**GAUTENG DEPARTMENT OF EDUCATION**

**SENIOR CERTIFICATE EXAMINATION**

**FUNCTIONAL MATHEMATICS SG**
**(First Paper: Algebra)**

**FEB / MAR 2006**

**TIME: 3 hours**

**MARKS: 150**

**INSTRUCTIONS**:

- Answer ALL questions.
- All relevant calculations must be shown.
- Pocket calculators may be used, unless otherwise stated.
- Final answers must be rounded off to TWO decimal digits, unless otherwise stated.
- Consult the information sheet at the back of the question paper.
- One sheet of graph paper is provided at the end of the question paper. Use it for Question 3.

## QUESTION 1

1.1 Simplify, without using a calculator.

1.1.1 $(27)^{\frac{2}{3}} + 16$ (3)

1.1.2 $4\sqrt{8} + 3\sqrt{18} - \sqrt{50}$ (6)

1.1.3 $\dfrac{32^{x}.16^{1-x}}{2^{x-1}}$ (5)

1.1.4 $\dfrac{5^{x+2} - 5^{x}}{5^{x-1}}$ (4)

1.2 Solve for $x$, without using a calculator.

1.2.1 $2^{x} = 0,25$ (3)

1.2.2 $16^{2x-1} = 8^{3x-6}$ (6)

**[27]**

## QUESTION 2

2.1 Solve for $x$, without using a calculator.

2.1.1 $\log 5x = 3$ (3)

2.1.2 $\log_2(x-1) = 3$ (3)

2.2 Use a calculator and solve for $x$. Round the answer off to 2 decimal digits.

$3^x = 18$ (3)

2.3 Simplify, without using a calculator.

2.3.1 $\log_3 ?$ (2)

2.3.2 $\log 8 + \log 20 - \log 16$ (4)

2.3.3 $3\log_4 2 - 2\log_2 4 + \log 10$ (6)

2.4 If log 2 = a and log 3 = b express **log 18** in terms of a and b. (3)

**[24]**

## QUESTION 3

3.1 Draw on the same set of axes graphs of $f(x) = 3^x$, $g(x) = (\frac{1}{3})^x$ and $h(x) = 2.3^x$ by first completing the following table:

| $x$ | -1 | 0 | 1 | 2 | 3 |
|---|---|---|---|---|---|
| $3^x$ | | | | | |
| $1^x$ <br> $3$ | | | | | |
| $2.3^x$ | | | | | |

(12)

3.2 Draw on the same set of axes the graph of $k(x) = \log_3 x$ making use of symmetry. (2)

3.3 Use the graphs and read off the values of the following. Indicate clearly on the graph where the readings were made (use A, B and C):

3.3.1 $3^x = 7$ $x = ?$ (2)

3.3.2 $2.3^x = 5$ $x = ?$ (2)

3.3.3 $3^x = (?)^x$ $x = ?$ (2)

**[20]**

## QUESTION 4

**USE ONLY THE FOLLOWING FORMULAE TO ANSWER THE FOLLOWING QUESTION.**

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

4.1 In the sequence 3; 6; 9; …..

4.1.1 Determine the twelfth term. (3)

4.1.2 Determine the sum of the first 21 terms of the sequence. (3)

4.2 In the sequence 600; 550; 500; ….. Which term will be equal to 0? (4)

4.3 $16-4x; 2x-6; 4x-8$ are the first 3 terms of an arithmetic sequence.

4.3.1 Show by calculation that the value of $x = 5$. (5)

4.3.2 Determine the sequence. (3)

4.4 If the third term of an arithmetic sequence is 11 and the seventeenth term is 39, determine the twelfth term of the sequence. (6)

**[24]**

## QUESTION 5

**USE ONLY THE FOLLOWING FORMULAE TO ANSWER THE FOLLOWING QUESTION.**

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

5.1 In the sequence $\frac{1}{9}; \frac{1}{3}; 1; \ldots$

5.1.1 Determine the tenth term. (4)

5.1.2 Determine the sum of the first 8 terms of the sequence. (3)

5.2 In the sequence 16; 8; 4 ….. Which term will be equal to $\frac{1}{16}$? (6)

5.3 Determine the first 3 terms of a geometric sequence of which the seventh term is 192 and the fourth term is -24. (7)

**[20]**

## QUESTION 6

6.1 Determine $\lim\limits_{x \to 2} \dfrac{x^2-2x-8}{x+2}$ (3)

6.2 If $f(x) = 3x + 8$, determine

6.2.1 $f(x+h)$. (2)

6.2.2 the derivative $f'(x)$ of $f(x)$ making use of first principles. (4)

6.3 Determine the derivative of

6.3.1 $D_x[6x^4 - 2x + 5]$ (3)

6.3.2 $D_x[2x^3(5x - 1)]$ (4)

6.4 A projectile is shot diagonally upwards. The vertical height above the ground, y metres, is given by the formula $y = 800t - 16t^2$ where $t$ is the time in seconds.

6.4.1 Determine the height of the projectile after 5 seconds. (2)

6.4.2 Determine the derivative $\frac{dy}{dt}$. (2)

6.4.3 Determine after how many seconds the projectile will reach a maximum height if $\frac{dy}{dt} = 0$. (3)

6.4.4 Determine the maximum height of the projectile after 25 seconds. (2)

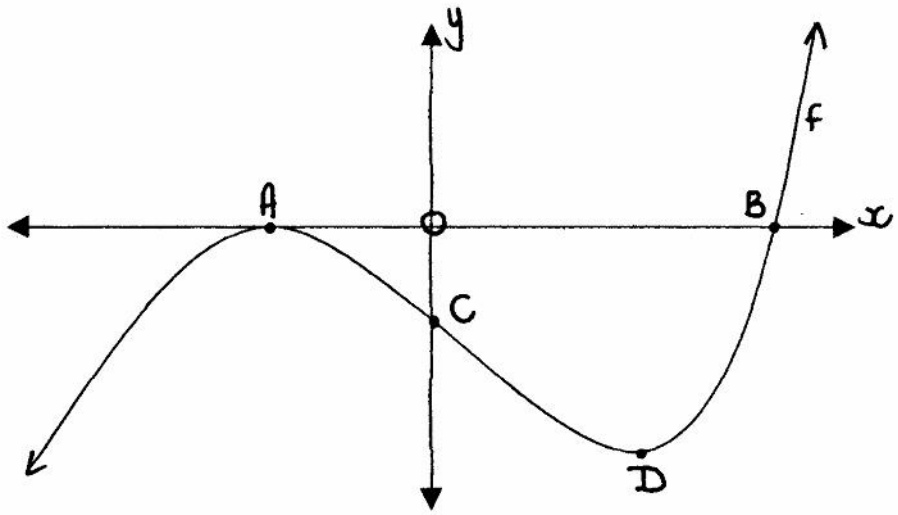
**[25]**

## QUESTION 7

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

$= (x+1)^2(x-2)$

$f$ is illustrated graphically as follows:



7.1 Write down the coordinates of A and B. (2)

7.2 Write down the coordinates of C. (1)

7.3 Determine $f'(x)$. (2)

7.4 If $f'(x) = 0$ determine the coordinates of D, the turning point. (5)

**[10]**

**TOTAL: 150**