Province of the EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 12

SEPTEMBER 2023

MATHEMATICS P1 (DEAF)

MARKS: 150

TIME: 3 hours

This question paper has 12 pages, including an information sheet.

INSTRUCTIONS AND INFORMATION

Read the **instructions**. **Answer** the **questions**.

1. This question paper has **ELEVEN questions**.
   Answer ALL the **questions**.

2. Clearly **show ALL calculations**, **diagrams**, **graphs** that you used in your answers.

3. You **may use** a prescribed **calculator**.
   Some questions will tell you **NOT** to **use a calculator**.

4. You will **NOT** always **get marks** for **answer only**.

5. **Round off** answers to **TWO decimal places**.
   Some questions will **tell** you **how** to **round off**.

6. **Diagrams** are **NOT** drawn to **scale**.
   Some questions will **tell** you to **use the scale**.

7. **Number** the **answers** the **same** as the numbers on the **question paper**.

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

9. Write **neatly**.
   Make sure your **work** is **easy** to **read**.

QUESTION 1

1.1 **Solve** for x:

1.1.1 $x^2 + x - 30 = 0$ (3)

1.1.2 $x(2x - 6) = -3$ (correct to **TWO decimal places**) (4)

1.1.3 $x^2 - 2x + 1 > 0$ (3)

1.1.4 $2x - 1 = \sqrt{4 - 5x}$ (4)

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

$y - 2x = -1$ and $2y^2 + 4xy = 6x^2$ (6)

1.3 **Given** the **quadratic equation**: $2x^2 - px + 1 = 0, x \in \mathbb{R}$.

Determine the **possible value(s)** of p, such that the equation has two **unequal** real roots. (5)

[25]

QUESTION 2

2.1 **Given** the **arithmetic sequence**.
The **tenth** and the **seventeenth terms** of an **arithmetic sequence** are 21 and 49 re**spectively**.

2.1.1 **Determine** the **common difference** of the **sequence**. (3)

2.1.2 **Calculate**: $T_1 + T_{18}$ (3)

2.2 Given: $\sum_{n=1}^{m}(4n-19)=1189$

2.2.1 **Write** down the **first three terms** of the **series**. (1)

2.2.2 **Calculate** the **value** of m. (4)

2.3 $-78;-76;-72;-66;\ \ldots$ is a **quadratic number pattern**.

2.3.1 Write down the next two terms of the number pattern. (1)

2.3.2 **Determine** the n^{th} term of the **number pattern** in the **form**, $T_n = an^2 + bn + c$. (4)

2.3.3 A **constant** k is **added** to T_n such that **all** the **terms** of the **quadratic number pattern become positive**. **Determine** the **value(s)** of k. (2)

[18]

QUESTION 3

3.1 The **first term** of a **geometric sequence** is 81 and the **common ratio** is r.
The **sum** of the **firs**t and **third terms** of the **same geometric sequence** is 117.
Calculate the **value** of r. (4)

3.2 **Given** the **convergent geometric series**: $3^x + 9^x + 27^x + 81^x + ...$

3.2.1 **Write** down the **common ratio** in terms of x. (1)

3.2.2 **Calculat**e the **value** of x, if $S_\infty = \frac{1}{2}$. (3)

[8]

QUESTION 4

Given: $f(x)=\dfrac{2}{x-5}+3$

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

4.2 **Write** down the **range** of *f*. (1)

4.3 **Determine** the **coordinates** of the x- and y-intercepts of *f*. (3)

