Province of the EASTERN CAPE EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 11

NOVEMBER 2023

TECHNICAL MATHEMATICS P1 (DEAF)

MARKS: **150**

TIME: **3 hours**

This question has 13 pages, a 2-page information sheet and an answer sheet.

INSTRUCTIONS AND INFORMATION

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

1. This **question paper** has **EIGHT questions**.

2. **Answer ALL** the **questions**.

3. Answer **QUESTIONS 5.5** on the **ANSWER SHEETS**.
   Write your **name** and **school's name** on the ANSWER SHEETS.
   Hand in the **ANSWER SHEETS** with your **ANSWER BOOK**.

4. **Show** ALL **calculations**, **diagrams**, **graphs**, etc. that you have **used** in your **answers**.

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

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

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

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

9. Write **neatly**.
   Your **work** must be **easy** to **read**.

QUESTION 1

1.1 **Do not use a calculator.**
Simplify.

1.1.1 $\left(5\sqrt[3]{3} - x^5\right)^0$ (1)

1.1.2 $x^{\frac{1}{2}}(3 - x)$ (2)

1.1.3 $\left(\sqrt{3} - 3\right)\left(\sqrt{3} + 3\right)$ (3)

1.1.4 $\dfrac{\log_2 32^{\frac{1}{5}} + \log_2 27^{\frac{1}{3}}}{\log_2 6 + \log_7 x^0}$ (6)

1.2 **Consider**: $y = \sqrt[x]{\dfrac{3^{x-1} - 7 \cdot 3^{x+1}}{6 \cdot 9^x}}$

1.2.1 **Prove** that $y = \frac{1}{3} \times \left(-\frac{31}{9}\right)^{\frac{1}{x}}$ (5)

1.2.2 **Show** that for $y \in$ **real numbers** then $x \notin$ **even numbers**. (1)

1.3 **Consider binary numbers** X = 100000_2 and Y = 111_2

1.3.1 **Write** X and Y in **decimal form**. (2)

1.3.2 **Determine** (X − Y) in **binary form**. (2)

1.4 The **picture** shown is a **vernier calliper**, an **instrument** that is used to **take accurate measurement readings** between **two graduation markings** on a **linear scale**.
It can **accurately measure** up to **0,1 mm**.

1.4.1 **Determine**, **in mm**, the **reading** of the **vernier calliper instrument** if the **thickness** of a **wool trend** is $\frac{1}{12}$ cm. (2)

1.4.2 **Write** the **vernier calliper** reading in **scientific notation.** (2)
[26]

QUESTION 2

2.1 **Given:** $\log 2 = x$, $\log 7 = y$ and $\log 10 = z$

2.1.1 **Write** down the **numerical value** of z. (1)

2.1.2 **Show that** $x + y - 2z = \log 0{,}14$. (5)

2.2 **Do not use a calculator.**
Solve for $x \in \mathbb{R}$.

2.2.1 $3^{x+1} \cdot 3^{x-3} = 1$ (4)

2.2.2 $\sqrt{48} - x^2\sqrt{3} = \sqrt{27}$ (6)

2.2.3 $10^x = 30$; given that $\log 3 = 0{,}48$ (4)

2.3 **Show that**:

$$2^{2x} \cdot 7^{x-1} - 5 \cdot 28^x = -34 \cdot 2^{2x} \cdot 7^{x-1}$$ (5)

2.4 The **formula used** to **convert** degrees Celsius (C) to degrees Fahrenheit (F) is:

$$C = \frac{5(F-32)}{9}$$

2.4.1 **Make** the F the **subject** of the **formula**. (2)

2.4.2 **Convert** 2 °C to F. (2)
[29]

QUESTION 3

3.1 **Solve** for x:

3.1.1 $x(x-2)=0$ (2)

3.1.2 $x^2+x\left(3-\frac{5}{x}\right)=0$ **(Correct to ONE decimal place)** (4)

3.1.3 $-7x^2-3x+4>0$ **(Represent the solution set on a NUMBER LINE)** (4)

3.2 **Solve** for x and y **simultaneously** in the following **equations**:

$y-\frac{x}{2}+1=0$ and $x^2+3y^2=2xy+4$ (6)

3.3 **Three different types** of **cylindrical cans shown** in the picture below are **given special codes according** their **ratios** of **heights** to **diameters** of the **tops** or **bottoms**. An **A1 round can type** has a **standard height** = **73 mm** and **diameter** = **62 mm**.

