education

Department:
Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE EXAMINATION - 2005

MATHEMATICS P1

STANDARD GRADE

OCTOBER/NOVEMBER 2005

Marks: 150

Time: 3 Hours

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

INSTRUCTIONS TO CANDIDATES

Read the following instructions carefully before answering the questions:

1. This paper consists of **8** questions. Answer **ALL** the questions.
2. Clearly show **ALL** calculations, diagrams, graphs, etc. 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 the question paper.**

QUESTION 1

1.1 Solve for x:

1.1.1 $x(2x + 1) = 10$ (4)

1.1.2 $3x^2 - 4x - 2 = 0$ (Round your answer off correct to **two** decimal places) (5)

1.1.3 $x - 3 = \sqrt{x + 3}$. (6)

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

$$y + x = 2$$
$$x^2 + y^2 + 6x = 4y - 4$$

(7)

[22]

QUESTION 2

2.1 For which values of k will $kx^2 - 6x + 3 = 0$ have non-real roots? (3)

2.2 Given the quadratic equation $3px^2 + (2p + 3)x + 2 = 0$.
Show that the roots are rational for all rational numbers p. (5)

2.3 Given: $f(x) = 2x^3 + 17x^2 + 7x + d$

2.3.1 Determine the value of d, given that $f(x)$ is exactly divisible by $(x + 1)$. (4)

2.3.2 Hence solve for x if $f(x) = 0$. (4)

[16]

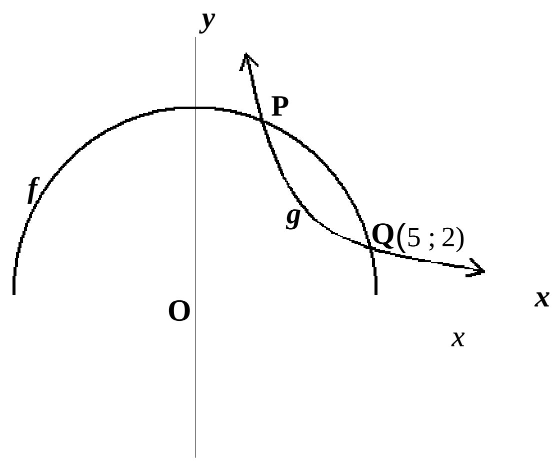
QUESTION 3

3.1 Given: $f(x) = (x-1)^2 - 4$ and
$g(x) = -2x + 1$.

3.1.1 On the same system of axes, draw neat sketch graphs of the functions f and g. Indicate the co-ordinates of all intercepts with the axes, as well as the co-ordinates of the turning point of f. Show all your calculations. (12)

3.1.2 Use your graph to solve for x if $f(x) < 0$. (2)

3.2 In the figure two sketch graphs, a semi-circle, f, and part of a hyperbola, g, are shown. The graphs intersect at P and Q (5; 2).



3.2.1 Determine the equation of f. (3)

3.2.2 Determine the equation of g. (3)

3.2.3 Write down the coordinates of P. (1)

[21]

QUESTION 4

4.1 Simplify to a single number **without using a calculator.**

4.1.1 $\dfrac{6^{2x-1}-36^{x}}{6^{2x}}$ (4)

4.1.2 $(\sqrt{50}-\sqrt{162})^{2}$ (4)

4.1.3 $\log_5 125+\dfrac{\log 32-\log 8}{\log 8}$. (6)

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

4.2.1 $\log x+\log 2=3$ (3)

4.2.2 $8^{x}\,.\,4^{x-2}=1$ (5)

4.2.3 $3x^{\frac{1}{5}}=6$. (3)

[25]

QUESTION 5

5.1 The second term of an arithmetic sequence is -2 and the fifth term is 7. Calculate:

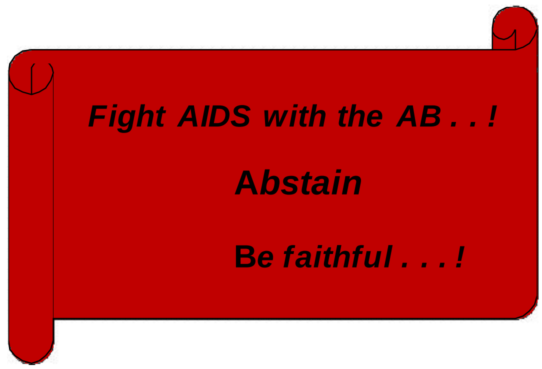
5.1.1 The first term and the common difference. (4)

5.1.2 The 100^{th} term of the sequence. (3)

5.1.3 The sum of the first 100 terms of the sequence. (3)

5.2 In the year 2001 there were 320 000 **new** AIDS sufferers in a certain country. The country made every effort to fight the disease. The number of new AIDS sufferers was thereby reduced by one half every year. The table below provides the number of new AIDS sufferers in the first three years.

