determine** the **equation** of $f^{-1}(x)$, in the form $y = ...$ (2)

5.4 For which **values** of x is $f^{-1}(x) < -1$? (2)

5.5 If PQ || SR || *y-axis* and QR ∥ *x-axis*, **determine** the **coordinates** of S. (4)

5.6 **Describe** the **change(s)** of $f(x)$ to $p(x) = 3(3^x) - 2$ (2)

[12]

QUESTION 6

6.1 The **buying price** of **machinery** bought by a company **5 years ago** was **R80 000. Using** the **reducing-balance method, calculate** the yearly rate of **depreciation** (**price drop**) if the **current book value** of the machinery is **R20 000.** (3)

6.2 **Calculate** the **real interest rate per year** of an **investment earning interest at 8,5% p.a. combined quarterly.** (3)

6.3 A parent made a **first deposit of R** x into a study **investment account**. **Three years** l**ater more amount** of **R15 000** is **deposite**d into the account. **Five years after** the **first deposit** was made, **R7 000** was **taken out** from the account. The **interest rate** for the **first five years** was **11% p.a**. **compounded monthly**. Thereafter the **interest rate changed** to **12% p.a. compounded half-yearly**.

6.3.1 **Calculate**, in terms of x, **how much money** was in the **account 3 years after** the **first deposit** was made. (This **answer should not include the second deposit.)** (2)

6.3.2 If the i**nvestment price** was **R90 132,56 after 8 years, calculate** the **first amount** that was **deposited**, i.e. the **value** of x. (5)

[13]

QUESTION 7

7.1 **Determine** $f'(x)$, from **first principles**, if $f(x)=\frac{1}{2}x^2$. (4)

7.2 **Determine**:

7.2.1 $f'(x)$, if $f(x)=\frac{1}{5}x^5-6x^{-2}$ (2)

7.2.2 $\frac{d}{dx}\left(x+\sqrt{x}\right)^2$ (4)

[10]

QUESTION 8

8.1 **Given**: $f(x) = -x^3 + 12x - 16$

8.1.1 Show that $(x-2)$ is a factor of $f(x)$. (2)

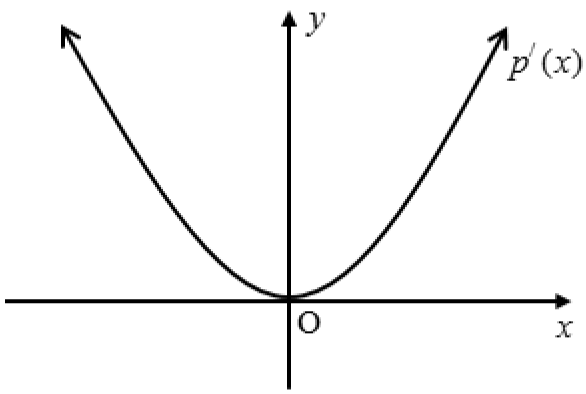
8.1.2 **Determine** the x-**intercepts** of f. (3)

8.1.3 **Determine** the **coordinates** of the **turning points** of f. (4)

8.1.4 **Sketch** the **graph** of f, clearly **showing turning points** and **intercepts with the axes.** (3)

8.1.5 **Determin**e the **equation of the tangent** at the **point of inflection**. (4)

8.2 A **sketch graph** of $p'(x)$ is given below.



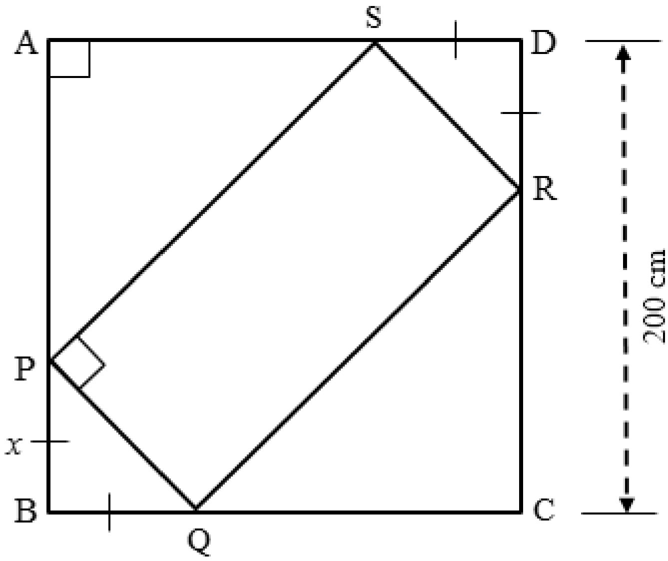
8.2.1 For **which values** of x is the **graph** of $p(x)$ **increasing?** (2)

8.2.2 For **which values** of x is the **graph** of $p(x)$ **concave up?** (2)

[20]

QUESTION 9

In the **diagram** below, **ABCD** is a **square** with **side length** CD = 200 cm. **PQRS** is a **rectangle** with **vertices on the sides of the square**. PB = BQ = SD = DR = x cm.



