DEPARTMENT OF EDUCATION
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE EXAMINATION - 2005

MATHEMATICS P1

STANDARD GRADE

FEBRUARY/MARCH 2005

Marks: 150

3 Hours

This question paper consists of 8 pages and 1 information sheet.

INSTRUCTIONS

Read the following instructions carefully before answering the questions.

1. This paper consists of **EIGHT** questions. Answer **ALL** the questions.

2. Clearly show **ALL** calculations, diagrams, graphs, et cetera you have used in determining the answers.

3. An approved calculator (non-programmable and non-graphical) may be used, unless stated otherwise.

4. If necessary, answers should be rounded off to **TWO** decimal places, unless stated otherwise.

5. Graph paper is **NOT** required in this question paper.

6. Number the answers **EXACTLY** as the questions are numbered.

7. Diagrams are not necessarily drawn to scale.

8. It is in your own interest to write legibly and to present the work neatly.

9. **An information sheet with formulae is included at the end of this question paper.**

QUESTION 1

1.1 Given: $f(x) = x(x+2) - 4$

Determine:

1.1.1 $f(-1)$ (2)

1.1.2 x if $f(x) = 0$ (Give your answer correct to **TWO** decimal places.) (7)

1.2 For which values of p will the following equation have non-real roots:

$3x^2 + 2x + 2 + p = 0$ (7)

1.3 Senami calculated the discriminant of a quadratic equation and determined the following:

$\Delta = (2k-9)(2k-1)$

Describe the nature of the roots of the equation if $k = 6$. (3)

1.4 Solve for x and y if they satisfy the following equations simultaneously:

$y + 7 = 2x$
$x^2 + xy + y^2 = 21$ (8)

[27]

QUESTION 2

2.1 If $f(x) = ax^3 - 5x^2 - 2x + 5$ is divided by $(x - 2)$, the remainder is -3.
Find the value of a. (5)

2.2 Solve the following equation:

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

[11]

QUESTION 3

3.1 Given: $f(x) = -x^2 + 4x - 3$

3.1.1 Calculate the x- and y-intercepts of the graph of f. (4)

3.1.2 Calculate the co-ordinates of the turning point of f. (5)

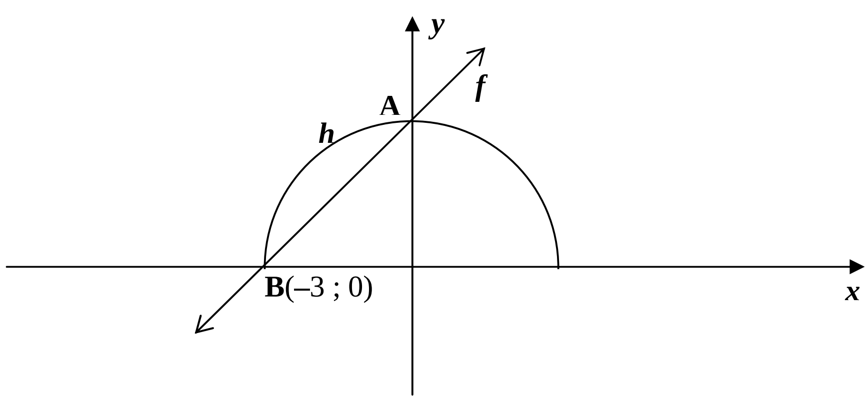
3.1.3 What is the largest possible value of $-x^2 + 4x - 3$? (1)

3.1.4 Make a neat sketch graph of f. Indicate the co-ordinates of the intercepts on the axes and of the turning point of the graph. (5)

3.1.5 On the same system of axes, **draw a straight line** which will help you to solve the equation $-x^2 + 4x - 3 = -1$. (2)

3.1.6 Use the graph to determine the values of x for which $-x^2 + 4x - 3 \geq 0$. (2)

3.2 The graphs of a straight line f and the semi-circle h are sketched below. A and B(–3 ; 0) are intercepts of the graphs on the co-ordinate axes. (2)



3.2.1 Determine the equation of h. (2)

3.2.2 Determine the equation of f. (2)

[25]