The following formulae may be used :

Area of a Circle = A = πr^2

Volume of a Cylinder = V = $\pi r^2 h$

Perimeter of a Circle = C = $2\pi r$

3.3.1 **Write** down the **length** of a **radius** of a **standard A1 cylindrical can**. (1)

3.3.2 **Determine** the **perimeter** of the top side of a standard A1 can. (1)

3.3.3 **Calculate** the **volume** of a **standard A1 can**. (2)

3.3.4 **Show** that $A=\frac{C^2}{4\pi}$ (3)

3.3.5 **Determine** the **diameter** of a **steel can** whose **area** is **5 665,36 mm²**. (3)

[26]

QUESTION 4

4.1 Without **solving** the **equation**, **determine** the **nature** of **roots** of:

$f(x)=\left(x-\sqrt{3}\right)\left(\sqrt{2}\,x-1\right)$ (3)

4.2 Consider: $g(x)=1\pm\sqrt{\frac{x+1}{x-1}+2}$

4.2.1 **Determine** the **value** of x for which g **is undefined**. (1)

4.2.2 **Determine** the v**alue** of x for which g **has equal roots**. (3)

4.2.3 **Write** down the **values** of $\frac{x+1}{x-1}$ for **which** g will be **non-real**. (1)
[8]

QUESTION 5

Given the **functions** f and g defined by $f(x)=-\frac{2}{x}-2$ and $g(x)=-\sqrt{16-x^2}$
A and B are **points** through which the **asymptote** of f cuts the **graph** of g.

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

5.2 **Determine** the x-intercepts of g. (2)

5.3 **Write** down the x-intercept of f. (3)

5.4 **Determine** the y-intercept of g. (1)

5.5 **Use the ANSWER SHEET.**
Sketch the **graphs** of f and g.
Show the **intercepts** and the **asymptotes** f and g. (6)

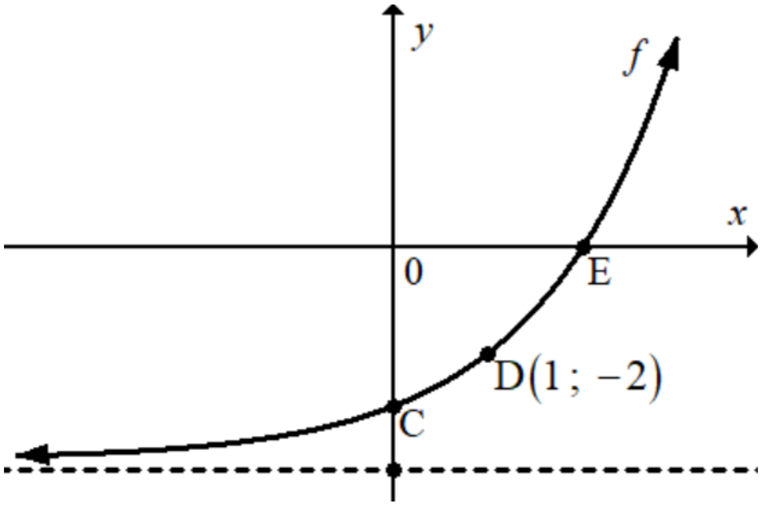
5.6 **Use** your **graph**.
Show the **points** where the **two functions** are **equal**.
Label the **points A**, **B** and **C**. (1)

5.7 **Write** down the **domain** of f. (1)

5.8 **Determine** the **values** of x for **which** $g(x)$ is below the line $y=-2$ (4)
[20]

QUESTION 6

Graph:
The **sketch** below **represents** the **graph** of **function** f defined by $f(x) = a^x - 4$.
The **graph passes** through **points** C, D (1; – 2) and E.
Points C and E are the **intercepts** of f.

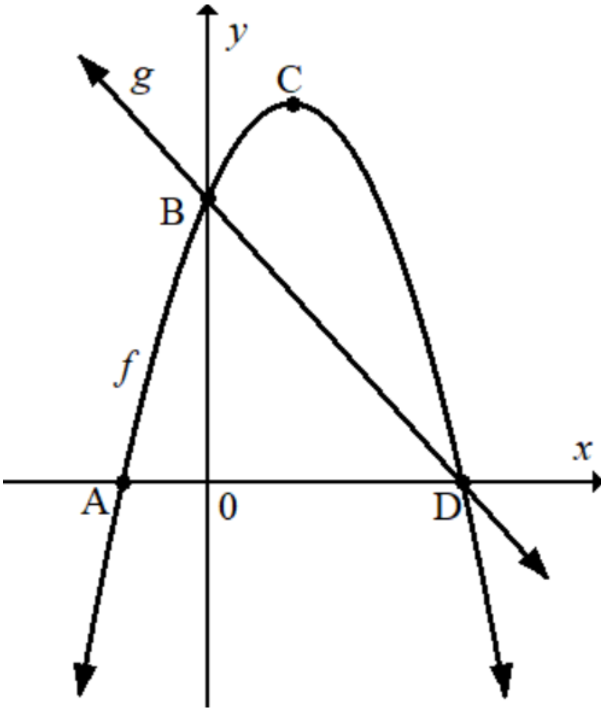


6.1	**Write** down the **equation** of an **asymptote** of f.	(1)
6.2	**Write** down the coordinates of C, the y-intercept of f.	(2)
6.3	**Determine** the **numerical value** of a.	(3)
6.4	**Write** down the **range** of f.	(1)
6.5	**Determine** the **coordinates** of E, the x-intercept of f.	(2)
6.6	**Write** down the **coordinates** of K, the **image** of **point** D (1; –2) if the **graph** of f is **reflected** about the x**-axis**.	(2)
		[11]

QUESTION 7

Graph:
The **sketch** below **represents** the **graphs** of **functions** f and g defined by
$f(x) = (6 - 2x)(x + 1)$ and $g(x) = -2x + 6$.