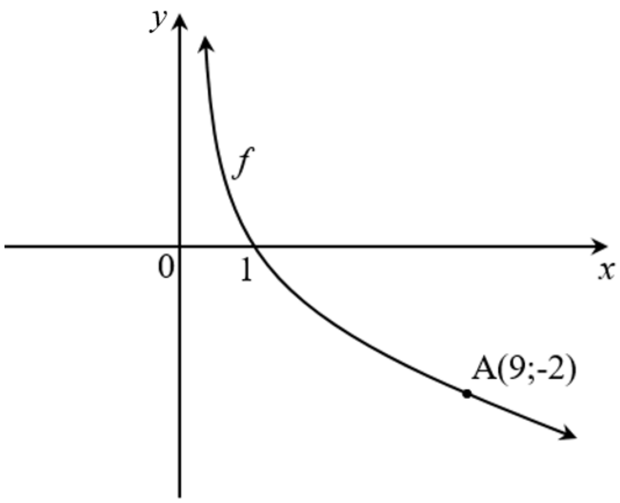
4.4 **Sketch** the **graph** of f, clearly **showing all asymptotes** and **intercepts** with the axes. (4)

4.5 **Describe** the **transformation** that the **graph** of *f* has to **undergo** to **form** the **graph** of h, where $h(x)=-\dfrac{2}{x-5}-5$. (3)

[13]

QUESTION 5

The **diagram** below **shows** the **graph** of $f(x)=\log_b x$, where b is a **constant**.
f passes through the point A$(9\ ;-2)$.



5.1 **Show** that $b=\frac{1}{3}$. (2)

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

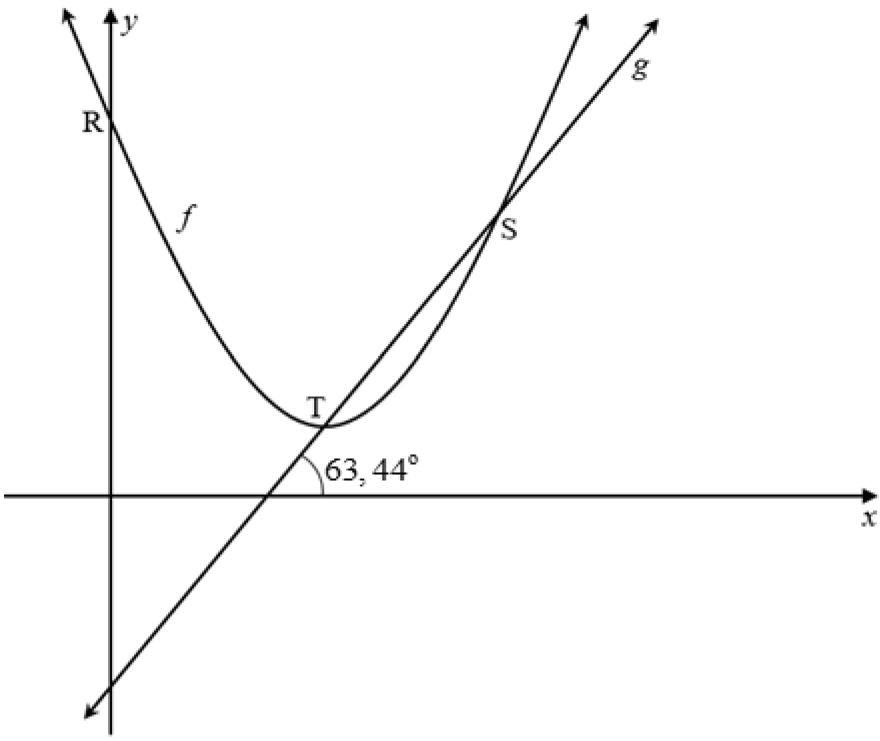
5.3 For **which values** of x is $f(x)\geq 0$? (2)

5.4 **Write** down the **equation** of the **asymptote** of g, if $g(x)=f^{-1}(x+1)$. (2)

[8]

QUESTION 6

The **diagram shows** the **graphs** of $f(x)=x^2-6x+11$ and $g(x)=ax+b.$
The **graph**s of f and g **intersect** at S and T, where T the **turning point** of f.
The **angle** of **inclination** of g is $63,44^{\circ}$.



