SENIOR CERTIFICATE EXAMINATION
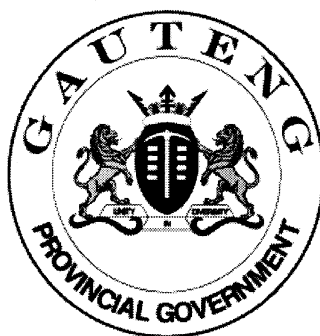
FEBRUARY / MARCH

2007

FUNCTIONAL MATHEMATICS

SG

First Paper : Algebra

FUNCTIONAL MATHEMATICS SG: Paper 1

303-2/1 E

303 2 1E   SG

8 pages

X05

GAUTENG DEPARTMENT OF EDUCATION

SENIOR CERTIFICATE EXAMINATION

FUNCTIONAL MATHEMATICS SG
(First Paper: Algebra)

TIME: 3 hours

MARKS: 150

INSTRUCTIONS:

- Answer ALL the 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 6.2.

QUESTION 1

Use the relevant formulae to answer the following questions.

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

1.1 The second term of an arithmetic series is 43 and the sixth term is 19. Determine

     1.1.1   the constant difference.   (4)

     1.1.2   the first term.   (2)

     1.1.3   the sum of the first ten terms of the series if the constant difference and the first term are respectively -6 and 49.   (5)

1.2 The nth term (T_n) of an arithmetic sequence is 4n + 3. Determine

     1.2.1   the first three terms of the sequence.   (3)

     1.2.2   the constant difference.   (1)

1.3 In the arithmetic sequence -7; -1; 5; ....., determine which term is equal to 425.   (6)

                                                      [21]

QUESTION 2

Use the relevant formulae to answer the following questions.

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

2.1 Consider the geometric sequence 3; 6; 12; .....; 192. Which term is equal to 192? (6)

2.2 The second term of a geometric sequence is 5. The seventh term is 160. Determine the common ratio. (5)

2.3 In a geometric sequence the first three terms are $m - 4$; $m - 3$; $m - 1$.

    2.3.1 Show that $m = 5$. (5)

    2.3.2 Determine the first three terms of the sequence. (3)

[19]

QUESTION 3

3.1 Solve for x, without using a calculator.

    3.1.1 $\log_x 625 = 4$ (3)

    3.1.2 $\log_x 108 - \log_x 4 = 3$ (4)

3.2 Use a calculator and solve for x, rounded off to two decimal digits where necessary.

    3.2.1 $2.7^x = 98$ (3)

    3.2.2 $6^{x+1} = 56$ (4)

3.3 Simplify, without using a calculator.

    3.3.1 $3 \log_6 3 + \log_6 80 - \log_6 10$ (6)

    3.3.2 $\frac{1}{2} \log_5 625 - \log_9 1 + \log_4 32$ (9)

3.4 If $\log 2 = y$, express **log 2 000** in terms of y. (3)

[32]

QUESTION 4

4.1   Simplify, without using a calculator.

4.1.1 $(81)^{\frac{3}{4}} + (\frac{1}{9})^{-2} + 27^0$ (5)

4.1.2 $\dfrac{\sqrt{48} + \sqrt{12}}{\sqrt{12}}$ (4)

4.1.3 $\dfrac{2^{n+2} - 5.2^{n+1}}{2^{n+1}}$ (4)

4.1.4 $\dfrac{2^{n+2} . 5.2^{n+1}}{4^{n+1}}$ (4)
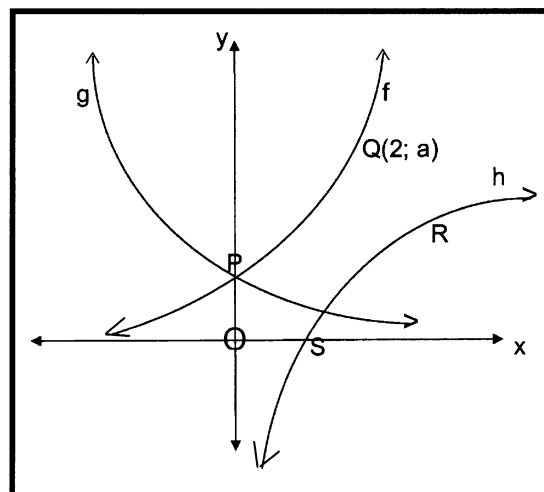
4.2   Solve for x, without using a calculator.

4.2.1 $5x^{\frac{1}{2}} = 45$ (3)

4.2.2 $27^{x+3} = 9^{2-2x}$ (4)

                                                                                        [24]

QUESTION 5

In the diagram above, the functions of $f(x) = 2^x$, $g(x)$ and $h(x)$ are presented.

5.1   Write down the coordinates of P.   (1)

5.2   Q(2 ; a) is a point on $f(x) = 2^x$. Determine the value of a.   (2)

5.3   If f and g are symmetrical around the y-axis, write down the equation of g.   (1)

                                                                                        P.T.O.

5.4   If f and h are symmetrical to the line y = x, write down the equation of h.   (1)

5.5   If a = 4, write down the coordinates of R.   (2)

5.6   Write down the coordinates of S.   (1)

5.7   For which value(s) of x is g(x) = f(x)?   (1)
          [9]

QUESTION 6

The area of an oil slick on water is increasing at a rate given by the formula A = $3(2,5)^t$.
A is the area in square metres and t is the time in hours.

6.1   Complete the following table in your answer book.

T(h)	0	1	2	3	5
A(m^2)					

(2)

6.2   Use the graph paper provided on page 8 to draw the graph of A by using the
information calculated in the table.   (4)
          [6]

QUESTION 7

7.1   An object travels s(t) metres in t seconds where s(t) = $2t^2$ + 5t + 1.

          7.1.1   Determine the distance the object travelled after 2 seconds.   (2)

          7.1.2   Determine s'(t).   (2)

          7.1.3   Determine the speed, s'(t), of the object after 2 seconds.   (2)

7.2   Determine $\displaystyle \lim_{x \to -3} \frac{x^2 - 9}{x + 3}$ (3)

7.3   If f(x) = 2x – 4, find f'(x) from first principles.   (5)

7.4   Determine f'(x) if

          7.4.1   f(x) = 7   (1)

          7.4.2   f(x) = $3x^3 - 2x^2 + 4x$ (3)

          7.4.3   f(x) = -2x(x + 1)   (4)
          [22]

QUESTION 8

Consider the expression $\quad f(x) = x^3 - 3x - 2$
$$= (x - 2)(x + 1)^2$$

8.1   Determine the coordinates of the x-intercepts.   (3)

8.2   Find the coordinates of y-intercept.   (2)

8.3   Determine f'(x).   (2)

8.4   Determine the coordinates of the turning points if f'(x) = 0.   (6)

8.5   Draw the graph of f(x).   (4)

[17]

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:*

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

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

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

EXAMINATION NUMBER:
EXAMENNOMMER:

INSTRUCTIONS/*INSTRUKSIES*:

- Use this graph paper to answer Question 6.2, then place it at the back of your answer book.
- *Gebruik hierdie grafiekpapier om Vraag 6.2 te beantwoord en plaas dit dan agter in jou antwoordboek.*

END/*EINDE*