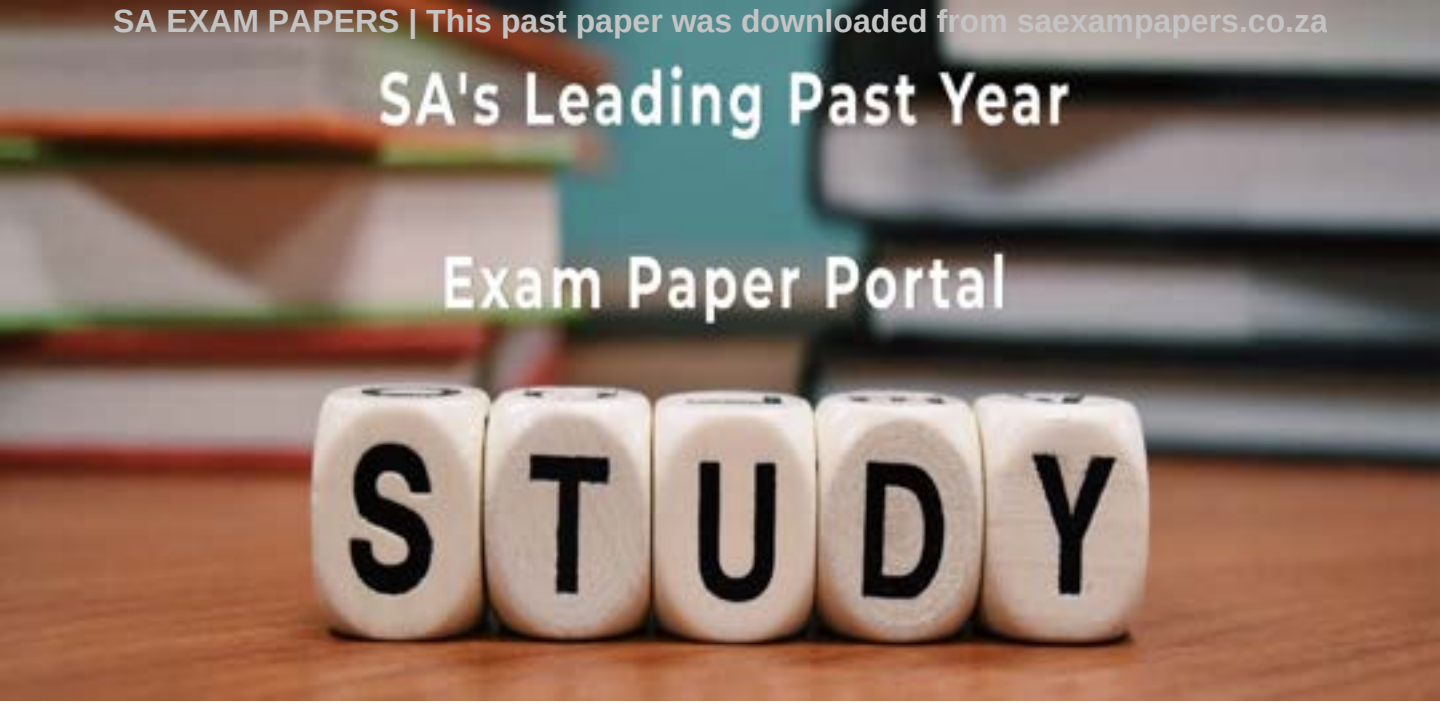

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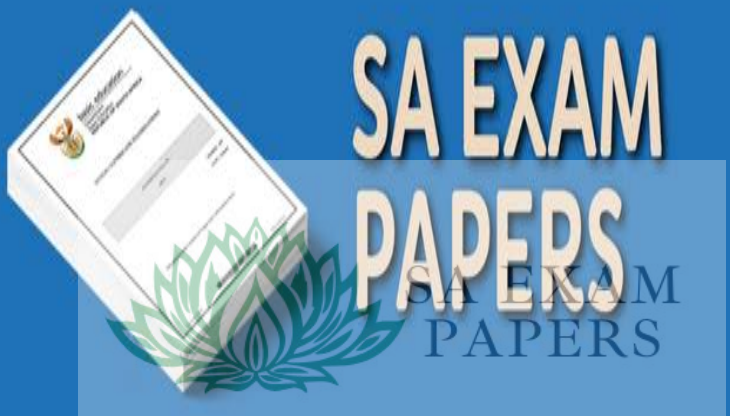


