Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 11

NOVEMBER 2022

TECHNICAL MATHEMATICS P1 (DEAF)

MARKS: **150**

TIME: **3 hours**

This question paper has 12 pages, including a 1-page answer sheet and a 2-page information sheet.

INSTRUCTIONS

Read the following instructions carefully before answering the questions.

1. This question paper has SEVEN questions.
2. Answer ALL the questions.
3. An ANSWER SHEET is attached for QUESTION 4.4. Write your name in the spaces provided**(given)** and then hand in with your ANSWER BOOK.
4. Number the answers correctly.
5. Clearly show ALL calculations, diagrams, graphs, et cetera, that you have used in determining**(finding out)** your answers.
6. An approved scientific calculator (non-programmable and non-graphical) may be used, unless stated otherwise.
7. ALL answers should be rounded off to TWO decimal places, unless stated otherwise.
8. Diagrams are NOT necessarily drawn to scale.
9. Write neatly.

QUESTION 1

1.1 **Simplify** the following completely **WITHOUT** using a **calculator**:

1.1.1 $(3-\sqrt{x})(3+\sqrt{x})$ (2)

1.1.2 $\left(\frac{3}{3^{3x}}+\frac{2}{3^{3x}}\right)\div\frac{10}{27^{x}}$ (4)

1.1.3 $\frac{\sqrt{2}(\sqrt{12}+\sqrt{75})}{\sqrt{6}}$ (4)

1.1.4 $\log_5\left(\frac{1}{5}\right)+\log_5 30-\log_5 6$ (5)

1.2 Prove that:

$$\frac{2(\log 1-\log 3-\log 2)}{\log 36}=-1$$ (5)

1.3 Given binary numbers:

100111_2 and 11_2

1.3.1 **Use** the **long division** method to calculate $100111_2 \div 11_2$ in **binary form**. (5)

1.3.2 **Convert(change)** your answer in **QUESTION 1.3.1** to a **decimal form without** using a **calculator**. (3)

1.4 A tender to build 280 000 000 houses within a period of 5 years has been awarded**(given)** to a construction company. Write the number of houses in **Scientific notation.** (2)

[30]

QUESTION 2

2.1 Solve for $x \in R$, WITHOUT using a calculator:

2.1.1 $\dfrac{1}{(x)^{\frac{5}{3}}} = 32$ (4)

2.1.2 $\sqrt{x+5} - x = 3$ (6)

2.1.3 $\log_x 3 = -1$ (2)

2.1.4 $\log_a(x-8) - \log_a 24 = -\log_a(x+2)$ (7)

2.2 **Show** that:

$$5.2^{1-x} + 2^{2-x} = \frac{7}{2^{x-1}}$$ (4)

2.3 The **formula** below is **used** to calculate the **Body Mass Index** (**BMI**) of a **human being**:

$$\text{Height(m)} = \sqrt{\frac{\text{Weight (kg)}}{\text{BMI}}}$$

BMI = Body Mass Index $(kg.m^{-2})$
Weight measured in kilograms (kg)
Height measured in metres (m)

2.3.1 Make Weight the subject of the formula. (2)

2.3.2 **Determine (find out)** the **Weight** of a **person** whose **BMI** is **29,9 kg. m^{-2}** and height 1 960 mm. (3)

[28]

QUESTION 3

3.1 **Solve** for x:

3.1.1 $x(x-2)-15=0$ (4)

