Province of the EASTERN CAPE EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 12

SEPTEMBER 2022

MATHEMATICS P1 (DEAF)

MARKS: **150**

TIME: **3 hours**

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

INSTRUCTIONS AND INFORMATION

Read the instructions.

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

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

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

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

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

6. Diagrams are NOT necessarily drawn to scale.

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

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

9. Write neatly.

QUESTION 1

1.1 **Solve** for x:

1.1.1 $x^2+4x-21=0$ (2)

1.1.2 $x(2x-7)=3$ (correct to TWO decimal places) (4)

1.1.3 $(2x+3)(x+1)<6$ (4)

1.1.4 $2\sqrt{x}+x=3$ (5)

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

$2y+x+3=0$ and $x^2+y^2+2xy=1$ (6)

1.3 It is given that $K^{\frac{1}{x}}=3$, $K^{\frac{1}{y}}=4$ and $K^{\frac{1}{w}}=12$.

Prove that $w=\dfrac{xy}{x+y}$.

(4)

[25]

QUESTION 2

2.1 An arithmetic series has a **common difference** of 4. $(3x-1)$ and $(2x+8)$ are the fourth and the seventh terms of the series, respectively.

2.1.1 **Determin**e the value of *x*. (3)

2.1.2 **Calculate** the:

(a) First term of the series (3)

(b) Sum of the first 42 terms of the series (3)

2.2 The first term of a **quadratic number pattern** is 61. $T_k = 4k - 26$ forms the first differences of the quadratic number pattern.

2.2.1 Write down the second and third terms of the quadratic number pattern. (2)

2.2.2 If the n^{th} term of the quadratic number pattern is given by $T_n = 2n^2 - 28n + 87$, calculate the value of the smallest term. (3)

2.2.3 A constant *k* is added to T_n such that all the terms of the quadratic number pattern become positive. **Determine(find out)** the values of *k*. (2)

[16]

QUESTION 3

3.1 Given that $p = 0,\dot{7} = 0,777777...$

3.1.1 Write down *p* as a **geometric series**. (1)

3.1.2 Represent the series in **sigma notation**. (3)

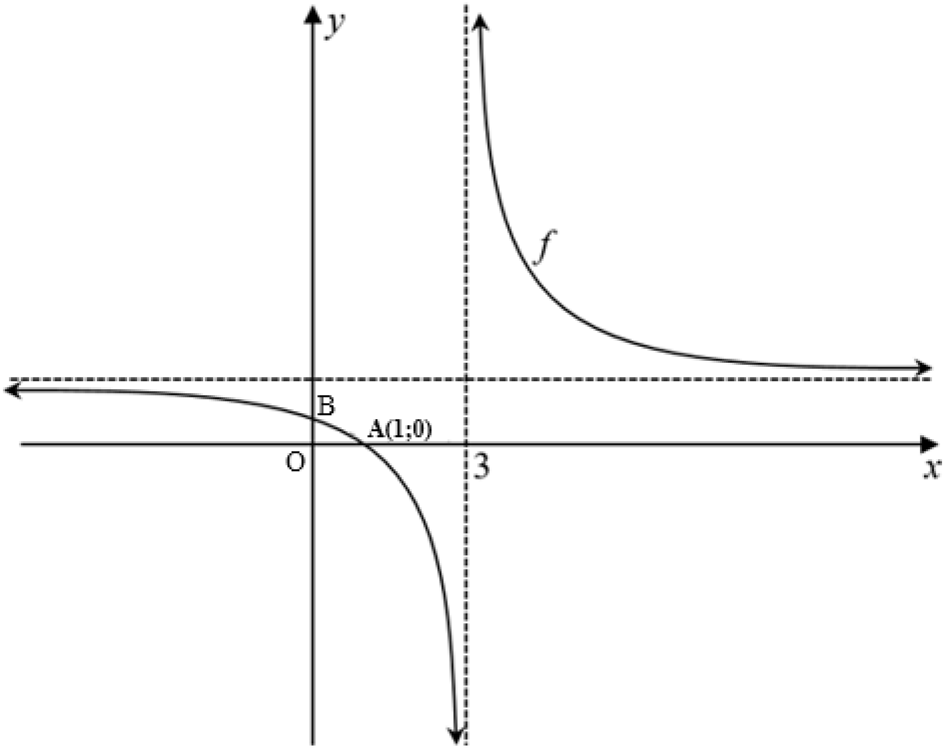
3.1.3 **Determine(find out)** the sum to **infinity** of the geometric series as a proper fraction. (2)

3.2 In a geometric sequence the sum of the 9^{th} and 10^{th} terms is 6 times the 8^{th} term. **Determine(find out)** the value(s) of r, the common ratio of the sequence. (4)

[10]

QUESTION 4

In the diagram below the graph of a **hyperbolic function**, $f(x)=\dfrac{x+k}{x+p}$, where k is a constant, is drawn. A(1 ; 0) and B are the x-intercept and y-intercept of f, respectively. The vertical asymptote goes through the x-axis at 3.



