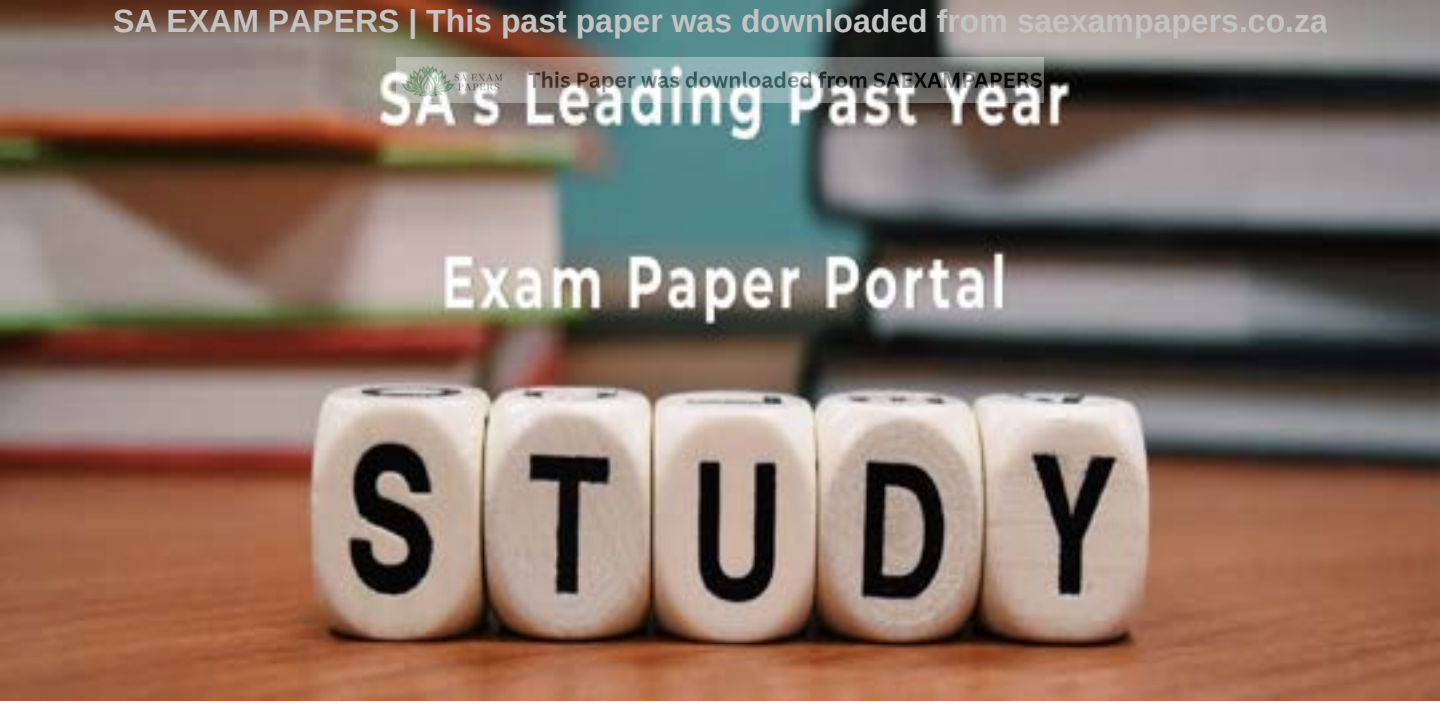


LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS

TEST NO 1

18 MARCH 2025

MARKS: 100

TIME: 2 Hours

This question paper consists of 6 pages, diagram sheet and information sheet.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of SEVEN questions.
2. Read the questions carefully.
3. Answer ALL the questions.
4. A DIAGRAM SHEET is attached at the back of this question paper. Use it to answer QUESTION 4.3 and QUESTION 6.3.
5. Number your answers exactly as the questions are numbered.
6. Clearly show ALL calculations, diagrams and graphs, etc. which you have used in determining your answers.
7. ANSWERS ONLY will not necessarily be awarded full marks.
8. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
9. If necessary, answers should be rounded off to TWO decimal places, unless stated otherwise.
10. Diagrams are NOT necessarily drawn to scale
11. Write neatly and legibly.