QUESTION 4

4.1 **Without using a calculator**, calculate the value of each of the following in its simplest form:

4.1.1 $(3^{-1}+2^{-1})^{-1}$ (3)

4.1.2 $\dfrac{9^{n-1}\,.\,27^{3-2n}}{81^{2-n}}$ (6)

4.1.3 $2\log 2+\log 25$ (3)

4.1.4 $\dfrac{\sqrt{98}-\sqrt{8}}{\sqrt{50}}$ (4)

4.2 Solve for *x*, **without using a calculator:**

4.2.1 $2x^{\frac{3}{4}}=16$ (4)

4.2.2 $3^{x}-3^{x-2}=24$ (6)

4.2.3 $\log x=\dfrac{\log 625}{\log 25}$ (4)

[30]

QUESTION 5

5.1 The following arithmetic sequence is given: $-1;\ 6;\ 13;\ \ldots$

Determine:

5.1.1 The 49^{th} term (3)

5.1.2 The sum of the first 87 terms (3)

5.2 $20\ ;\ 16\ ;\ \ldots$ is a geometric sequence.

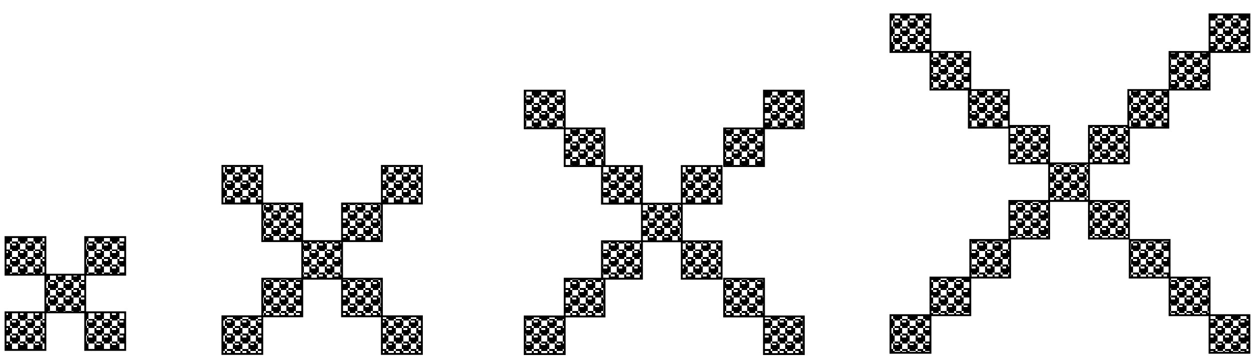
Calculate the sum of the first ten terms. (4)

5.3 The following are three consecutive terms of a geometric sequence:

$3x - 2\ ;\ 2x + 2\ ;\ 4x + 1$ (x is a natural number)

Calculate the value of x. (6)

5.4 Tiles are arranged as shown below. The first arrangement has 5 tiles, the second arrangement has 9 tiles, the third arrangement has 13 tiles and the fourth arrangement has 17 tiles. The arrangements continue in this pattern.

