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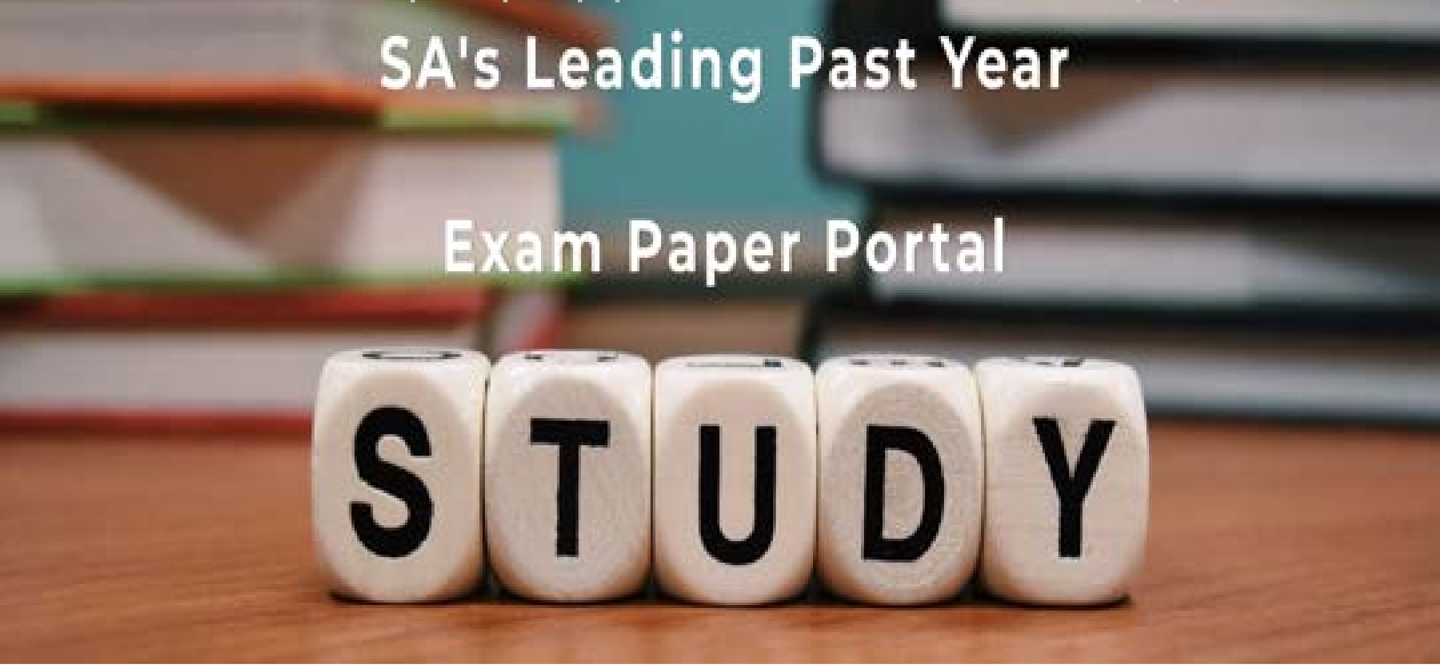

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DISTRICT PAPER

GRADE 12

END OF TERM 1 TEST 2024

NATIONAL SENIOR CERTIFICATE

JOHANNESBURG NORTH [D10]

MATHEMATICS

MARKS: 100

TIME: 2 hours

EXAMINER: MR S NDLOVU
MODERATOR: MS B RANTAO

This question paper consists of 7 printed pages including the cover page.

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INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 6 questions. **Answer ALL** the questions.
2. Clearly show **ALL** calculations, diagrams, graphs, et cetera that you have used in determining your answers.
3. Answers only will not necessarily be awarded full marks.
4. You may use an approved scientific calculator (non-programmable and non- graphical), unless stated otherwise.
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. Write neatly and legibly.

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QUESTION 1

1.1 Solve for x, in each of the following:

1.1.1 $(x-2)(x+9)=0$ (2)

1.1.2 $5x^2-2=6x$ (correct to TWO decimal places) (5)

1.1.3 $2x^2-5x-3\geq 0$ (4)

1.2 Solve simultaneously for x and y in the following equations:

$2y+x-3=0$ and $x^2-3xy+5y^2=3$ (6)

[17]

QUESTION 2

2.1 Given that $S_n=n^2+2n$

2.1.1 Determine S_{100} (2)

2.1.2 Determine the first three terms of the original pattern. (3)

2.2 Calculate the value of n if it is given that:

$$\sum_{k=2}^{n}(5-2k)=-\frac{800n}{17}$$ (6)

[11]

