Province of the
EASTERN CAPE
EDUCATION

Iphondo leMpuma Kapa: Isebe leMfundo
Provinsie van die Oos Kaap: Departement van Onderwys
Porofensie Ya Kapa Botjhabela: Lefapha la Thuto

NATIONAL SENIOR CERTIFICATE

GRADE 12

SEPTEMBER 2024

MATHEMATICS P1

MARKS: **150**

TIME: **3 hours**

This question paper consists of 13 pages, including a 1-page information sheet.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 12 questions.
2. Answer ALL the questions.
3. Clearly show ALL calculations, diagrams, graphs, et cetera which you have used in determining your answers.
4. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
5. Answers only will NOT necessarily be awarded full marks.
6. If necessary, answers should be rounded off to TWO decimal places, unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. Number the answers correctly according to the numbering system used in this question paper.
9. An information sheet with formulae is included at the end of the question paper.
10. Write neatly and legibly.



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QUESTION 1

1.1 Solve for x:

1.1.1 $(2x-4)(x-1)=0$ (2)

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

1.1.3 $x^2+4x-21\leq 0$ (3)

1.1.4 $-\sqrt{x-1}=3-2x$ (4)

1.2 Solve simultaneously for x and y:

$2x=1-y$ and $xy-x^2+y^2=5$ (6)

1.3 Given that:

- $f(x)=x^2+3x$
- $2x-[t(x)]^{\frac{1}{2}}=0$

For which values of k will the equation $f(-x)+\frac{t(2k)}{4}=0$ have equal roots? (5)

[24]



QUESTION 2

2.1 Given the quadratic number pattern: $-5; -4; -1; 4; ...$

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

2.1.2 Calculate the 35^{th} term of the quadratic number pattern. (1)

2.1.3 Which TWO consecutive terms of the first differences sequence will have a product of 1 155? (4)

2.2 Given the arithmetic sequence: $60; 65; 70; ...$

Calculate the value of p for which $T_p = 430$. (3)

2.3 The sum of the first three terms of an increasing arithmetic series is 30 and the product of the same three terms is 510. Determine the values of a and d, the first term and the common difference of the series respectively. (5)

[17]

QUESTION 3

3.1 An infinite geometric series has a first term of 2 and constant ratio of $\frac{1}{3}$.

3.1.1 Calculate the next two terms. (1)

3.1.2 Calculate the value of S_∞. (2)

3.2 Determine the value of m if:

$$\sum_{k=3}^{m} 8(2)^{k-1} = 131\,040$$

(5)

[8]

QUESTION 4

Consider the function: $f(x)=\frac{-1}{x+5}-2$

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

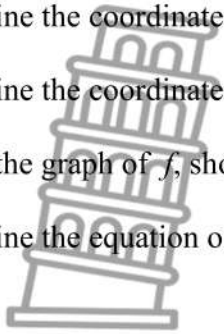
4.2 Determine the coordinates of the x-intercept of f. (2)

4.3 Determine the coordinates of the y-intercept of f. (2)

4.4 Sketch the graph of f, show clearly all asymptotes and intercepts with the axes. (3)

4.5 Determine the equation of the axis of symmetry that has a gradient of –1. (2)

[11]