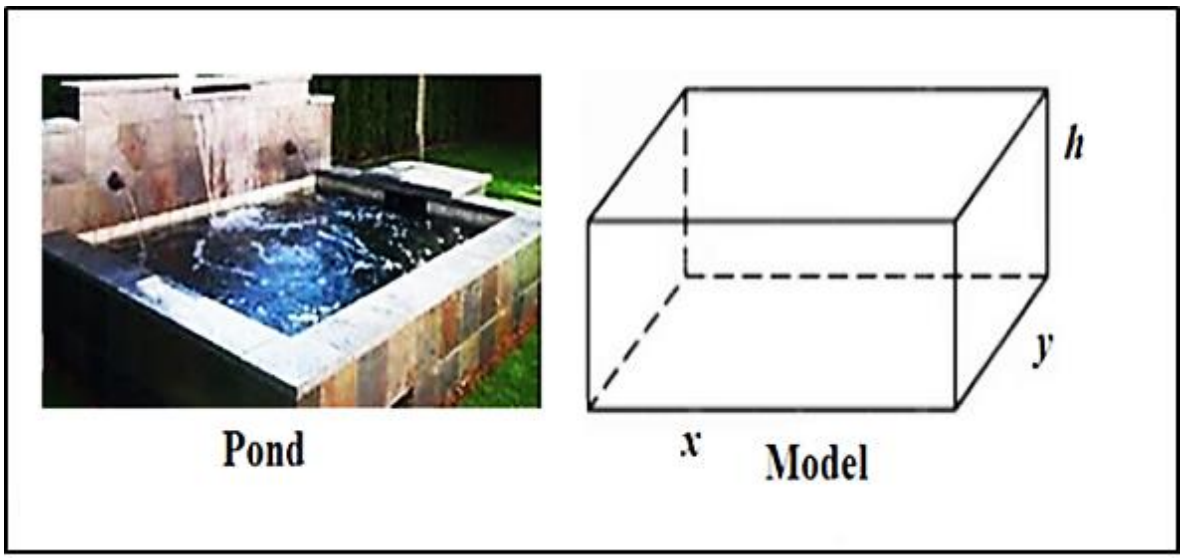
3.1.2 $2x-\frac{7}{x}=-3$ (correct to TWO decimal places) (5)

3.1.3 $x^2-x-12\leq 0$ (represent the solution set on a number line) (4)

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

$y-x=-2$ and $x^2-x-10=y$ (6)

3.3 The diagram below shows a rectangular fish pond and its rectangular geometric model alongside it. The length of the pond is x metres, width is y metres and height is h metres.



3.3.1 Show that $x = 9 - y$, if the perimeter of the pond is 18 m. (2)

3.3.2 **Write** the **formula** for the **area** of the **pond** in **terms** of ***y***. (1)

3.3.3 **Determine(find out)** the **numerical values** of the **length** and the **width** that will **yield** a **perimeter** that is **equal** to the **area** of the **pond**, $x > y$. (5)

3.4 **Determine(find out),** without solving the equation, the **nature** of **roots** of $f(x) = x^2 + x + 1$. (3)

3.5 **Determine (find out)** for which value(s) of c the **equation** $g(x) = x^2 + x + c$ will have **equal roots**. (3)

[33]

QUESTION 4

Given function f defined by $f(x) = 2(x-3)^2 - 8$

4.1 Write down the coordinates of the turning point of f. (2)

4.2 **Determine(find out)** the y intercept of f. (2)

4.3 **Determine(find out)** the x intercept of f. (4)

4.4 **Sketch** the **graph** of f on the ANSWER SHEET **provided(given)** at the end of the question paper. Clearly **indicate(show)** the **intercepts** with the **axes** and the **coordinates** of the **turning point**. (4)

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

4.6 **Determine(find out)** the **coordinates** of the **turning point** of **function** h, that results from shifting f, 2 units vertically upwards. (2)