JOHANNESBURG CENTRAL DISTRICT (D14)

NAME OF SCHOOL:

GRADE 12

MATHEMATICS

TERM 1 CONTROLLED TEST

2024

MARKS : 100

TIME : 2 HOURS

This paper consists of 8 pages including the cover page, diagram sheet and information sheet

INSTRUCTIONS AND INFORMATION

1. Read the following instructions carefully before answering the questions.
2. This question paper consists of TWELVE questions. Answer ALL the questions.
3. Clearly show ALL calculations, diagrams, graphs, et cetera that you have used in determining your answer.
4. You may use an approved scientific calculator (non-programmable and nongraphical), unless stated otherwise.
5. Answers only will not necessarily be awarded full marks.
6. If necessary, round off answers 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. Write neatly and legibly.
10. An information sheet with formulae is included at the end of the question paper.

QUESTION 1

Solve for x:

1.1. $(2-x)(3x-1)=0$ (2)

1.2. $x(3x+2)=6$ (correct to two decimal places) (4)

1.3. $\sqrt{5-x}-x=1$ (5)

1.4. $x(2x-1)\geq 0$ (3)

1.5. Solve for x and y simultaneously:

$2x-1=y$ and $x^2-xy=3x-3$ (5)

[19]

QUESTION 2

Given the quadratic sequence $m; 4; n; 22; ...$

2.1. Calculate the value(s) of m and n if the second difference is 4 (4)

2.2. Calculate the nth term of the sequence (4)

2.3. Determine the first term of the sequence that will have a value greater than 407 (4)

[12]

QUESTION 3

3.1. Given the arithmetic series: $-3+1+5+\cdots+393$

3.1.1. How many terms are in the series above? (3)

3.1.2. Write the series above in sigma notation (2)

3.1.3. Hence, or otherwise, calculate the sum of the terms in the sequence above (3)

3.2. Given the following geometric sequence: $\frac{1}{9} + \frac{x}{18} + \frac{x^2}{36} + \cdots$

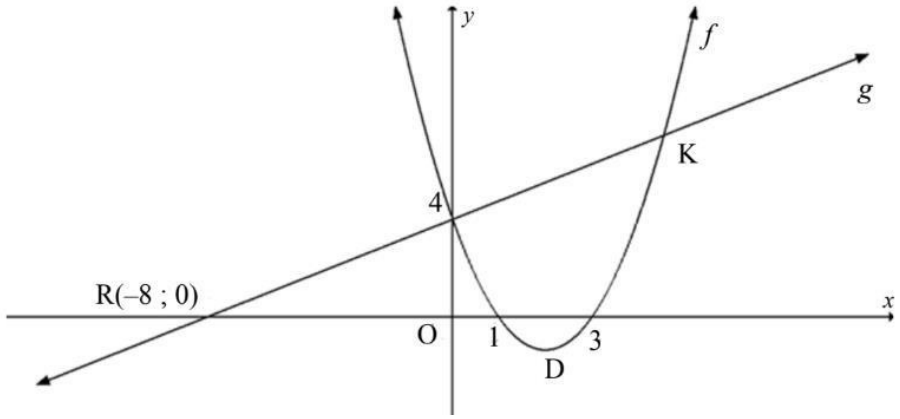
Determine the value(s) of x for which the sequence converges (3)

[11]

QUESTION 4

The graphs of $f(x) = ax^2 + bx + c$ and $g(x) = mx + q$ are sketched below.