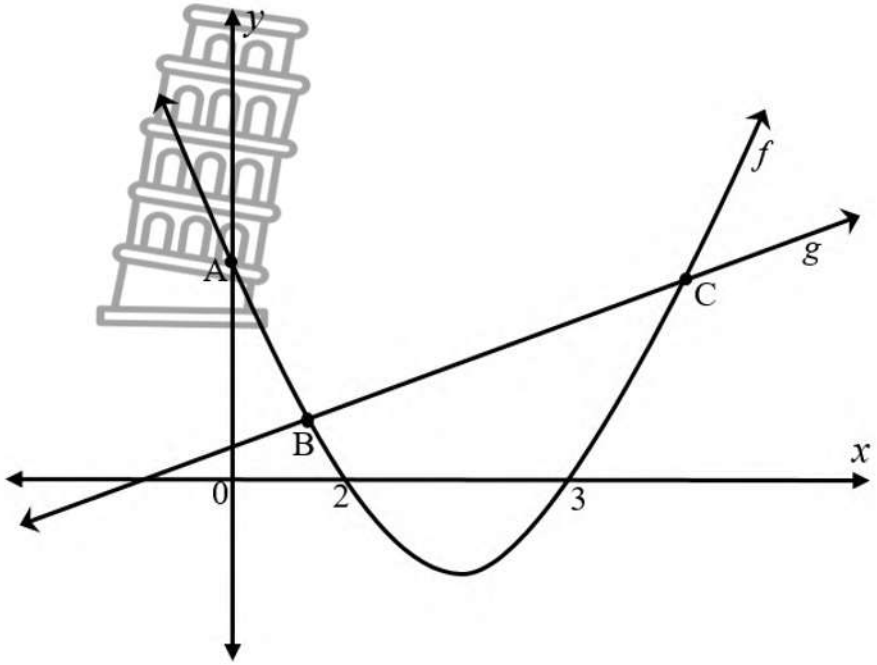




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QUESTION 5

The graphs of $f(x)=x^2-5x+6$ and $g(x)=x+1$ are drawn below. B and C are points of intersection of f and g. The graph of f has x-intercepts at $(2;0)$ and $(3;0)$ and a y-intercept at A.



5.1 Determine the equation of the axis of symmetry of f. (2)

5.2 Calculate the coordinates of B and C. (4)

5.3 PQ is the vertical distance between the graphs g and f between B and C. Determine the maximum length of PQ. (4)

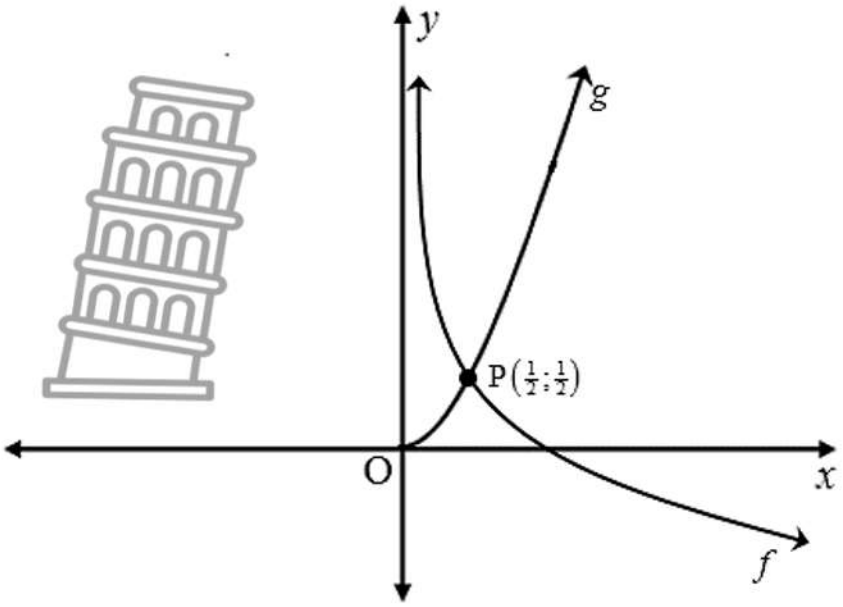
5.4 Determine the range of $t(x)$ if $f(x)-2=t(x)$. (2)

5.5 For which values of x is $f(x).g'(x)<0$? (2)

[14]

QUESTION 6

The diagram below shows the graphs of $f(x) = -\log_c x$ and $g(x) = d\,x^2$; $x \geq 0$.
The point $P\left(\frac{1}{2};\frac{1}{2}\right)$ is the point of intersection of the graphs f and g.



6.1 Calculate the values of c and d. (3)

6.2 Determine:

6.2.1 The equation of $g^{-1}(x)$ in the form $y = \ldots$ (2)

6.2.2 The equation of $h^{-1}(x)$ in the form $y = \ldots$, if h is a reflection of f in the x-axis (2)

6.2.3 The x-values for which $h^{-1}(x) > 0$ (1)
[8]

QUESTION 7

7.1 A car that is worth R180 000, depreciates at 13% p.a. compounded annually on the reducing balance method. Calculate the value of the car in 6 years. (3)

7.2 Lumi opened a 15-year savings plan account that pays interest at 8% per annum compounded monthly. She saves an amount of R900 every month for the first 10 years. Her first payment was at the end of the first month. For the last 5 years of her savings plan she managed to increase her monthly payments to R1 300.

Calculate the value of her savings at the end of the savings period. (5)

7.3 Mr Leanya bought a house for R850 000. He obtained a loan from the bank at an interest rate of 13% per annum compounded monthly to pay for the house. He agreed to pay monthly instalments of R9 958,39 for 20 years.

7.3.1 Calculate the balance of his loan immediately after his 75^{th} instalment. (3)

7.3.2 Mr Leanya experienced financial difficulties after his 75^{th} instalment and did not pay the 76^{th} to the 79^{th} instalments. At the end of the 80^{th} month he increased his monthly instalment so as to pay off the loan in the same time interval as planned initially.

