education

Department:
Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE**

GRADE 11

MATHEMATICS P1

EXEMPLAR 2007

MARKS: 150

TIME: 3 hours

This question paper consists of 9 pages, a sheet of graph paper and a 2-page formula sheet.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions:

1.   This question paper consists of 11 questions. Answer ALL the questions.

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

3.   An approved scientific 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.   Number the answers correctly according to the numbering system used in this ques-
          tion paper.

6.   Diagrams are NOT necessarily drawn to scale.

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

8.   A sheet of graph paper for answering QUESTION 11.2 and QUESTION 11.3 is
          included at the end of this question paper. Write your name/examination number on
          this sheet in the space provided and hand it in together with your ANSWER BOOK.

QUESTION 1

1.1   Solve for x:

      1.1.1 $x(x-9)+14=0$ (3)

      1.1.2 $x^2-x=3$ (Show your answer correct to ONE decimal place.)   (5)

      1.1.3 $\dfrac{1}{x+1}+\dfrac{2x}{x-1}=1$ (6)

1.2   Solve simultaneously for x and y in the following system of equations:

$$x+y=2$$

$$x^2+y^2-52=0 \tag{7}$$

1.3   If $A=\dfrac{\sqrt{x+4}}{x-2}$, determine the values of x for which:

      1.3.1   A is undefined   (2)

      1.3.2   A is non-real   (2)

                                                                [25]

QUESTION 2

Simplify each of the following:

2.1 $\dfrac{x^{\frac{1}{3}}\,x^{\frac{1}{4}}}{x^{\frac{1}{6}}}$ (3)

2.2 $\sqrt{128x^6}+\sqrt{98x^6}$ (3)

2.3   Show that $\dfrac{\sqrt{x}}{x}+\dfrac{y}{\sqrt{x}}$ can be written as $\dfrac{\sqrt{x}(1+y)}{x}$.   (4)

                                                                   [10]

QUESTION 3

A researcher is investigating the number of trees in a forest over a period of n years. After investigating numerous data, the following data model emerged:

YEAR	NUMBER OF TREES IN HUNDREDS
1	1
2	3
3	9
4	27

3.1   How many trees, in hundreds, are there in the SIXTH year if this pattern is continued? (2)

3.2   Determine an algebraic expression that describes the number of trees in the nth year in the forest. (2)

3.3   Do you think this model, which determines the number of trees in the forest, will continue indefinitely? Give a reason for your answer. (2)

[6]

QUESTION 4

Two learners, Anna and Dipika, did an investigation on number patterns. They managed to achieve the same results for t, but noticed that the patterns they had arrived at, looked different.

| Anna's Table				Dipika's Table		
n	t	Pattern		n	t	Pattern
1	3	1×3		1	3	$1^2 + 2 \times 1$
2	8	2×4		2	8	$2^2 + 2 \times 2$
3	15	3×5		3	15	$3^3 + 2 \times 3$
4	24	4×6		4	24	$4^2 + 2 \times 4$

4.1   Determine an algebraic formula for Anna's pattern. (2)

4.2   If Dipika's pattern formula can be written as $t = n^2 + 2n$, state whether the formula for Dipika's pattern and the formula for Anna's pattern are equivalent. Motivate your answer. (2)

4.3   Determine the value of n for which the learners would have obtained a result of $t = 143$. (5)
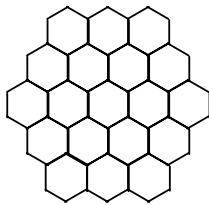
[9]

QUESTION 5

Busisiwe is using regular hexagonal (six-sided) carpet tiles to make floor rugs. She has arranged the tiles in the following patterns to make rugs of different sizes:
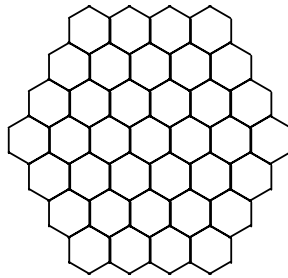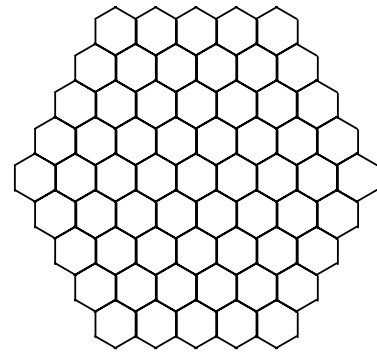
RUGS:
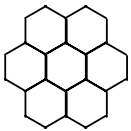
Pattern 2   Pattern 3   Pattern 4   Pattern 5
(7 tiles)   (19 tiles)   (37 tiles)   (61 tiles)

5.1   How many tiles will Busisiwe need to make Pattern 6 in this sequence?   (2)

5.2   Make a conjecture that describes the relationship between the pattern number and the number of tiles needed for the pattern.   (2)

