Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 11

NOVEMBER 2012

MATHEMATICS P1

MARKS: **150**

TIME: **3 hours**

This question paper consists of 14 pages, including an information sheet and a 2 page diagram sheet.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 8 questions.
2. Answer ALL the questions.
3. Clearly show ALL calculations, diagrams, graphs, et cetera that you have used in determining the answers.
4. An approved scientific calculator (non-programmable and non-graphical may be used), unless stated otherwise.
5. Answer only will not necessarily be awarded full marks.
6. If necessary, answers should be rounded off to TWO decimal places, unless stated otherwise.
7. Number the answers correctly according to the numbering system used in this question paper.
8. Diagrams are NOT drawn to scale.
9. An information sheet with formulae is attached.
10. A diagram sheet is supplied for QUESTIONS 2.4, 3.2.1, 5.3 and 8.2. Write your name in the space provided and then hand the diagram sheet in with your ANSWER SHEET.
11. Write legibly and present your work neatly.

QUESTION 1

1.1 Solve for *x* (correct to two decimal places where necessary):

1.1.1 $(x+3)(x-1) = -x+1$ (4)

1.1.2 $x^2 + 3x - 4 < 0$ (3)

1.1.3 $x^2 + 3x = 1$ (5)

1.2 Solve for *x* and *y* simultaneously in the following set of equations.

$x + y = 3$ and $2x^2 + 2y^2 = 5xy$ (8)

1.3 $f(x) = x^2 - 2x$. Show that by completing the square that:

$f(x-1) = (x-2)^2 - 1$ (4)

1.4 Solve for *x*:

$2.5^x = 50$ (3)

[27]

QUESTION 2

Given:

$$f(x) = \left(\frac{1}{5}\right)^x, x \in \mathbb{R}; \quad g(x) = \frac{x}{5}, x \in \mathbb{R}; \quad h(x) = \frac{1}{x} + 5, x > 0, x \in \mathbb{R}$$

2.1 Write down the co-ordinates of the y-intercept of the graph f. (1)

2.2 Give the equations of the asymptotes of f and h. (3)

2.3 Which of the functions are decreasing? (2)

2.4 Sketch the graphs of f, g and h on the same system of axes. Show all asymptotes. (4)

2.5 Write the equation of the graph obtained by reflecting f in the y-axis. (1)

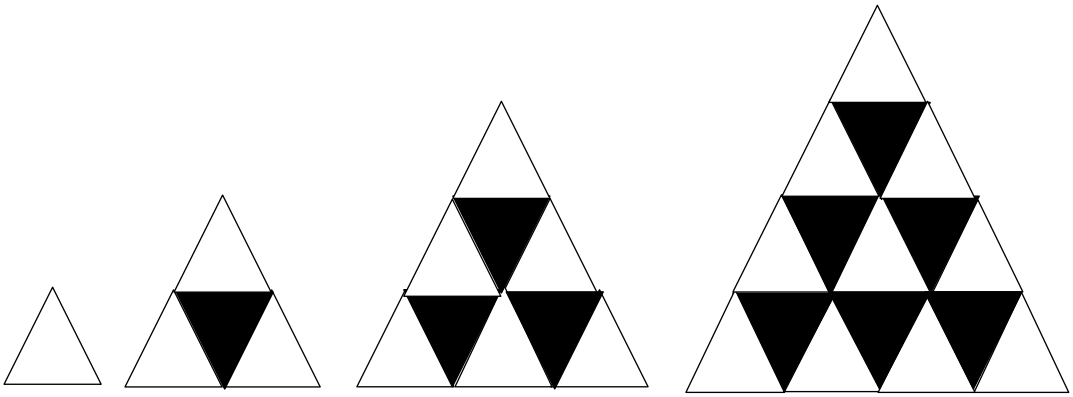
2.6 Give the equation of the graph obtained by shifting g vertically up by five units. (1)

[12]

QUESTION 3

3.1 The general term of: 5 ; 12 ; 29 ; 48 ; 77 ;… is $T_n = 3n^2 + 2$
Is this statement true? Show working to motivate your answer. (4)

3.2 The first four shapes of a sequence are shown below.



The table below shows the number of white and black triangles in the first three shapes.