4.1 Write down the **value** of p. (1)

4.2 **Determine(find out)** the **value** of k. (2)

4.3 **Calculate** the **coordinates** of B. (2)

4.4 **Determine(find out)** the **values** of x for which $x.f(x)\leq 0$. (3)

4.5 **Rewrite** the **equation** of f in the form $f(x)=\dfrac{a}{x+p}+q$. (2)

[10]

QUESTION 5

Given the function: $f(x) = -3^x + 1$

5.1 Draw the graph of f in your ANSWER BOOK. Clearly **show** the **intercepts** with the axes as well as the asymptote of the graph. (3)

5.2 Write down the **range** of f. (2)

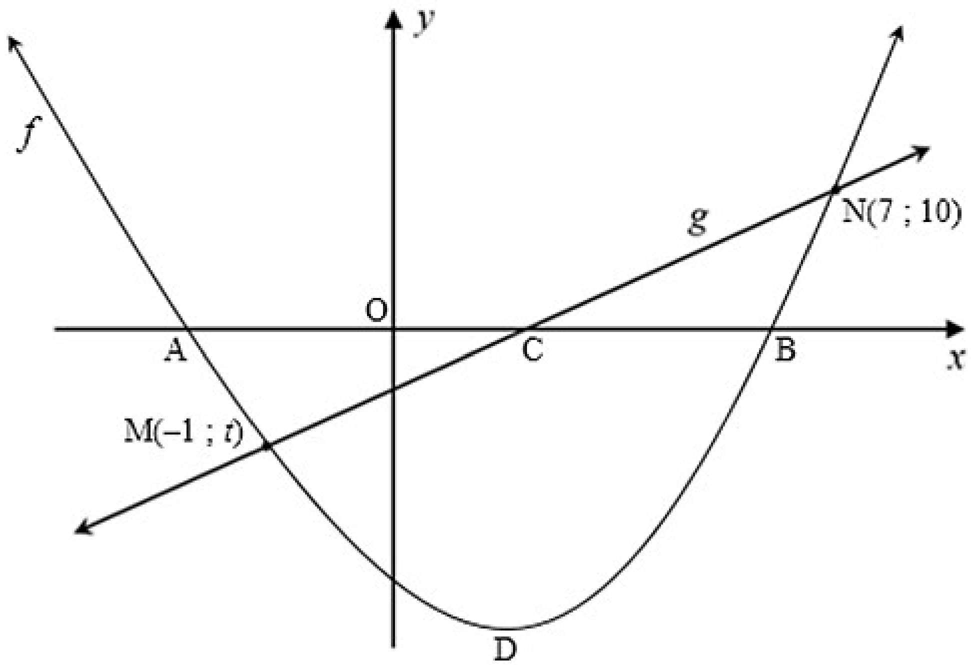
5.3 **Determine(find out)** the **equation** of the **asymptote** of g, given that $g(x) = -f(x)$. (2)

5.4 If g is shifted 1 unit upwards to give a new function h, **determine(find out)** the **equation** of h^{-1}, the inverse of h in the form $y = ...$ (3)

[10]

QUESTION 6

The diagram below shows the graphs of $f(x) = x^2 - 4x - 11$ and $g(x) = f'(x)$. A and B are the *x*-intercepts of f and C the *x*-intercept of *g*. D is the turning point of f. f and *g* intersect at M(–1 ; *t*) and N(7 ; 10).



6.1 **Calculate** the:

6.1.1 **Coordinates** of D (3)

6.1.2 Distance CN (4)

6.2 For which value(s) of x, is:

6.2.1 $f(x) < g(x)$? (2)

6.2.2 $g(x) - f(x)$ a maximum? (4)

[13]

QUESTION 7

7.1 Corniel bought an ice cream machine that **depreciated(become less)** at 17% p.a. on the reducing balance method. The value of the machine depreciated to a book value of R27 763,12 over a period of 4 years. What was the **original price** of the machine? (2)

7.2 After completing his studies, Lubabalo decides to save money to buy himself a car for cash. He wants to save R300 000 by making equal monthly deposits into a savings account that pays interest of 8,6% p.a. compounded monthly, over a period of 7 years. How much must he **deposit** per **month** if he wants to achieve his goal? (3)

7.3 Yolanda **acquired(got)** a **mortgage(house)** loan to buy a house. She was **required(asked)** to pay R8 901,96 monthly and she was charged 10,4% interest per annum compounded monthly. Her payment period was 25 years and her first payment was made at the end of the first month after she took out the loan.

