GAUTENG DEPARTMENT OF EDUCATION

SENIOR CERTIFICATE EXAMINATION

FUNCTIONAL MATHEMATICS SG
(First Paper: Algebra)

TIME: 3 hours

MARKS: 150

INSTRUCTIONS:

- Answer ALL questions.
- Show all relevant calculations.
- Pocket calculators may be used, unless otherwise stated.
- Round off final answers to TWO decimal digits, unless otherwise stated.
- Consult the information sheet on page 7 of the question paper.
- Use the graph paper on page 8 to answer Question 3.2

QUESTION 1

1.1   Simplify, without using a calculator.

1.1.1 $\dfrac{2^{x+1} \cdot 8^{x-2}}{16^{x-2}}$

(6)

1.1.2 $8^{\frac{1}{3}} + 5^0 - 64^{\frac{2}{3}}$

(5)

1.1.3 $\dfrac{3^{x+4} - 6 \cdot 3^{x+1}}{3^x \cdot 7}$

(5)

1.1.4 $\dfrac{2\sqrt{12} + \sqrt{75}}{3\sqrt{3}}$

(5)

1.2   Solve for x, without using a calculator.

1.2.1 $x^{\frac{3}{4}} = 8$

(3)

1.2.2 $3^{2x+1} = 27$

(3)

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QUESTION 2

2.1   Simplify, without using a calculator.

   2.1.1 $\log 75 + 3\log 2 - \log 6$ (5)

   2.1.2 $\log_3 81 - \log_6 1 + \log_{25} 5$ (6)

2.2   Solve for x, without using a calculator.

   2.2.1 $\log_6 2x = 1$ (2)

   2.2.2 $\log x = \dfrac{\log 64}{\log 8}$ (4)

2.3   Solve for x, rounded off to 2 decimal digits.

   $25^x = 50$ (3)

2.4   If $\log 3 = a$ and $\log 5 = b$, express **log 75** in terms of a and b.   (3)

          [23]

QUESTION 3

3.1   Complete the following table in your answer book.

x	-1	0	1	2	3
$y = 2^x$					
$y = 3.2^x$					

          (2)

3.2   Use the graph paper provided on page 8 and draw the graphs of $f(x) = 2^x$ and $g(x) = 3.2^x$ on one set of axes.   (4)

3.3   Make use of symmetry and draw on the same set of axes the graphs of $h(x) = (½)^x$ and $k(x) = \log_2 x$.   (4)

3.4   Determine graphically the value of the following. Show clearly on the graph where the readings are made. (Use A, B and C.)

   3.4.1 $2^x = 7$ (2)

   3.4.2 $3.2^{½} = y$ (2)

   3.4.3 $\log_2 x = 0$ (2)

3.5   Determine the y-intercept of $3.2^x = y$ (1)

          [17]

QUESTION 4

Use the relevant formulae to answer the following questions.

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

4.1   Given the sequence 2; 5; 8; .... Calculate

    4.1.1   the 50th term of the sequence.   (3)

    4.1.2   the sum of the first fifty terms of the sequence.   (5)

4.2   The first term of an arithmetic sequence is -3 and the third term is equal to 3.
Determine

    4.2.1   the constant difference.   (4)

    4.2.2   the 25th term.   (3)

    4.2.3   which term is equal to 57.   (4)

4.3   The general term of an arithmetic sequence is $T_n = -3n + 2.$
Determine the first 3 terms of the sequence.   (3)

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QUESTION 5

Use the relevant formulae to answer the following questions.

$$T_n = ar^{n-1} \qquad S_n = \frac{a(r^n - 1)}{r - 1}$$

5.1   The 8th term of a geometric sequence is 640 and the third term is 20.
Calculate

    5.1.1   the common ratio.   (5)

    5.1.2   the first term.   (2)

5.2   Given the geometric series 1 + 3 + 9 + ... Determine

    5.2.1   the 8th term.   (3)

    5.2.2   the sum of the first eight terms of the series.   (4)

5.3   The first three terms of a geometric sequence are x; x + 1; x + 3.

    5.3.1   Determine the value of x.   (5)

    5.3.2   Determine the first three terms of the sequence.   (2)

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QUESTION 6

6.1 **Given: $f(x) = 3x^2$**

    6.1.1   Determine the average gradient of the curve of f between the points $x = 1$ and $x = 4$. (4)

    6.1.2   (a)   Determine $f(x + h)$. (2)

                   (b)   Hence, determine the derivative $f'(x)$ from first principles. (4)

6.2 Use the rules with regard to derivatives and determine $f'(x)$ if:

    6.2.1 $f(x) = 3$ (1)

    6.2.2 $f(x) = 3x^6 - 2x$ (2)

    6.2.3 $f(x) = (x + 1)(3x - 2)$ (4)

6.3 **Given: $f(x) = 2x^2 - 4x$**

    Determine

    6.3.1 $f(2)$ (2)
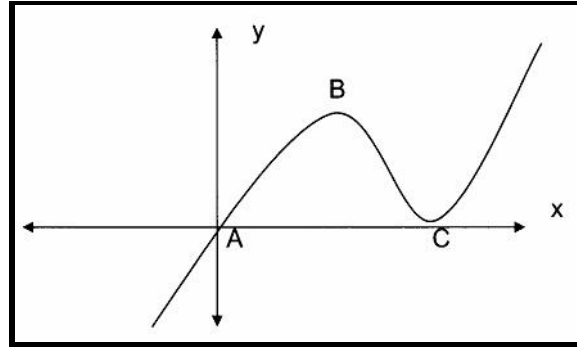
    6.3.2 $f'(x)$ (2)

    6.3.3 $f'(2)$ (2)

    6.3.4   the equation of the tangent to the curve of f at the point $x = 2$, by making use of the equation $y - y_1 = m(x - x_1)$ or $y = mx + c$. (4)

6.4 Determine $\lim\limits_{x \to 3} \dfrac{x^2 - 9}{x - 3}$ (3)

[30]

QUESTION 7

7.1   The diagram below shows the graph of $f(x) = x^3 - 6x^2 + 9x$.

7.1.1   Write down the coordinates of A.   (1)

7.1.2   Calculate the coordinates of B and C, the turning points of the curve
         of $f(x)$, if $f'(x) = 0$.   (9)
                                                                                    [10]

                                                                    TOTAL: 150

INFORMATION SHEET / *INLIGTINGSBLAD*

Logarithms/Logaritmes

$$\log_a PQ = \log_a P + \log_a Q$$

$$\log_a {}^P/_Q = \log_a P - \log_a Q$$

$$\log_a P^n = n \log_a P$$

$$\log_Q P = \frac{\log_b P}{\log_b Q}$$

Sequences and Series/Rye en Reekse

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

$$S_n = {}^n/_2[2a + (n-1)d]$$

$$T_n = ar^{n-1}$$

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

Calculus/Differensiaalrekene

$$D_x[x^n] = nx^{n-1}$$

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

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

EXAMINATION NUMBER:
***EKSAMENNOMMER*:**

INSTRUCTIONS/*INSTRUKSIES*:

- **Use this graph paper to answer Question 3.2, then place it at the back of your answer book.**
- ***Gebruik hierdie grafiekpapier om Vraag 3.2 te beantwoord en plaas dit dan agter in jou antwoordboek.***

END/*EINDE*