5.3   Use variables to write an algebraic statement to generalise the relationship between the pattern number and the number of tiles.   (4)

[8]

QUESTION 6

6.1   A computer is purchased for R16 000. It depreciates at 15% per annum.

   6.1.1   Determine the book value of the computer after 3 years if depreciation is calculated according to the straight-line method.   (3)

   6.1.2   Find the rate, according to the reducing-balance method, that would yield the same book value as in QUESTION 6.1.1 after 3 years.   (5)

6.2   Peter invests R12 500,00 for 5 years at 12% per annum compounded monthly for the first 2 years and 14% per annum compounded semi-annually for the next 3 years. How much will Peter receive in total after 5 years?   (4)

6.3   Thanda invests R120 000. He is quoted a nominal interest rate of 7,2% per annum
           compounded monthly.

           6.3.1   Calculate the effective rate per annum correct to THREE decimal
                         places.   (4)

           6.3.2   Use the effective rate to calculate the value of Thanda's investment if
                         he invested the money for 3 years.   (3)

           6.3.3   Suppose Thanda invests his money for a total period of 4 years, but
                         after 18 months makes a withdrawal of R20 000, how much will he
                         receive at the end of the 4 years?   (5)
                                                                                                  [24]

QUESTION 7

The graphs of $f(x) = x(x+3)$ and $g(x) = -\dfrac{1}{2}x + 2$, are represented below:
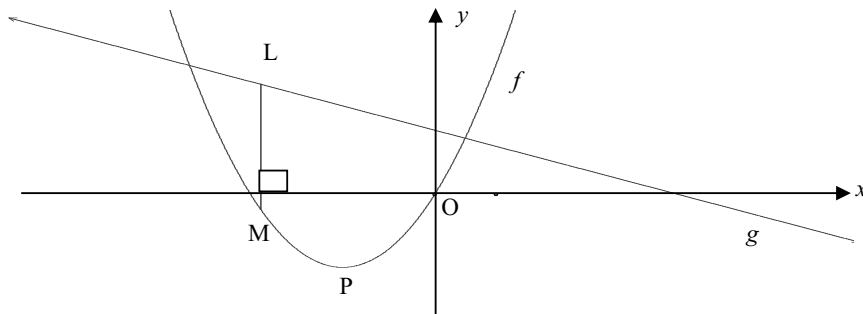
7.1   Determine the values of x for which $f(x) = 0$.   (2)

7.2   Calculate the coordinates of P, the turning point of f.   (5)

7.3   Determine the average gradient of the curve f between $x = -5$ and $x = -3$.   (3)

7.4   Hence state what you can deduce about the function, f, between $x = -5$ and $x = -3$. (2)

7.5   Determine the values of x for which $f(x) > 0$.   (3)

7.6   Give the coordinates of the turning point of $f(x-2)$.   (2)

7.7   L is a point on the straight line and M is a point on the parabola such that LM is
           perpendicular to the x-axis. Show that the expression for LM can be written as:

           $$LM = -\left(x + \frac{7}{4}\right)^2 + \frac{81}{16}$$ (5)

7.8   Hence state the maximum length of LM and the corresponding x-value at which it
           occurs.   (2)
                                                                                                  [24]

QUESTION 8

The following graph is a graph of $f(x) = a.b^x$ $(a \neq 0)$. P(2 ; 144) is a point on f.

8.1   8.1.1   If $b = \dfrac{3}{4}$, calculate the value of a.   (3)

        8.1.2   Hence write down the equation of f.   (1)

8.2   Determine, correct to TWO decimal places, the value of $f(13)$.   (2)

8.3   Describe the transformation of the curve of f to h if $h(x) = f(-x)$ (2)

[8]

QUESTION 9

Given: $h(x) = \dfrac{1}{x+4} - 2$.

9.1   Determine the equations of the asymptotes of h.   (2)

9.2   Determine the coordinates of the intercepts of h with the x- and y-axes.   (6)

9.3   Sketch the graph of h showing clearly the asymptotes and ALL intercepts with the axes.   (4)

[12]