QUESTION 1

1.1 Solve for x:

1.1.1 $(x+3)(2-x)=0$ (2)

1.1.2 $x^2-2x-15\geq 0$ (3)

1.2 Given: $\frac{x+3}{\sqrt{x+5}}=1\ ;\ x\in\mathbb{R}$

1.2.1 For which value(s) of x will $\frac{x+3}{\sqrt{x+5}}$ be undefined? (2)

1.2.2 Solve for x. (4)

[11]

QUESTION 2

2.1 Given the following geometric series: $\frac{24}{x}+12+6x+3x^2+\ldots$

2.1.1 Determine the value of r, the common ratio, in terms of x. (1)

2.1.2 If $x=4$, determine the sum of the series to 10 terms. (3)

2.2 The sum of the first n terms of an arithmetic series is given by $S_n=-n^2+8n$

2.2.1 Calculate the sum of the first 15 terms. (2)

2.2.2 Calculate the value of T_{15}. (2)

2.2.3 If the first term of the series is 7, which term of the series will have a value of -169? (4)

[12]

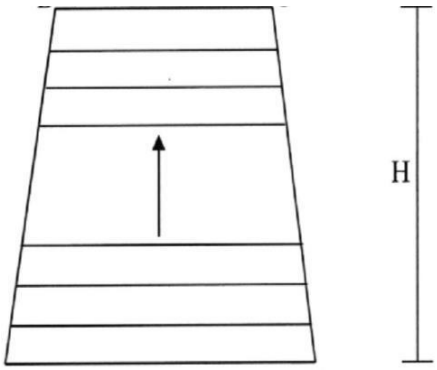
QUESTION 3

3.1 Given that: $k = \sum_{n=1}^{\infty} (x-1)^n$

3.1.1 Determine the values x for which k converges. (2)

3.1.2 Calculate the value of k when $x = \frac{2}{3}$. (4)

3.2 An air-traffic control tower with 11 horizontal supports is constructed at an airport. The front view of the tower is shown in the diagram below. The length of the bottom horizontal support is 70 cm long and is secured to the ground. Each additional support is shorter than the one below it. The length of each horizontal support decreases with constant difference from each other. If the top horizontal support is 50 cm, which horizontal support has a length of 58 cm? (5)



[11]

QUESTION 4

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

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

4.2 Calculate the intercepts with the axes. (3)

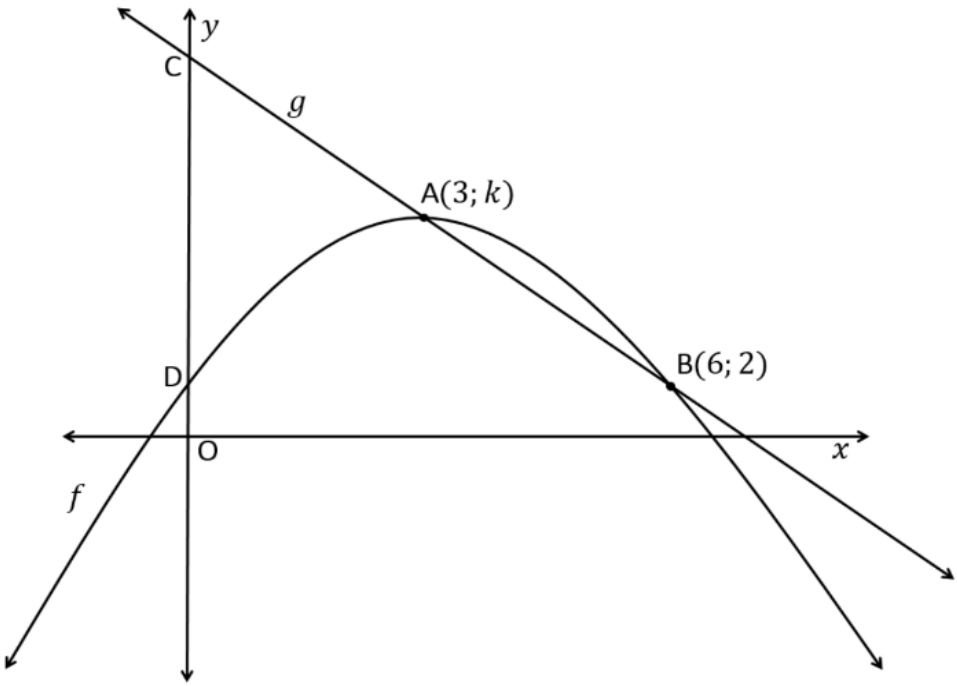
4.3 On the diagram sheet provided, draw a graph of f, showing all asymptotes and intercepts with the axes. (3)