Shape number, n	**1**	**2**	**3**	**4**	**5**
Number of white triangles	**1**	**3**	**6**		
Number of black triangles	**0**	**1**	**3**		
Total number of triangles	**1**	**4**	**9**		

3.2.1 Copy the table and complete it. (6)

3.2.2 How many triangles will there be altogether in the 12^{th} shape? (2)

3.2.3 Determine the general term for the number of black triangles in the *n*th shape. (7)

3.2.4 The number of black triangles in the *n*th shape is 190. Determine the value of *n*. (5)

[24]

QUESTION 4

4.1 A company bought machinery valued at R15 000. The depreciation is calculated at a rate of 12% p.a. on a straight-line basis. Calculate the value of the machinery at the end of six years. (3)

4.2 R2 500,00 is deposited into a savings account at 15% interest per annum compounded monthly.

4.2.1 What is the monthly nominal interest rate? (1)

4.2.2 Determine the effective yearly interest rate, correct to two decimal places. (4)

4.2.3 Calculate the amount of money in the savings account at the end of seven years. (4)

4.3 A new car depreciates in value by 18% in the first year.

4.3.1 Determine the original cost if it is now worth R183 680.00 after one year. (4)

4.3.2 If the car depreciates on reducing balance by 15% in the second year and by 12% in the third and fourth years, calculate the value of the car to the nearest rand after four years. (4)

4.4 Deneo takes out a loan of R550 000 in order to finance her new business. After four years she expands her business and borrows a further R560 000. Three years after this she pays off the total debt in one payment. The interest rate of the loan was 18% p.a. compounded quarterly. Determine the value of her payment. (5)

[25]

QUESTION 5

Given: $f(x) = \frac{1}{2}(x-4)^2 - 2$ and $g(x) = \frac{-2}{x-1} - 1$

5.1 Calculate the co-ordinates of the *x*-intercept and the *y*-intercept of g. (3)

5.2 Calculate the co-ordinates of the *x*-intercepts of f. (3)

5.3 On the same set of axes, sketch the graphs of f and g. Indicate all intercepts with the axes and the co-ordinates of the turning point of f. (7)

5.4 Write down the range of g. (2)

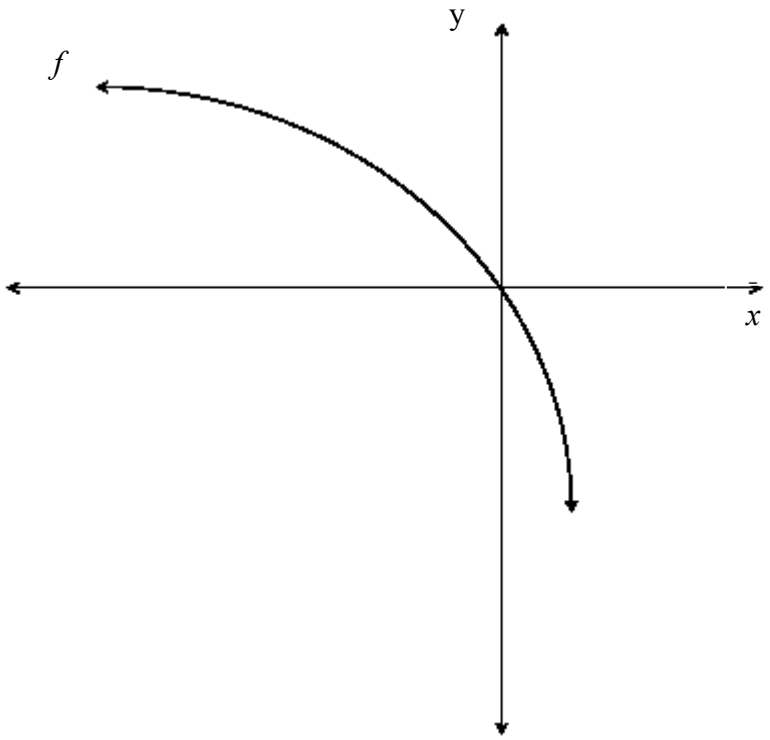
5.5 What is the minimum value of $f(x)$? (1)

5.6 For which values of x will both $f(x)$ and $g(x)$ increase as x increases? (2)

[18]

QUESTION 6

The graph of $f(x) = 1 + a.2^x$ (a is a constant) passes through the origin as shown below.