- A and D are the ***x*-intercepts** of f.
- B is the common ***y*-intercept** for both f and g.
- C is the **turning point** of f.
- B and D are the **points** where the **two graphs cut each other**.



7.1	**Write** down the **coordinates** of **points**, **A** and **D**.	(2)
7.2	**Write** down the **coordinates** of **B**.	(2)
7.3	**Determine** the **coordinates** of **C**.	(3)
7.4	**Write** down the **values** of x for which $f(x) = g(x)$.	(2)
7.5	**Determine** the **function** $h(x)$ in the form: $h(x) = (a + 2x)(x - b)$ if $h(x)$ results from shifting f 2 units to the right.	(2)
7.6	**Calculate** the **area** of ΔBOD.	(2)
		[13]

QUESTION 8

8.1 **Calculate** 7,8% of **R2 567**. (1)

8.2 **Determine** the **effective annual interest rate** of 7,8% **compounded monthly**. (3)

8.3 The **value** of **farm machinery bought** at the **beginnin**g of the year in **2017**.
It is **depreciated** over the years at a **rate** of **7,2% per annum**.
It is **compounded quarterly** on a **reducing balance method** to **R800 000**.
Determine the **initial cost** of the **machinery** when it was **new**. (5)

8.4 A **school invested** a **sum** of **R320 000** in an **investment account** to **buy** a **school bus** costing **R950 000**.

- The **interest rate** for the **first three years** of the **investment** is **5% per annum(yearly).**
- At the **end** of the **third year**, the **school deposited** a **further R400 000** into the **account**.
- The **interest rate** then **increased** to **5,8%** for the **remaining years** of the **investment**.

8.4.1 **Calculate** the **amount** that was in the **investment account** at the **end** of the **third year**. (3)

8.4.2 **Determine** how **long** it will **take** the **investment** to **reach** the **required amount** of **R950 000**. (5)

[17]

TOTAL: 150

INFORMATION SHEET: TECHNICAL MATHEMATICS

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

$a^x = b \Leftrightarrow x = \log_a b$, $\quad a > 0, a \neq 1$ and $b>0$

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

$i_{eff} = \left(1 + \frac{i}{m}\right)^m - 1$

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

$\int k x^n dx = \frac{k x^{n+1}}{n+1} + C$, $\quad n, k \in \mathbb{R}$ with $n \neq -1$ and $k \neq 0$

$\int \frac{k}{x} dx = k \ln x + C$, $x > 0$ and $k \in \mathbb{R}$; $k \neq 0$

$\int k a^{nx} dx = \frac{k a^{nx}}{n \ln a} + C$, $a > 0$; $a \neq 1$ and $k, a \in \mathbb{R}$; $k \neq 0$

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

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

$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

In ΔABC**:** $\quad \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ $\qquad a^2 = b^2 + c^2 - 2bc \cdot \cos A$

area of Δ ABC $= \frac{1}{2} ab \cdot \sin C$

$\sin^2\theta + \cos^2\theta = 1$ $\qquad 1 + \tan^2\theta = \sec^2\theta$ $\qquad 1 + \cot^2\theta = \text{cosec}^2\theta$

$\pi \, rad = 180°$

Angular velocity = $\omega = 2\pi n$ where n = rotation frequency

Angular velocity = $\omega = 360°n$ where n = rotation frequency

Circumferential velocity = $v = \pi Dn$ where D = diameter and n = rotation frequency

Circumferential velocity = $v = \omega r$ where ω = angular velocity and r = radius

Arc length $= s = r\theta$ where r = radius and θ = central angle in radians

Area of a sector $= \frac{rs}{2}$ where r = radius, s = arc length

Area of a sector $= \frac{r^2\theta}{2}$ where r = radius and θ = central angle in radians

$4h^2 - 4dh + x^2 = 0$ where h = height of segment, d = diameter of circle and x = length of chord

$A_T = a(m_1 + m_2 + m_3 + \ldots + m_n)$ where $a =$ width of equal parts, $m_1 = \frac{o_1 + o_2}{2}$
$o_n = n^{th}$ ordinate and n = number of ordinates

OR

$A_T = a\left(\frac{o_1 + o_n}{2} + o_2 + o_3 + \ldots + o_{n-1}\right)$ where $a =$ width of equal parts, $o_n = n^{th}$ ordinate and $n =$ number of ordinates

ANSWER SHEET

NAME AND SURNAME: ……………………………………………..

SCHOOL: ……………………………………..

QUESTION 5.5