4.4 Determine the equation of the axis of symmetry of f with a negative gradient. (2)

[10]

QUESTION 5

Sketched below are the graphs of $f(x)=ax^2+bx+c$ and $g(x)=-3x+20$.
Graph f has a turning point at $A(3;k)$. Graph f and g intersect at A and $B(6;2)$.



5.1 Calculate the numerical value of k, the y-coordinate of A. (2)

5.2 Determine the range of $y=-f(x)$. (2)

5.3 Calculate the numerical values of a, b, and c. (6)

5.4 Determine the value(s) of x for which $f(x)>g(x)$. (2)

[12]

QUESTION 6

Given: $h(x)=a^x; a>0$ and $a\neq 0$. B$\left(-1\ ;\ \frac{1}{2}\right)$ is a point that lies on h, the graph of $h(x)$.

$(4;-2)$ is a point on the graph.

6.1 Determine the value of a. (2)

6.2 Write down the equation of h^{-1} in the form $y=....$ (2)

6.3 Sketch the graphs of h and h^{-1} on the same set of axes. Clearly show all intercepts with the axes. (4)

6.4 Write down the domain of h^{-1}. (1)

6.5 Determine the value(s) of for which $h^{-1}(x)>1$. (1)

6.6 If it is given that $t(x)=\left(\frac{1}{2}\right)^x-1$.

6.6.1 Describe the transformation from h to t. (2)

6.6.2 Determine the equation of the asymptote of t. (1)

[13]

QUESTION 7

7.1 If $\sin 35^\circ = k$, determine the following in terms of k:

7.1.1 $\cos 55^\circ$ (3)

7.1.2 $\sin 70^\circ$ (3)

7.1.3 $\cos 80^\circ$ (3)

7.2 If $\sin x-\cos x=\frac{3}{4}$, calculate the value of $\sin 2x$ WITHOUT using a calculator. (5)

7.3 Simplify to a single trigonometric ratio:

$$\frac{\tan(180^\circ+x).\cos(360^\circ-x)}{\sin(x-180^\circ)\cos(90^\circ+x)\ +\cos(720^\circ+x).\cos(-x)} \quad (6)$$

7.4 Prove the identity:

$$\frac{\cos 2x+\cos^2 x+3\sin^2 x}{2-2\sin^2 x}=\frac{1}{\cos^2 x} \quad (4)$$

7.5 Determine the general solution of $2\sin x\cos x-\cos^2 x=0$ (7)

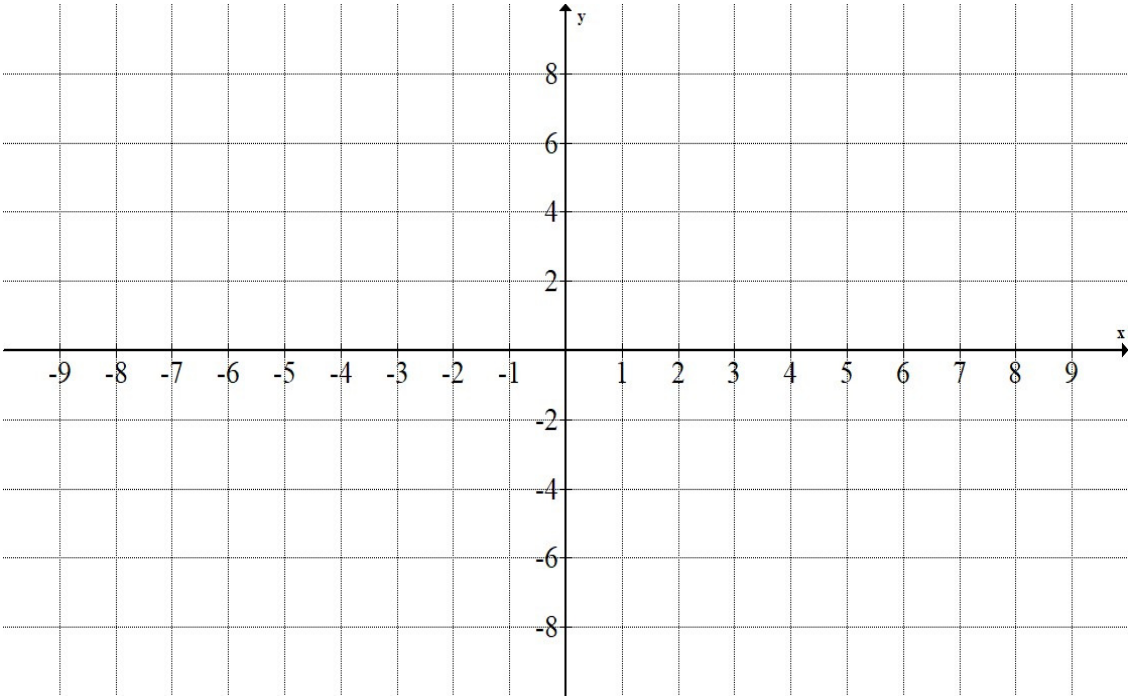
[31]