Calculate the value of his new adjusted monthly instalment. (5)

[16]

QUESTION 8

8.1 Determine $f'(x)$ from first principles if $f(x) = x^2 - 3$. (4)

8.2 Determine:

8.2.1 $\frac{dy}{dx}$ if $y = -3x^2 + 7x$ (2)

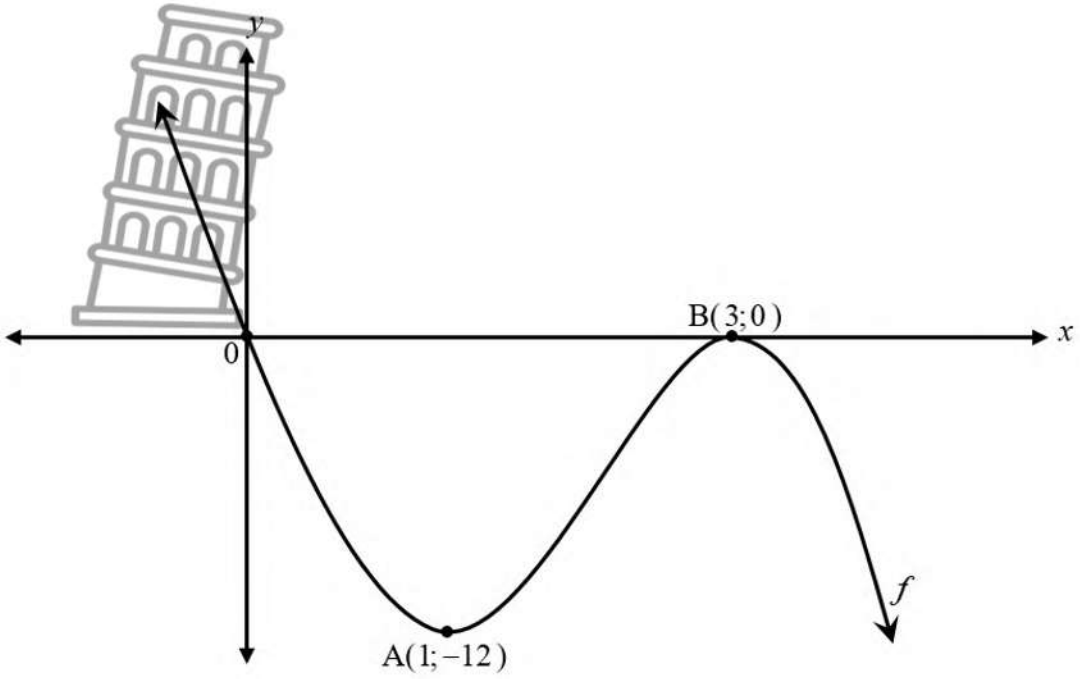
8.2.2 $D_x\left[\frac{x^3 - 5x^2}{x^3} - \sqrt{x}\right]$ (4)

8.3 Suppose that $g(x)$ represents the rate of change of $h(x) = -x^3 - 3x^2 + 1$. Calculate the largest value of $g(x)$. (3)

[13]

QUESTION 9

9.1 The sketch below shows the graph of $f(x) = -3x^3 + mx^2 + nx$. The graph of f passes through the origin and has a local minimum and a local maximum at A$(1;-12)$ and B$(3;0)$ respectively.



9.1.1 Show that $m = 18$ and $n = -27$ (5)

9.1.2 Explain the difference between $f(a)$ and $f'(a)$. (2)

9.1.3 $g(x)$ is the tangent to the curve of $f(x)$ at the point of inflection. Determine the equation of $h(x)$, the straight line that is perpendicular to $g(x)$ and passes through the origin. (5)

9.1.4 For which values of x will $f''(x) > 0$? (2)

9.2 The function t is defined by $t(x) = 2x^3 + bx + c$ and has the following properties.

- $t(-3) = t(3) = t(0) = 0$
- $t'(-1,5) = t'(1,5) = 0$

Use this information to draw a neatly labelled sketch graph of t, without solving for b and c. (3)

[17]

QUESTION 10

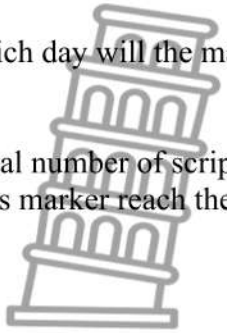
The number of scripts marked by a certain marker was tracked at a marking centre t days after marking started, and is represented by the function, $S(t) = -3t^2 + 30t$, $1 \leq t \leq 10, t \in \mathbb{Z}$, where $S(t)$ is measured in scripts per day.