6.1 Show that $a = -1$ (2)

6.2 Determine the value of $f(-15)$ correct to five decimal places. (2)

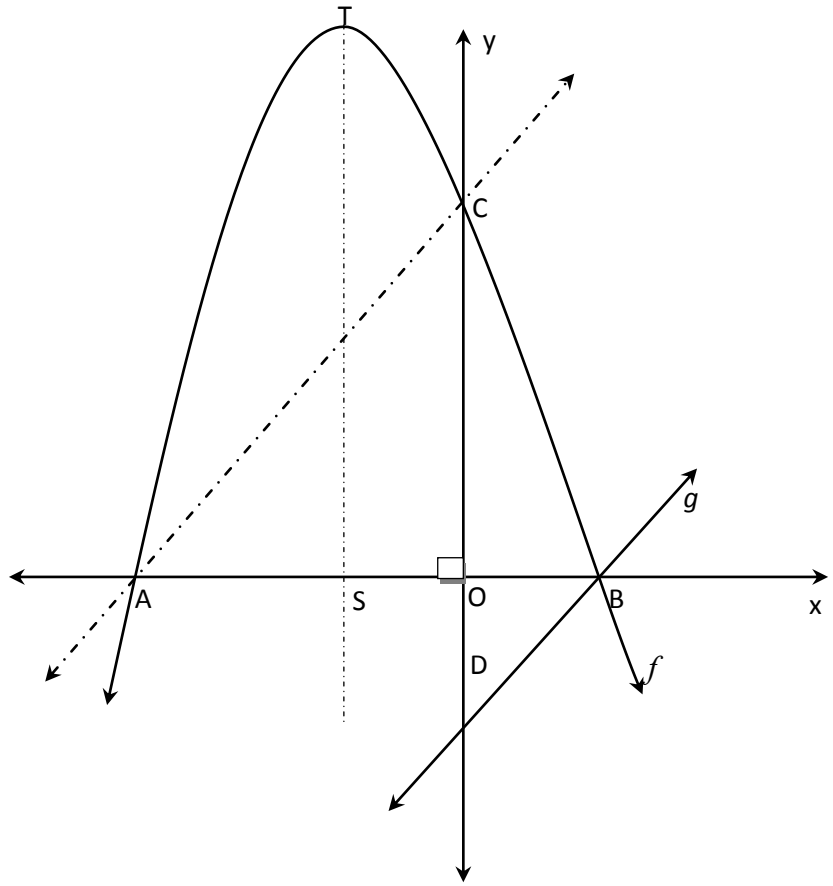
6.3 Determine the value of x if P(x ; 0,5) lies on the graph of f. (3)

6.4 If the graph of f is shifted two units to the right to give the function h, write down the equation of h. (2)

[9]

QUESTION 7

The sketch shows the graphs of $f(x) = -x^2 - 2x + 3$ and $g(x) = mx + c$. A and B are the intercepts on the x-axis. C and D are the intercepts on the y-axis. T is the turning point on the graph of f.



7.1 Determine the lengths of OC and AB. (5)

7.2 Determine the equation of the axis of symmetry of the graph of f. (2)

7.3 Show that the length of ST = 4 units. (3)

7.4 The graph of g is parallel to AC.

Determine:

7.4.1 the gradient of AC. (3)

7.4.2 the equation of g. (4)

[17]

QUESTION 8

A company makes two types of clocks. The wall models sell for R40 each and the table models for R50 each. The maximum number of wall models that can be made in a day is 35 and the maximum number of table models is 20. The dispatch department can only pack 50 clocks per day. The minimum income needed to cover costs is R2 000 per day.
Let the number of wall models made per day be x and the number of table models be y.

8.1 Write down all the constraints. (4)

8.2 Draw a graph to show the constraints and clearly indicate the feasible region. (5)

8.3 Calculate the critical points (vertices) of the feasible region. (4)

8.4 The profit on a wall model is R20 and on a table model R10. Write down the equation of the objective function (profit line). (1)

8.5 Determine the maximum as well as the minimum profit. (4)
[18]

TOTAL: 150

INFORMATION SHEET: MATHEMATICS

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

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

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

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

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

$$F = \frac{x\left[(1+i)^n - 1\right]}{i} \qquad P = \frac{x[1-(1+i)^{-n}]}{i} \qquad f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \qquad \mathrm{M}\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$$

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

$$m = \frac{y_2 - y_1}{x_2 - x_1} \qquad m = \tan\theta \qquad (x-a)^2 + (y-b)^2 = r^2$$

In ΔABC: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$ $\quad a^2 = b^2 + c^2 - 2bc.\cos A$