6.1 **Calculate** the **coordinates** of T. (4)

6.2 **Determine** the **equation** of g in the form $y=mx+c.$ (3)

6.3 Hence, or otherwise **determine** the **coordinates** of S. (4)

6.4 **Determine** the **values** of:

6.4.1 x, for which $f(x)\leq 6$ (2)

6.4.2 k, for which $f(x)+k$ will have **real roots** (2)

[15]

QUESTION 7

7.1 Lufezo **deposited R97 000** into an **account** that **offered interest** at **9,1% p.a**. **compounded quarterly**.
Calculate how **many years** it took for his **investment** to reach **R166 433**. (4)

7.2 On **1 January 2018** a **school bought** a **new bus** for **R482 000**.
On **that day** they also **started** a **sinking fund** to **make provision** for a **new bus** in **5 years' time**.

7.2.1 **Over** the **next 5 years** the **value** of the bus **depreciated** at **14,7% p.a.** on the **reducing-balance method**.
Calculate the **trade-in value** of the **bus after 5 years**. (2)

7.2.2 The **price** of these **buses increases** by **8,1% per year**.
Calculate the **price** of a **new bus** on **1 January 2023**, i.e. **after 5 years**. (2)

7.2.3 The **bank offered** an **interest rate** of **7,3% p.a., compounded monthly**, for the **sinking fund**.

The **first payment**, x rands, was **made** in the **fund** on **1 January 2018** and **thereafter** the **same amount** was **deposited** on the **first day** of **every month**.

The **last payment** was **made** on **1 December 2022**.

On **31 December 2022** the **school bought** a **new bus** and used the **trade-in value** of the **old bus** as a **deposit**.

Calculate the **monthly payment** into the **sinking fund**. (6)

[14]

QUESTION 8

8.1 **Determine** $f^{/}(x)$ from **first principles** if $f(x)=1-x^2$. (5)

8.2 **Determine**:

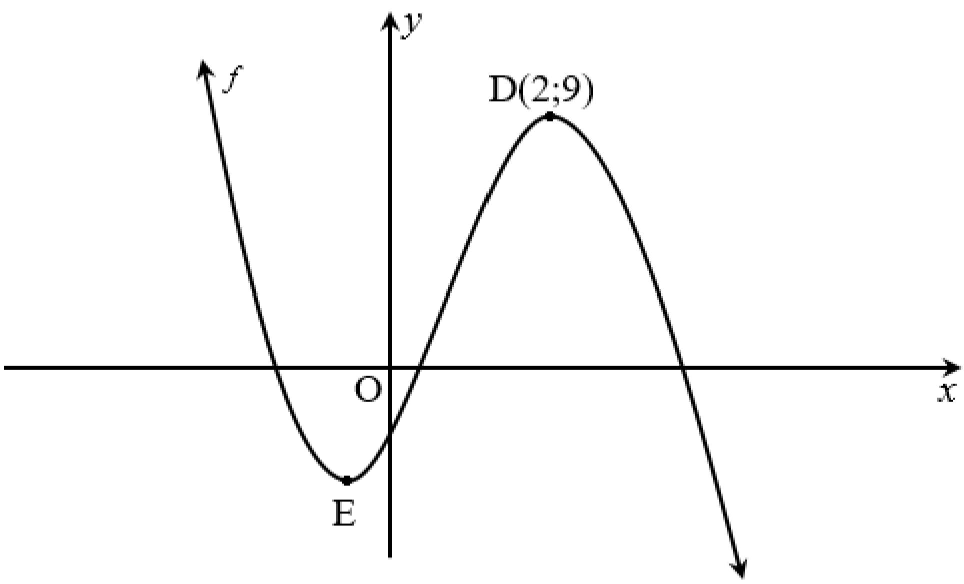
8.2.1 $D_x\left(x-\dfrac{1}{x}\right)^2$ (3)

8.2.2 $\dfrac{dy}{dx}$ if $y=\dfrac{x^5}{10}-\dfrac{2}{\sqrt{x}}$ (3)

[11]

QUESTION 9

The **diagram** shows the **graph** of $f(x)=-2x^3+ax^2+bx-3$. D(2 ; 9).
E are the **turning points** of f.