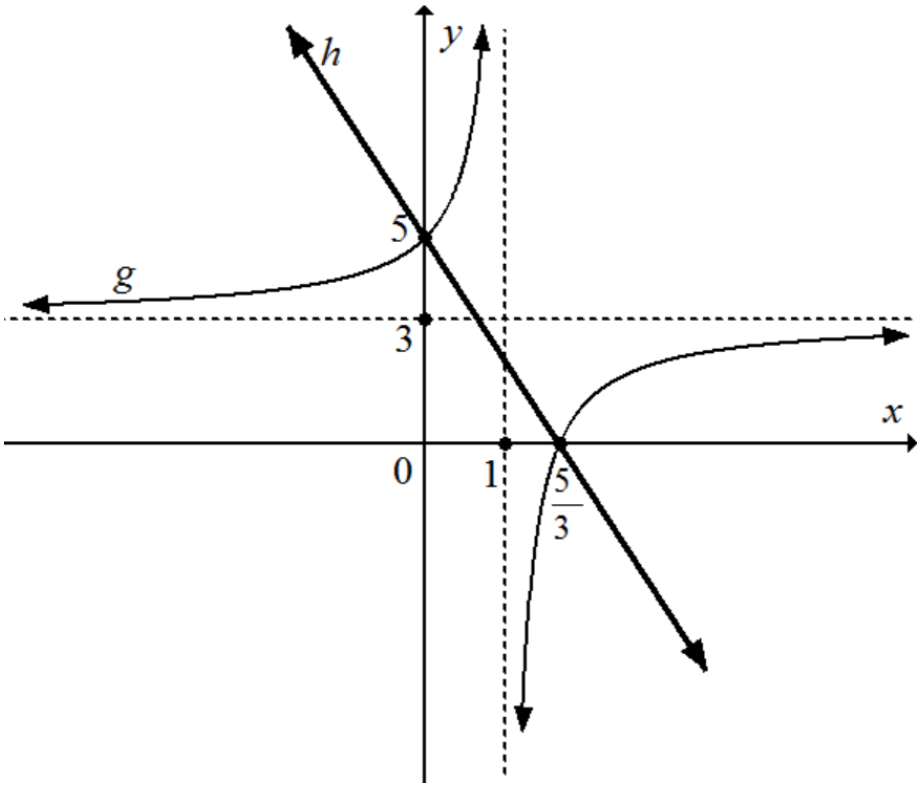
[15]

QUESTION 5

The graphs drawn below represent functions defined by $g(x) = \frac{a}{x-p} + q$ and $h(x) = mx + c$.

The graphs, g and h intersect at point (0;5) and $\left(\frac{5}{3};0\right)$ respectively.

$x = 1$ and $y = 3$ are the asymptotes of g.



Determine(find out):

5.1 The numerical value of m (3)

5.2 The numerical value of c (1)

5.3 The numerical value of q (2)

5.4 The numerical value of p (1)

5.5 The numerical value of a (4)

5.6 The domain of g (1)

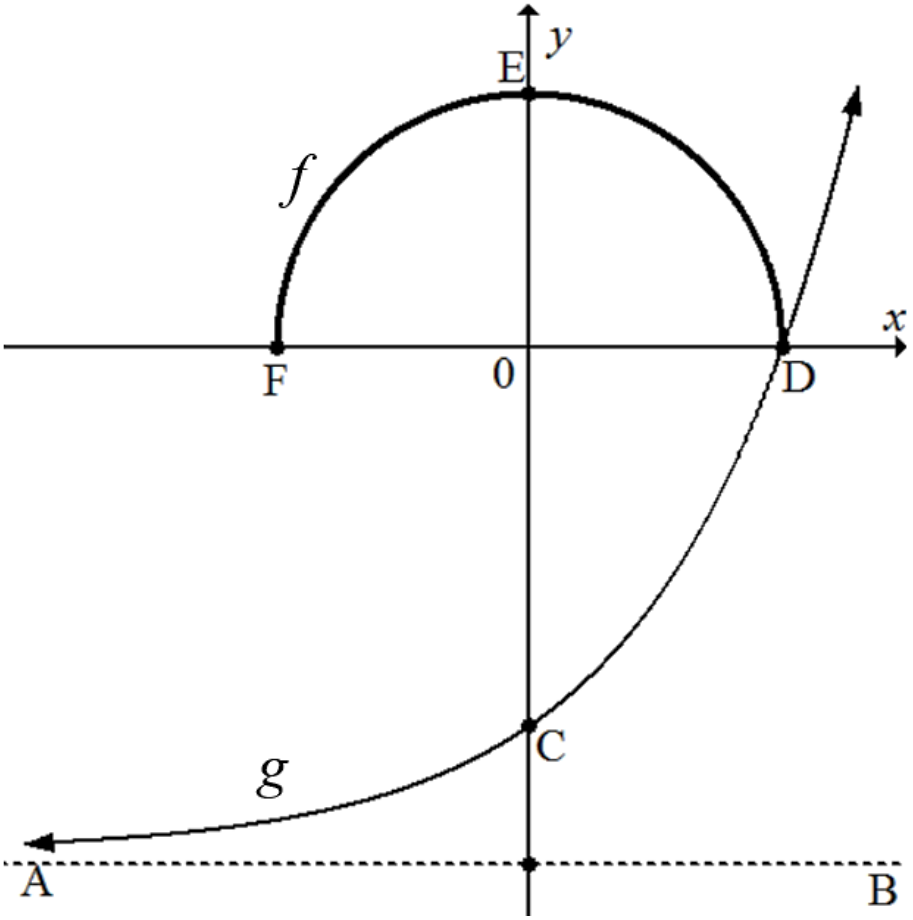
5.7 The values of x for which $g(x) \leq h(x)$. (4)