7.3.1 **Calculate** the to**tal value** of the mortgage loan, (to the nearest rand), Yolanda needed. (3)

7.3.2 After 204 payments, Yolanda could only afford to pay R7 500 per month, going forward.

(a) **Determine(find out)** the **outstanding balance** after the 204th payment. (3)

(b) How **long** did it take for Yolanda to **pay** up the **outstanding balance**, if she was allowed to pay the new instalment? (4)

[15]

QUESTION 8

8.1 **Determine(find out)** $f^{/}(x)$ from **first principles** if $f(x)=x-3x^2$. (5)

8.2 **Determine(find out)**:

8.2.1 $D_x\left[3x^4-\dfrac{4}{x^2}\right]$ (3)

8.2.2 $\dfrac{dy}{dx}$ if $y=a^2x+6\sqrt{x}$ (3)

[11]

QUESTION 9

Given: $f(x)=x^3-3x+2$

9.1 Calculate the **coordinates** of the **turning points** of f. (4)

9.2 Calculate the x-intercepts of f. (3)

9.3 **Determine(find out)** the **values** of x for which f:

9.3.1 Is decreasing (2)

9.3.2 Will be **concaved** down (3)

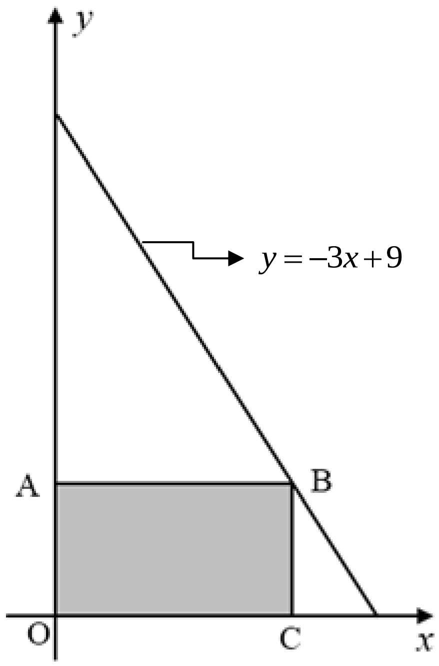
9.4 **Draw** the **graph** of $g(x)=(x-3)^3-3(x-3)+2$, clearly **indicating** the **intercepts** with the axes and the turning points. (4)

9.5 **Determine(find out)** the **value(s)** of k such that $g(x)=k$ always has 3 distinct roots. (2)

[18]

QUESTION 10

The diagram below shows a rectangle OABC, where B lies on the straight line $y = -3x + 9$. C lies on the x-axis and A lies on the y-axis as shown.



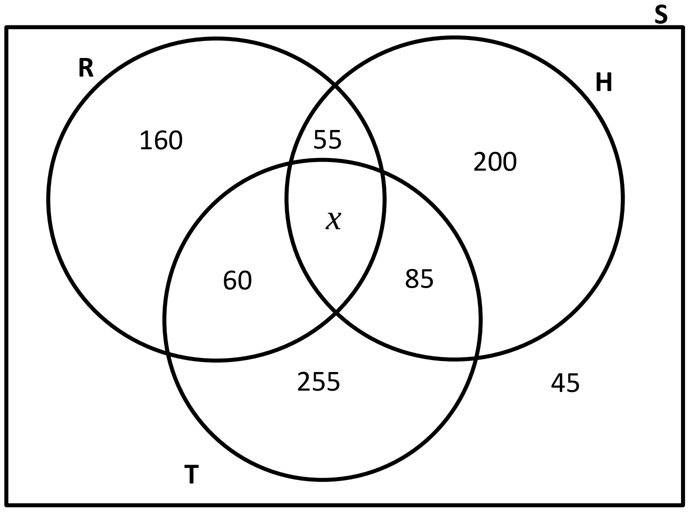
10.1 If B(x ; y), write down the **lengths** of OC and OA in terms of x. (2)

10.2 **Determine**(find out) the **coordinates** of B for which rectangle OABC has a maximum area. (4)

[6]

QUESTION 11

11.1 During a **survey**(study) at a certain school, 900 learners were asked to **indicate**(show) what sport they would like to play as a winter sport code. Learners could choose at most three sport codes. The sport codes indicated by learners were Rugby (R), Hockey (H) and Tennis (T). There will be boys and girls' teams in all three sport codes.
The data collected is shown in the Venn diagram below.



11.1.1 **Determine**(find out) how many learners want to play all three sport codes. (2)

11.1.2 If a learner is randomly chosen, what is the probability that he/she prefers to play hockey only? (2)

11.1.3 **Determine**(find out) the percentage of learners who are likely to play at least 2 of the sport codes. (2)

11.2 Consider the word SPECTRUM.

11.2.1 How many ways can the 8 letters be **arranged**:

(a) In any order? (1)

(b) Such that the first letter is a vowel? (2)

11.2.2 Calculate the **probability** that in a particular arrangement of the 8 letters, the letters T, P and R will be next to each other, in any order. (2)

11.3 A bag contains only two colours of tennis balls, red and green, in the ratio 1 : 3. Two balls are picked at random, one after the other, without replacement. **Calculate** the number of balls in the bag given that the **probability** of picking first a red ball and second a green ball is equal to $\frac{1}{5}$. (5)

[16]

TOTAL: 150

INFORMATION SHEET: MATHEMATICS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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