9.1 **Determine** the **values** of a and b. (5)

9.2 If $f(x)=-2x^3+5x^2+4x-3$, **calculate** the **coordinates** for E. (3)

9.3 **Determine** the **values** of x for which:

9.3.1 $f^{/}(x)<0$ (2)

9.3.2 The **graph** of f is **concave down** (3)

9.4 **Determine** the **equation** of the **tangent** to the **graph** of f at $P(-1\ ;\ 0)$, in the form $y=mx+c$. (4)

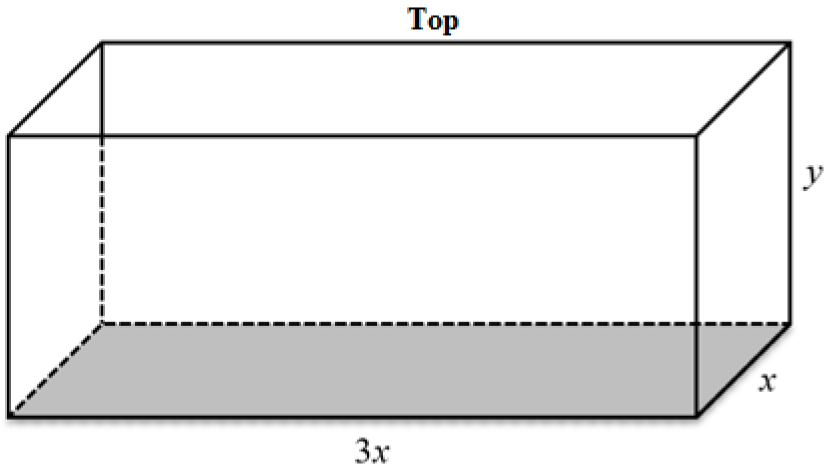
[17]

QUESTION 10

The **wooden box** in the **diagram** is a **rectangular prism** and it is **open** at the **top**.

The **dimensions** of the **base** are $3x$ metres by x metres and the **height** is y metres.

The **total surface area** is $147\,\text{m}^2$.



10.1 **Show** that $y = \dfrac{147 - 3x^2}{8x}$. (2)

10.2 **Calculate** the **value** of x for which the **volume** of the **box** is a **maximum**. (5)
[7]

QUESTION 11

11.1 A **survey** was **carried** out among **210 people**.
It is to **determine** whether they **prefer(choose) watching rugby** or **soccer** on **TV**.
The **results** are **shown** in the **contingency table below**.

	WATCH SOCCER	WATCH RUGBY	TOTAL
Female	72	a	120
Male	54	36	90
Total	b	84	210

11.1.1 **Determine** the **values** of a and b. (2)

11.1.2 **Give** the **probability** that an **individual chosen at random** is a **female preferring** to **watch soccer**. (2)

11.1.3 **Are** the **events** 'being male' and 'watch rugby' **independent**? **Justify** your **answer with calculations**. (4)

11.2 The **password** of a **computer** has 3 letters and 3 digits, **in that order**.
All 10 digits and 26 letters of the **alphabet may be used, without repetition**.

Example:

A	B	C	1	2	3

11.2.1 **How many different passwords** can be **formed** out of the 10 digits and 26 letters? (2)

11.2.2 **Calculate** the **probability** that the **first letter** of a **password formed** is a vowel and the **last digit** of the **password** is a **factor** of 9. (4)

[14]

TOTAL: 150

INFORMATION SHEET: MATHEMATICS

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

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

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

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

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

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

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

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

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

In ΔABC: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

$$a^2 = b^2 + c^2 - 2bc.\cos A$$

$$area\ \Delta ABC = \frac{1}{2}ab.\sin C$$

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

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

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

$\bar{x} = \frac{\sum x}{n}$ $\sigma^2 = \frac{\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2}{n}$

$P(A) = \frac{n(A)}{n(S)}$ $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

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