5.8 The equation of the function f, a reflection of g about the x-axis (2)

[18]

QUESTION 6

The graphs below represent functions defined by $f(x) = \sqrt{r^2 - x^2}$ and $g(x) = 2^x - 4$.
AB is an asymptote of g.
C is the y-intercept of g.
D is the common x-intercept for both the graph of f and g.
F and E are the x- and y-intercepts of f, respectively.



6.1 **Write** the **equation** of **AB**, the **asymptote** of g. (1)

6.2 **Determine**(find out) the **coordinates** of C and D, the intercepts of g. (5)

6.3 **Determine**(find out) the **defining equation** of f. (2)

6.4 **Write** the **value** of x for which $f(x) - g(x) = 0$. (1)

6.5 **Determine**(find out) the **length** of **EC**. (2)

6.6 **State** a **reason**, **why** $f(x)$ is a **function**. (1)
[12]

QUESTION 7

7.1 A nominal interest rate charged is 6,3% per annum, compounded quarterly. **Determine**(find out) the **effective interest rate** per **annum**. (3)

7.2 The production of chicken eggs grows from 2 500 to 8 949, compound production rate over a period of 6 years. **Determine**(find out) the **production rate** of **eggs** per **annum**, **compounded** annually. (4)

7.3 Mr Faku bought office furniture to the value of R25 000 as shown in the picture below. He paid a deposit of 11% and took a higher purchase loan for the remaining amount to be paid over a period 4 years, on 16% interest rate per annum.

7.3.1 **Determine**(find out) the amount paid by Mr Faku as a deposit. (2)