Year	New AIDS sufferers
2001	320 000
2002	160 000
2003	80 000



5.2.1 Calculate how many new AIDS sufferers there would be in 2008. (5)

5.2.2 How many people in total would have been reported as new AIDS sufferers n years after 2000? (Simplify your answer). (4)

5.2.3 Was the country's effort to combat AIDS successful? Justify your answer. (2)

5.3 A new house costs R350 000. It is reported that the price of residential properties increases at a rate of 12 % per year, compounded monthly.

What will the same house cost in 12 years time? (Round your answer off to the nearest thousand)

(6)
[27]

QUESTION 6

6.1 Determine $f'(x)$ from **first principles** if $f(x) = 7x - 3$. (5)

6.2 Given: $f(x) = x^3 - 5x$

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

6.2.2 Determine the gradient of the tangent to the graph of $y = x^3 - 5x$ at the point where $x = -2$. (3)

6.3 Determine $\frac{dy}{dx}$ in each of the following:

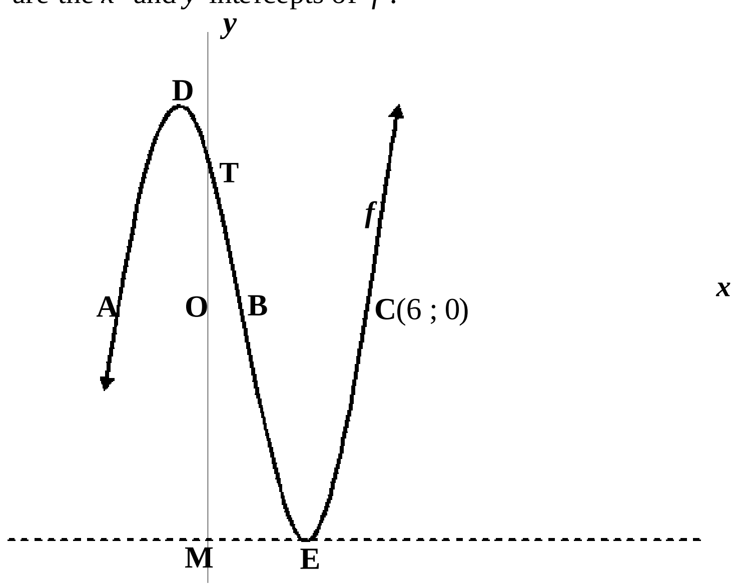
6.3.1 $y = x^6 - 2x + 1$ (3)

6.3.2 $y = 2\sqrt{x} - \frac{1}{x^3}$ (4)

[19]

QUESTION 7

The graph, f, shown below is defined by $f(x) = x^3 - 5x^2 - 8x + 12$.
A, B, C(6 ; 0) and T are the x- and y-intercepts of f.



7.1 Determine the co-ordinates of the turning points D and E of f. (7)

7.2 Write down the equation of the tangent, ME, to f. (1)

7.3 Write down the length of TM if M is on the y-axis. (2)

[10]

QUESTION 8

During a drought, the people in a village wanted to find out how much water they were using every week. They measured the amount of water in water tanks used by some of the people. In one of the tanks the volume of water, in litres, ***t*** weeks after measurement began, was found to be:

$$V = -100t^2 + 200t + 9\,900$$

8.1	After how many weeks was the volume a maximum?	(3)
8.2	After how many weeks is the tank empty?	(3)
8.3	Is the volume increasing or decreasing in the sixth week? Give a reason for your answer.	(4) **[10]**

TOTAL: 150

Mathematics Formula Sheet (HG and SG)
Wiskunde Formuleblad (HG en SG)

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

$T_n = a + (n-1)d$ $\quad S_n = \frac{n}{2}(a + T_n)$ or / of $S_n = \frac{n}{2}(a + l)$

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

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

$$S_\infty = \frac{a}{1-r} \quad (|r| < 1)$$

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

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

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

$$y = mx + c$$

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

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

$$m = \tan\theta$$

$$(x_3; y_3) = \left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$$

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

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

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

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

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