QUESTION 3

3.1 Prove that for any Geometric Sequence the sum is given by

$S_n=\frac{a(1-r^n)}{1-r}$, $r\neq 1$, if the first term is a and the constant ratio is r. (4)

3.2 Given the geometric series: $8(x-2)+4(x-2)^2+2(x-2)^3+\cdots$

3.2.1 Determine the values of x for which the series will converge. (3)

3.2.2 If $x=3.5$, determine the sum to infinity of the series. (4)

[11]

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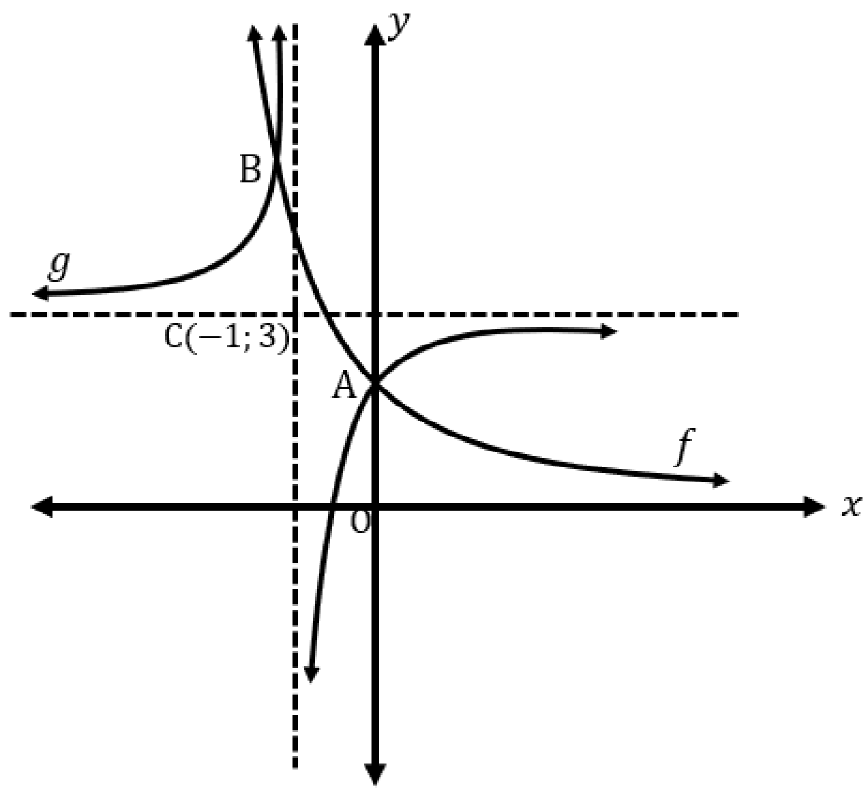
QUESTION 4

In the diagram below, the graphs of $f(x) = \left(\frac{1}{5}\right)^x$ and $g(x) = \frac{a}{x+p} + q$ are sketched.

The two graphs intersect at points A and B as shown on the sketch. The point A is a point where both graphs cross the y-axis. The asymptotes of graph g meet at point $C(-1; 3)$.



4.1 Determine the coordinates of A. (1)

4.2 Determine the equation of g by finding the values of a; p and q. (4)

4.3 Determine the $f^{-1}(x)$ and write it in the form $y = \cdots$ (3)

4.4 Sketch the graph of $f^{-1}(x)$ and clearly show any two points on the graph. (3)

4.5 Determine the values of x for which $f^{-1}(x) \geq -2$ (2)

4.6 Graph $h(x)$ is produced by shifting graph g 1 unit to the right and 2 units vertically downwards. Write down the equation of graph h. (2)

[15]