QUESTION 10

The diagram below shows the graphs of $f(x) = \sin ax$ and $g(x) = \cos(x + b°)$.
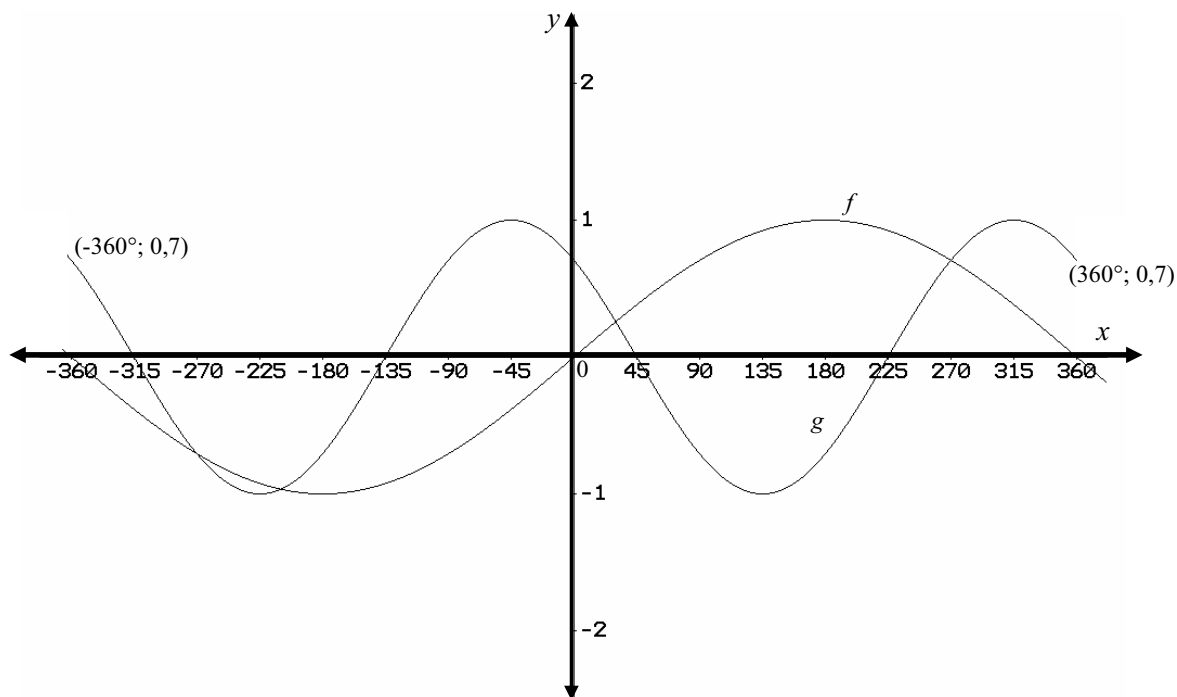
10.1   What is the period of *f*?   (1)

10.2   Determine the values of *a* and *b*.   (2)

10.3   State the range of *h* if $h(x) = g(x) – 1$.   (2)

[5]

QUESTION 11

A bicycle manufacturer makes two different models of bicycles, namely mountain bikes and speed bikes. The bicycle manufacturer works under the following constraints:

- No more than 5 mountain bicycles can be assembled daily.
- No more than 3 speed bicycles can be assembled daily.
- It takes one man to assemble a mountain bicycle, two men to assemble a speed bicycle and there are 8 men working at the bicycle manufacturer.

Let x represent the number of mountain bicycles and let y represent the number of speed bicycles.

11.1	Determine algebraically the constraints that apply to this problem.	(6)
11.2	Represent the constraints graphically on the graph paper provided.	(4)
11.3	By means of shading, clearly indicate the feasible region on the graph.	(2)
11.4	The profit on a mountain bicycle is R200 and the profit on a speed bicycle is R600. Write down an expression to represent the profit on the bicycles.	(3)
11.5	Determine the number of each model bicycle that would maximise the profit to the manufacturer.	(4)

[19]

TOTAL:　　　150

NAME/EXAMINATION NUMBER:

GRAPH PAPER

QUESTION 11

11.2 and 11.3
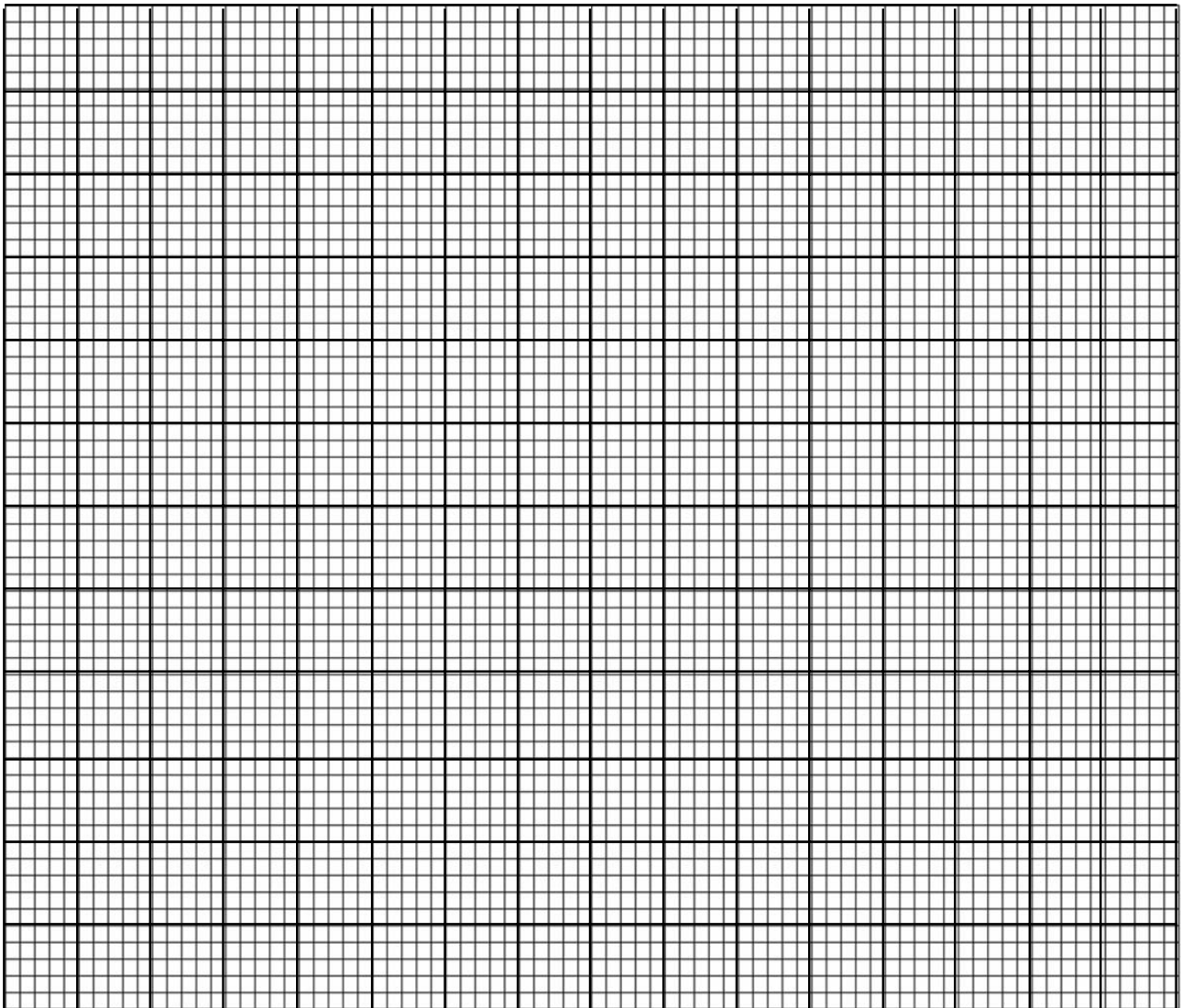
INFORMATION SHEET : MATHEMATICS
INLIGTINGSBLAD : WISKUNDE

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

$$A = P(1 + ni) \qquad\qquad A = P(1 - ni)$$

$$A = P(1 - i)^n \qquad\qquad A = P(1 + i)^n$$

$$\sum_{i=1}^{n} 1 = n \qquad\qquad \sum_{i=1}^{n} i = \frac{n(n+1)}{2}$$

$$\sum_{i=1}^{n} \left(a + (i-1)d\right) = \frac{n}{2}\left(2a + (n-1)d\right)$$

$$\sum_{i=1}^{n} ar^{i-1} = \frac{a\left(r^n - 1\right)}{r - 1} \quad ; \quad r \neq 1 \qquad\qquad \sum_{i=1}^{\infty} ar^{i-1} = \frac{a}{1-r} \; ; \; -1 < r < 1$$

$$F = \frac{x\left[(1+i)^n - 1\right]}{i} \qquad\qquad P = \frac{x[1 - (1+i)^{-n}]}{i}$$

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

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

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

$$y = mx + c \qquad\qquad y - y_1 = m(x - x_1)$$

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

$$(x - a)^2 + (y - b)^2 = r^2$$

In $\triangle ABC$: $\qquad \dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

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

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

$$\sin(\alpha + \beta) = \sin\alpha.\cos\beta + \cos\alpha.\sin\alpha \qquad \sin(\alpha - \beta) = \sin\alpha.\cos\beta - \cos\alpha.\sin\alpha$$

$$\cos(\alpha + \beta) = \cos\alpha.\cos\beta - \sin\alpha.\sin\beta \qquad \cos(\alpha - \beta) = \cos\alpha.\cos\beta + \sin\alpha.\sin\beta$$

$$\cos 2\alpha = \begin{cases} \cos^2 \alpha - \sin^2 \alpha \\ 1 - 2\sin^2 \alpha \\ 2\cos^2 \alpha - 1 \end{cases}$$

$$\sin 2\alpha = 2\sin\alpha.\cos\alpha$$

$$\bar{x} = \frac{\sum x}{n}$$

$$\bar{x} = \frac{\sum fx}{n}$$

$$var = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}$$

$$var = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n}$$

$$s.d = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n}}$$

$$P(A) = \frac{n(A)}{n(s)}$$

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$