7.3.2 Calculate the total amount paid, in instalments, at the end of 4 years. (3)

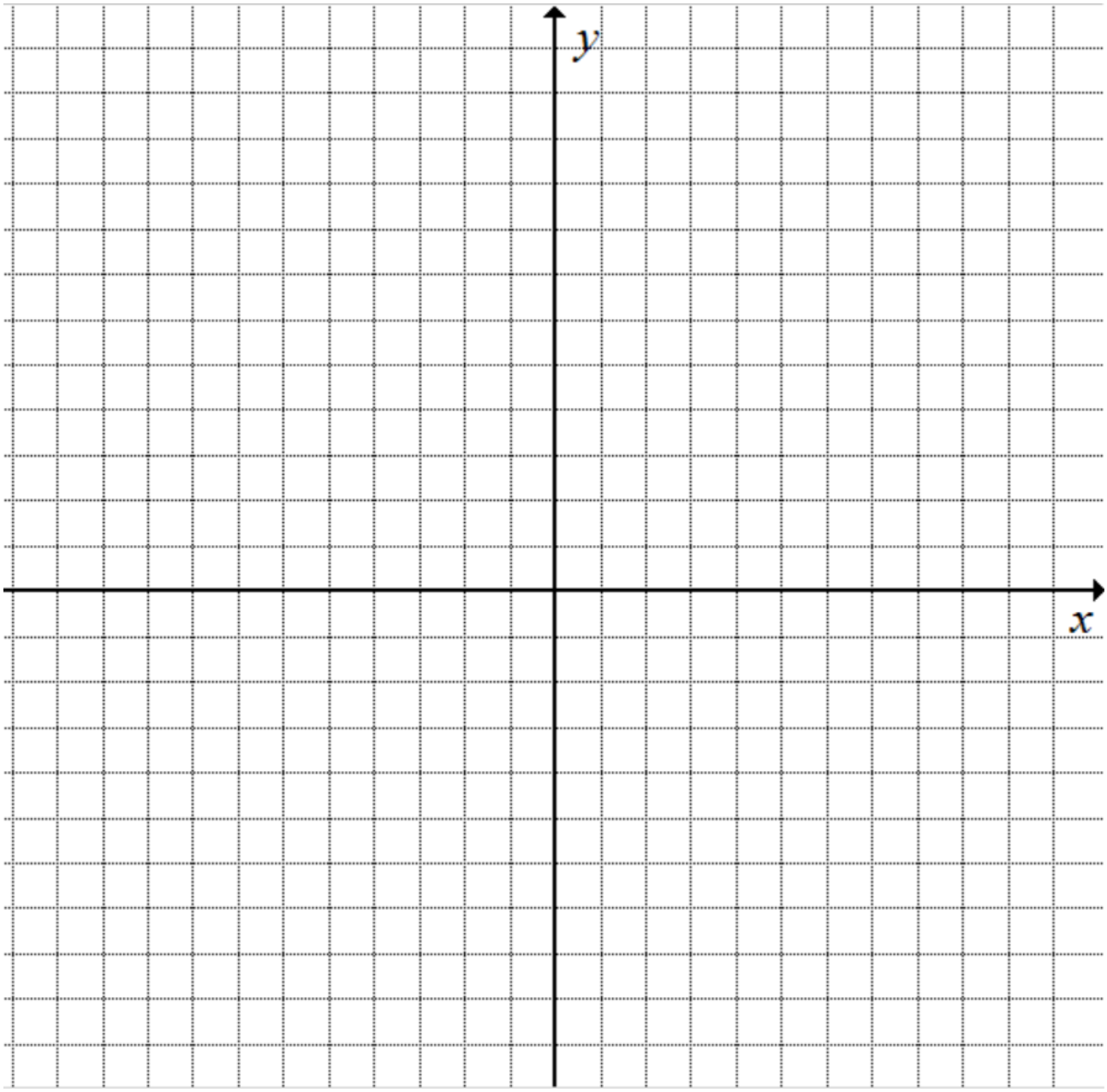
7.3.3 **Determine**(find out) the amount he paid monthly over a period of 4 years. (2)
[14]

TOTAL: 150

ANSWER SHEET

NAME AND SURNAME: …… SCHOOL: …….

QUESTION 4.4



INFORMATION SHEET: TECHNICAL MATHEMATICS

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

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

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

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

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

$$\int x^n dx = \frac{x^{n+1}}{n+1} + C, \; n \neq -1 \qquad \int k x^n dx = k. \frac{x^{n+1}}{n+1} + C, \; n \neq -1$$

$$\int \frac{1}{x} dx = \ln x + C, \; x > 0 \qquad \int \frac{k}{x} dx = k. \ln x + C, \; x > 0$$

$$\int a^x dx = \frac{a^x}{\ln a} + C, \; a > 0 \qquad \int k a^{nx} dx = k. \frac{a^{nx}}{n \ln a} + C, \; a > 0$$

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

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

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

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

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

$$\sin^2\theta + \cos^2\theta = 1 \qquad 1 + \tan^2\theta = \sec^2\theta$$

$$1 + \cot^2\theta = \text{cosec}^2\theta$$

$\pi rad = 180°$

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 = $v = 2\pi rn$ where r = radius and = rotation frequency

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 and θ = central angle in radians

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

$A_T = a(m_1 + m_2 + m_3 + ... + m_n)$ where a = equal parts, $m_1 = \frac{o_1 + o_2}{2}$ and n = number of ordinates

OR

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