TOTAL:100

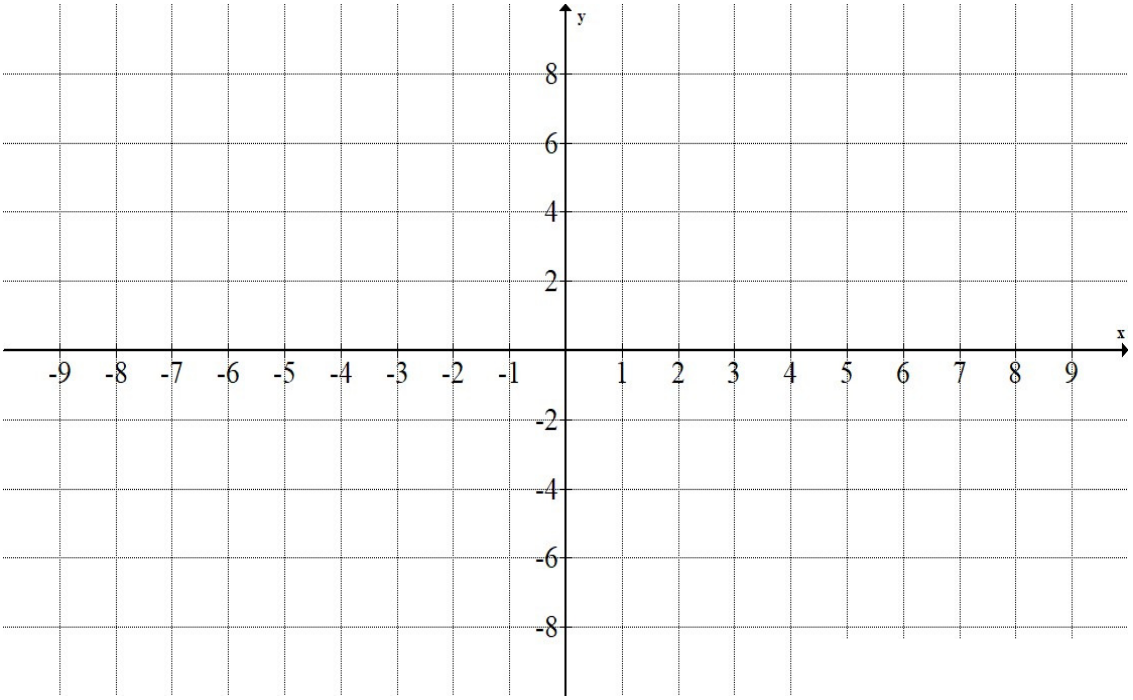
DIAGRAM SHEET

NAME OF LEARNER: …….. **CLASS**: ……

4.3



6.3



INFORMATION SHEET: MATHEMATICS

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

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

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

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

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

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

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

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

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

In ΔABC:

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

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

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

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

$$\bar{x} = \frac{\sum x}{n} \qquad \partial^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n} \qquad P(A) = \frac{n(A)}{n(S)} \quad P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

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