9.1 **Show** that the **area** of the **rectangle is given** by, $\text{A} = 2\left(200x - x^2\right)$. (3)

9.2 **Determine** the **value** of x for which the **area of the rectangle** will be a **maximum**. (3)

9.3 What is the **ratio** of the **maximum area** of PQRS : area of ABCD? (3)

[9]

QUESTION 10

10.1 **Events A** and **B** are **independent events**. It is further given that:

- P(A) = 0,6
- P(B) = 0,5

10.1.1 Are the **events mutually (equally) exclusive**? **Motivate** your answer. (2)

10.1.2 **Represent** the **information** on a **Venn-diagram**. (3)

10.1.3 **Calculate:**

(a) P(**only A**) (1)

(b) P(**not A or not B**) (2)

10.2 The **contingency table** below shows **100 learners' answers about camping.**

	Boys	Girls	Total
Like Camping	24	30	54
Dislike Camping	14	32	46
Total	38	62	100

10.2.1 If a learner from this group is **chosen randomly**, what is the **probability** that it is a girl? (1)

10.2.2 Is the **event, "like camping" not depending** on the **gender?** (4)

10.3 There are **only red balls** and **green balls** in a **bag**. A **ball** is **taken at random** from the bag. The **probability** that the **ball is green** is $\frac{3}{7}$. The **ball is put back** in the bag. **2 more red balls** and **3 more green balls** are **put in the bag**.

Thereafter, **a ball is taken at random** from the bag and the **probability that this ball is green is** $\frac{6}{13}$**.**

Determine how many of **each colour ball** was at **first in the bag**. (5)
[18]

TOTAL: 150

INFORMATION SHEET: MATHEMATICS

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$A = P(1+ni)$ $\quad A = P(1-ni)$ $\quad A = P(1-i)^n$ $\quad A = P(1+i)^n$

$T_n = a + (n-1)d$ $\quad S_n = \frac{n}{2}(2a + (n-1)d)$

$T_n = ar^{n-1}$ $\quad S_n = \frac{a(r^n - 1)}{r-1}$; $r \neq 1$ $\quad S_\infty = \frac{a}{1-r}$; $-1 < r < 1$

$F = \frac{x\left[(1+i)^n - 1\right]}{i}$ $\quad P = \frac{x\left[1 - (1+i)^{-n}\right]}{i}$

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $\quad \mathrm{M}\left(\frac{x_1 + x_2}{2} ; \frac{y_1 + y_2}{2}\right)$

$y = mx + c$ $\quad y - y_1 = m(x - x_1)$ $\quad m = \frac{y_2 - y_1}{x_2 - x_1}$ $\quad m = \tan\theta$

$$(x-a)^2 + (y-b)^2 = r^2$$

In ΔABC:

$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ $\quad a^2 = b^2 + c^2 - 2bc.\cos A$ $\quad area\,\Delta ABC = \frac{1}{2}ab.\sin C$

$\sin(\alpha + \beta) = \sin\alpha.\cos\beta + \cos\alpha.\sin\beta$ $\quad \sin(\alpha - \beta) = \sin\alpha.\cos\beta - \cos\alpha.\sin\beta$

$\cos(\alpha + \beta) = \cos\alpha.\cos\beta - \sin\alpha.\sin\beta$ $\quad \cos(\alpha - \beta) = \cos\alpha.\cos\beta + \sin\alpha.\sin\beta$

$\cos 2\alpha = \begin{cases} \cos^2\alpha - \sin^2\alpha \\ 1 - 2\sin^2\alpha \\ 2\cos^2\alpha - 1 \end{cases}$ $\quad \sin 2\alpha = 2\sin\alpha.\cos\alpha$

$\bar{x} = \frac{\sum x}{n}$ $\quad \partial^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n}$ $\quad P(A) = \frac{n(A)}{n(S)}$

$P\,(A \text{ or } B) = P\,(A) + P\,(B) - P\,(A \text{ and } B)$

$\hat{y} = a + bx$ $\quad b = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sum(x - \bar{x})^2}$