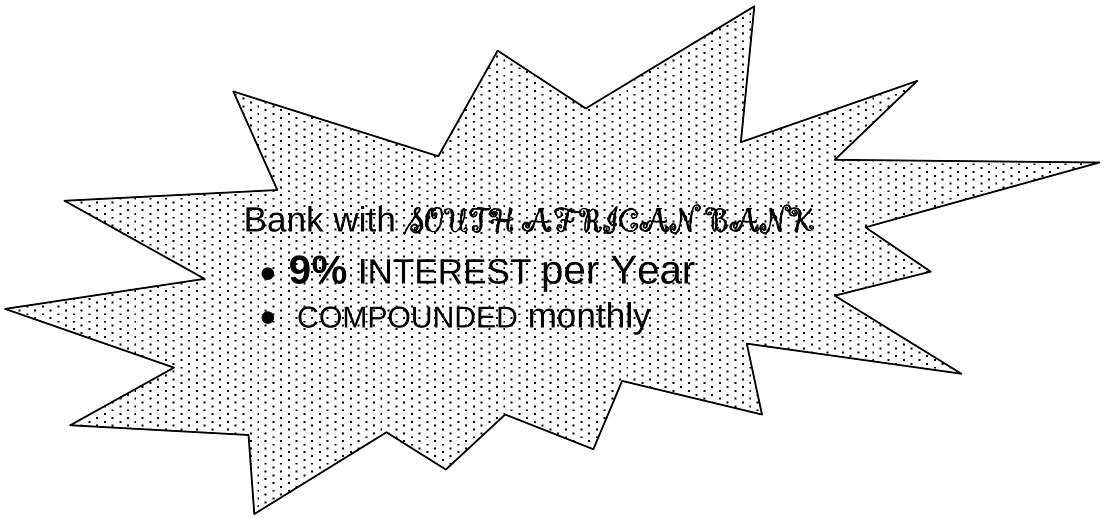


Arrangement 1 Arrangement 2 Arrangement 3 Arrangement 4

Derive, in terms of n, a formula for the number of tiles in the n^{th} arrangement. (3)
[19]

QUESTION 6

Read the advertisement below carefully and then answer the question that follows.
Round off your answer correct to **TWO** decimal places.



In 3 years' time Thembi needs R12 500 for a vacation. How much money does he need to deposit now into SOUTH AFRICAN BANK in order to be able to withdraw that amount at the end of the 3 years? **[5]**

QUESTION 7

7.1 Use **first principles** to determine the derivative of $f(x)$ if $f(x) = 4x^2$ (5)

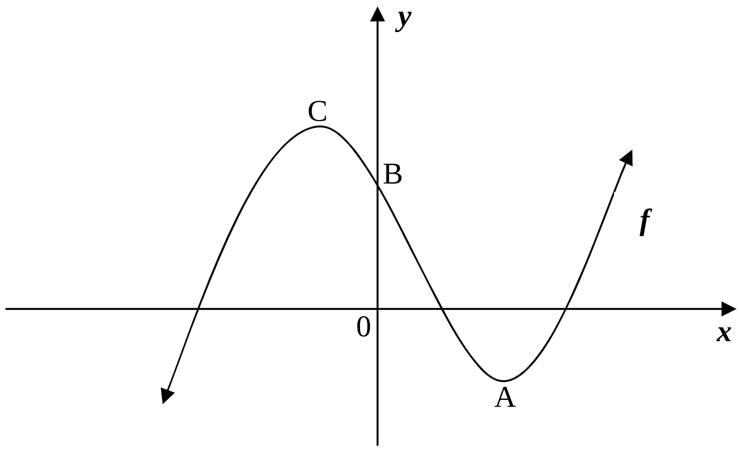
7.2 Use differentiation rules to determine the derivatives of the following functions:

7.2.1 $y = 4x^3 + 12x^2 + 9x$ (3)

7.2.2 $f(x) = -\dfrac{1}{x^4} + \sqrt{x}$ (4)

7.3 The graph below, not drawn to scale, represents the function given by:

$$f(x) = x^3 - 3x^2 - 9x + 25$$



7.3.1 Determine the co-ordinates of the turning points A and C. (8)

7.3.2 Use the graph to solve for x if $f'(x) \leq 0$. (2)

7.3.3 Determine the gradient of the tangent to the graph of f at the y-intercept B. (5)

[27]

QUESTION 8

A biologist states that when a certain type of antibacterium is introduced into a culture of bacteria, the number of bacteria present is given by the formula where $b(t)$, in millions, is the number of bacteria present at time *t*, measured in hours:

$$b(t) = -4t^2 + 60t + 1500$$

8.1 How many bacteria were present at the beginning? (3)

8.2 At what moment was the maximum number of bacteria present? (3)

[6]

TOTAL: 150

Information Sheet (HG and SG)
Inligtingsblad (HG en SG)

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

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

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

$$A = P\left(1 + \frac{r}{100}\right)^n \qquad A = P\left(1 - \frac{r}{100}\right)^n$$

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

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

$$y = mx + c$$

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

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

$$m = \tan\theta$$

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

$$x^2 + y^2 = r^2$$

$$(x - p)^2 + (y - q)^2 = r^2$$

In ΔABC:

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

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

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