- The x-intercepts of f are at (1 ; 0) and (3 ; 0).
- The y-intercept of f is (0 ; 4).
- Point D is the turning point of f.
- The x-intercept of g is at (– 8; 0).
- The graphs of f and g intersect at points K and (0 ; 4).



4.1. Determine the equation of f in the form $y = ax^2 + bx + c$ (3)

4.2. Determine the coordinates of point D. (3)

4.3. Determine the equation of g (3)

4.4. Determine the coordinates of point K. (4)

4.5. Write down the values of x for which:

4.5.1. $f(x) < 0$ (1)

4.5.2. $f(x).g(x) \geq 0$ (2)

4.6. When the graph of f is shifted 3 units down and 2 units to the right it forms the graph of h. Write down the equation of h in the form $h(x) = a(x - p)^2 + q$.

(2)

[18]

QUESTION 5

Given $t(x) = 4^x$

5.1. Write down the equation of t^{-1}, the inverse of t in the form $y = \cdots$ (2)

5.2. On the DIAGRAM SHEET, sketch the graphs of t and t^{-1} on the same system of axes. Show all intercepts with the axes and the line of reflection (4)

5.3. Write down the domain of t^{-1} (2)

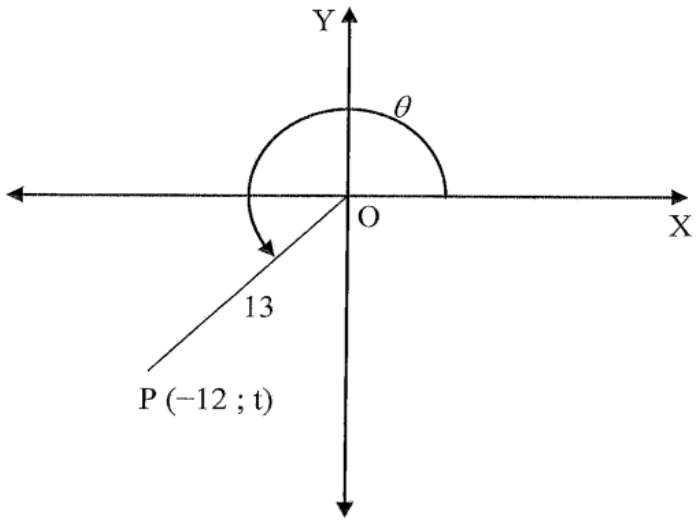
5.4. For which values of x will $t^{-1}(x) = 2$? (2)

5.5. Show that $t\left(x + \frac{1}{2}\right) = 2.t(x)$ (3)

[13]

QUESTION 6

In the diagram below, reflex angle $\hat{XOP} = \theta$. P is the point (−12 ; t) and OP = 13 units.



6.1. Determine, without the use of a calculator:

6.1.1. the value of t (2)

6.1.2. $\sin\theta$ (2)

6.1.3. $\cos(\theta + 45°)$ (4)

6.2. Simplify the following, without the use of a calculator:

$$\frac{2\cos(180°+x)\sin(180°-x)\sin 74°}{\sin(x+360°)\sin 37°\sin 53°\sin(x-90°)} \quad (7)$$

6.3. Prove that: $(1-\tan A)\left(\frac{\cos A}{\cos 2A}\right) = \frac{1}{\cos A+\sin A}$ (4)

6.4. If ΔABC is a scalene triangle, show that: $\cos(A+B) = -\cos C$. (3)

6.5. 6.5.1. Simplify $\frac{4\sin x\cos x}{2\sin^2 x-1}$ to a single trigonometric ratio (3)

6.5.2. Hence calculate the value of $\frac{4\sin 15°\cos 15°}{2\sin^2 15°-1}$ WITHOUT using a calculator leave your answer in simplest surd form. (2)

[27]

GRAND TOTAL: 100 MARKS

INFORMATION SHEET: MATHEMATICS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

DIAGRAM SHEET

NAME AND SURNAME: _____

GRADE: _____