10.1 Determine the number of scripts that were marked by the marker on the third day. (2)

10.2 On which day will the marker reach the maximum number of scripts marked per day? (3)

10.3 The total number of scripts that a marker had to mark for the 10 days was 500. Did this marker reach the quota? Support your answer with calculations. (2)

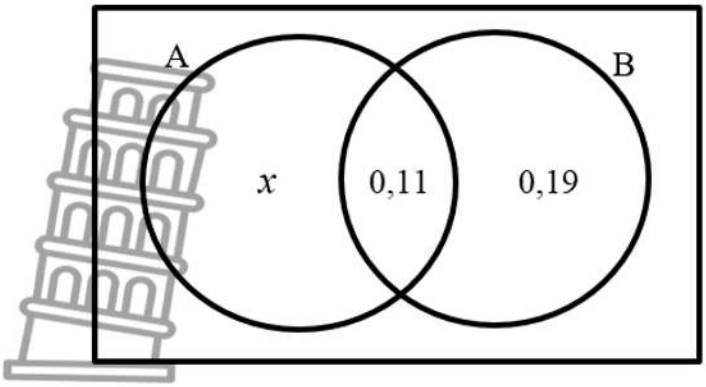
[7]





QUESTION 11

11.1 Two events A and B are shown on the Venn diagram below.
It is given that P[not (A or B)] = 0,41.



Determine:

11.1.1 The value of x and hence P(A) (2)

11.1.2 P (A or not B) (2)

11.2 The results for the soccer club, City Brothers FC's 30 games during the 2022–2023 season are shown below.

	HOME GAME	AWAY GAME	TOTAL
WINS	3	4	7
LOSSES	7	7	14
DRAWS	5	a	9
TOTAL	15	15	30

11.2.1 Write down the value of a. (1)

11.2.2 What is the probability that in a randomly selected match City Brothers FC was the losing team? (1)

11.2.3 Are the events 'winning a game' and 'playing at the home ground' independent? Justify your answer with calculations. (3)
[9]

QUESTION 12

The province of KwaZulu-Natal has introduced a new number plate system starting from December 2023. The new number plate code consists of two letters, two digits and then two letters. The system is using the digits, 0–9 and the letters of the alphabet excluding the vowels. Below is an example of this new number plate. Note that all number plates come with the ZN suffix which is independent from the code.



[Source: KZN Provincial Gazette 2614-new number plates for KZN]

12.1 How many number plate codes are possible with the new system, if digits and letters may not be repeated? (2)

12.2 Calculate the probability that a number plate code will start with a letter of the alphabet that is before letter G, with the first digit being a composite number and that the last digit is a factor of 4. Digits and letters may not be repeated. (4)

[6]

TOTAL: 150

INFORMATION SHEET: MATHEMATICS

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

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

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

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

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

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

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

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

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

In ΔABC: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$ $\qquad a^2 = b^2 + c^2 - 2bc.\cos A$ $\qquad area\,\Delta ABC = \dfrac{1}{2}ab.\sin C$

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

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

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

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

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

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

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Dear Mr West

RE: CORRECTION TO MARKING GUIDELINE (MATHEMATICS P1)

7.2	$F_v = \frac{x[(1+i)^n - 1]}{i}$ $= \frac{900\left[\left(1+\frac{0,08}{12}\right)^{120} - 1\right]}{\frac{0,08}{12}}\left(1+\frac{0,08}{12}\right)^{60} + \frac{1300\left[\left(1+\frac{0,08}{12}\right)^{60} - 1\right]}{\frac{0,08}{12}}$ $= 245\,305,23 + 95\,519,91$ $= R340\,825,14$ **was omitted in the original MG**	✓ $n = 120$ and/*en* $i = \frac{8\%}{12}$ or / *of* $\frac{8}{1200}$ ✓ $n = 60$ *in* F_v ✓ substitution into F_v / *vervanging in* F_v ✓ $\times\left(1+\frac{0,08}{12}\right)^{60}$ ✓ answer / *antwoord* (5)

OR/OF (alternative method)

7.2	$F_v = \frac{x[(1+i)^n - 1]}{i}$ $= \frac{900\left[\left(1+\frac{0,08}{12}\right)^{180} - 1\right]}{\frac{0,08}{12}} + \frac{400\left[\left(1+\frac{0,08}{12}\right)^{60} - 1\right]}{\frac{0,08}{12}}$ $= 311\,434,40 + 29\,390,74$ $= R340\,825,14$	✓ $n = 180$ and/*en* $i = \frac{8\%}{12}$ or / *of* $\frac{8}{1200}$ ✓ substitution into F_v / *vervanging in* F_v working with 900 ✓ $n = 60$ *in* F_v ✓ substitution into F_v / *vervanging in* F_v working with 400 ✓ answer / *antwoord* (5)

Regards

C.F. HERADIEN
(ECIM)