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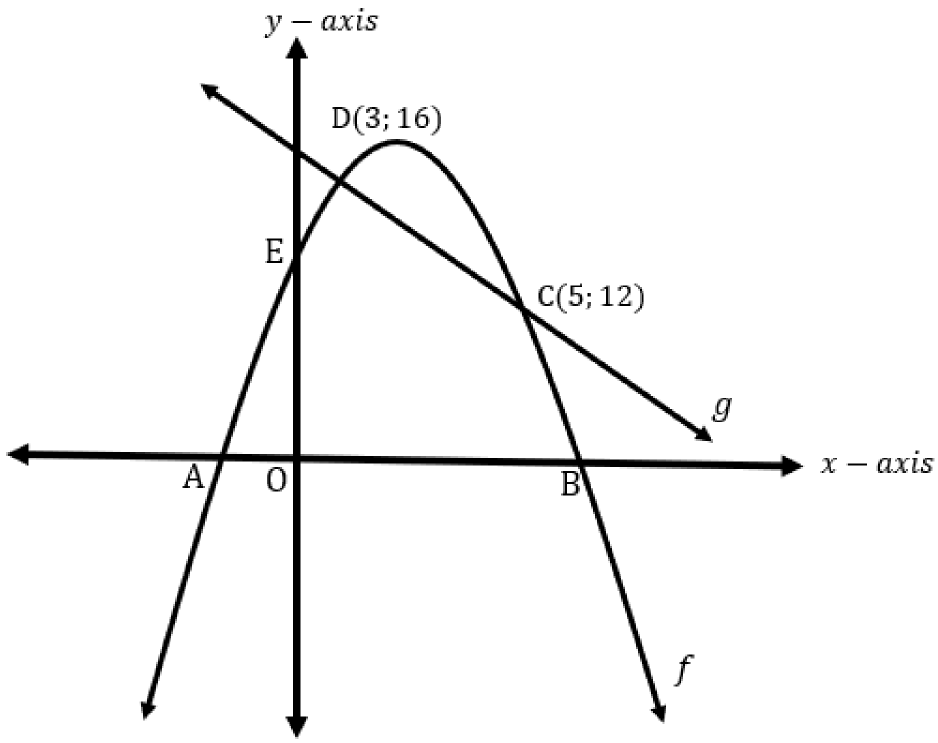
QUESTION 5

The functions $f(x) = a(x-p)^2 + q$ and $g(x) = -\frac{1}{5}x + c$ are drawn below, with f passing through A, B, C, D and E. A and B are the x-intercepts of f. $D(3;16)$ is the turning point of graph f. $C(5;12)$ is the point of intersection of graphs f and g.



5.1	Determine the value of c in graph g.	(2)
5.2	Determine the equation of graph f by finding the values of a, p and q.	(3)
5.3	Determine the equation of $k(x)$, a line perpendicular to graph g and passing through point E.	(3)
5.4	Determine the values of x for which $f(x) \geq k(x)$	(3)
5.5	It is further given that graph $h(x) = 2^{-f(x)}$, determine the minimum value of the graph h.	(2)
5.6	Determine the average gradient of graph f between $x = -3$ and $x = 1$	(4)

[17]

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QUESTION 6

6.1 Given: $\cos 17° = \frac{k}{5}$

Without using a calculator, determine in terms of k, each of the following.

6.1.1 $\sin 17°$ (3)

6.1.2 $\tan 253°$ (3)

6.1.3 $\sin 124°$ (4)

6.2 Given: $\sin(\alpha - \beta) = \sin\alpha\cos\beta - \cos\alpha\sin\beta$.

Use the above identity to deduce that $\cos(\alpha - \beta) = \cos\alpha\cos\beta + \sin\alpha\sin\beta$. (3)

6.3.1 Simplify the following expression.

$\cos(60° + x) + \sin(30° - x)$ (3)

6.3.2 Hence, or otherwise, determine **without the use of a calculator**, the value of:

$\cos(60° + x) + \sin(30° - x)$ if $x = 45°$ (2)

6.4 Prove that:

$$\frac{1 - \cos 2\theta + \sin 2\theta}{1 + \cos 2\theta + \sin 2\theta} = \tan\theta$$ (5)

6.5 Determine the general solution of the equation:

$\cos 2x + 5\sin x = -2$ (6)

[29]

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INFORMATION SHEET: MATHEMATICS

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

$A = P(1 + in)$

$A = P(1 - in)$

$A = P(1 + i)^n$

$A = P(1 - i)^n$

$\sum_{i=1}^{n} 1 = n$

$\sum_{i=1}^{n} i = \frac{n(n+1)}{2}$

$T_n = a + (n-1)d$

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

$T_n = ar^{n-1}$

$S_n = \frac{a(1-r^n)}{1-r}$; $r \neq 1$

$S_\infty = \frac{a}{1-r}$; $r \neq 1$

$F_v = \frac{x[(1+i)^n - 1]}{i}$

$P_V = \frac{x[1 - (1+i)^{-n}]}{i}$

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

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$M\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$

$y = mx + c$

$y - y_1 = m(x - x_1)$

$m = \frac{y_2 - y_1}{x_2 - x_1}$

$m = \tan\theta$

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

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

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

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

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

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

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

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

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

$\sin 2\alpha = 2\sin\alpha.\cos\alpha$

$\bar{x} = \frac{\sum x}{n}$

$\sigma^2 = \frac{\sum_i^n (xi - \bar{x})^2}{n}$

$P(A) = \frac{n(A)}{n((S)}$

$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

$\hat{y} = a + bx$

$b = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sum(x - \bar{x})^2}$

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