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

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

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

$$\cos 2\alpha = \begin{cases} \cos^2\alpha - \sin^2\alpha \\ 1 - 2\sin^2\alpha \\ 2\cos^2\alpha - 1 \end{cases} \qquad \cos(\alpha - \beta) = \cos\alpha.\cos\beta + \sin\alpha.\sin\beta$$

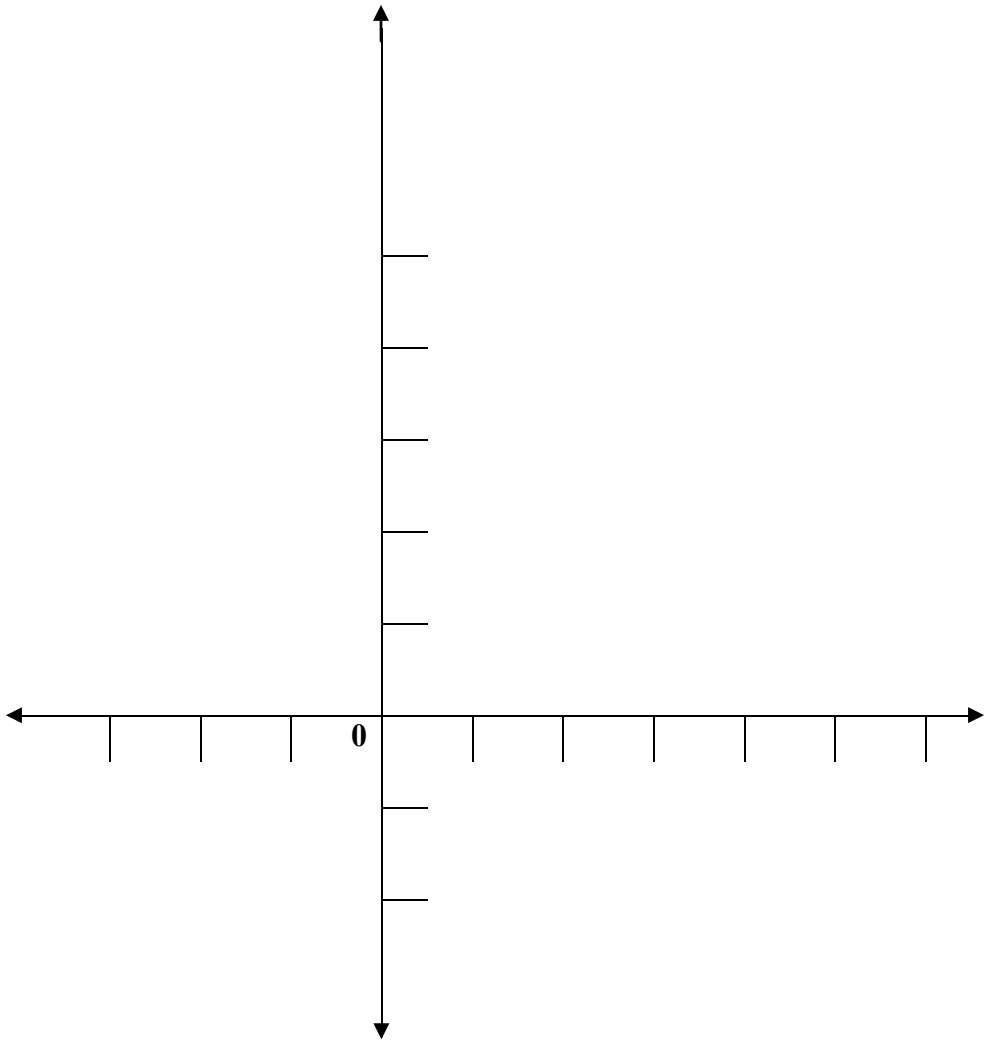
$$\sin 2\alpha = 2\sin\alpha.\cos\alpha$$

$$\bar{x} = \frac{\sum fx}{n} \qquad \partial^2 = \frac{\sum_{i=1}^{n} \left(x_i - \bar{x}\right)^2}{n} \qquad P(A) = \frac{n(A)}{n(S)} \qquad (A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

DIAGRAM SHEET

NAME:

QUESTION 2.4



QUESTION 3.2.1

Shape number, n	1	2	3	4	5
Number of white triangles	1	3	6		
Number of black triangles	0	1	3		
Total number of triangles	1	4	9		

DIAGRAM SHEET

NAME:

QUESTION 5.3

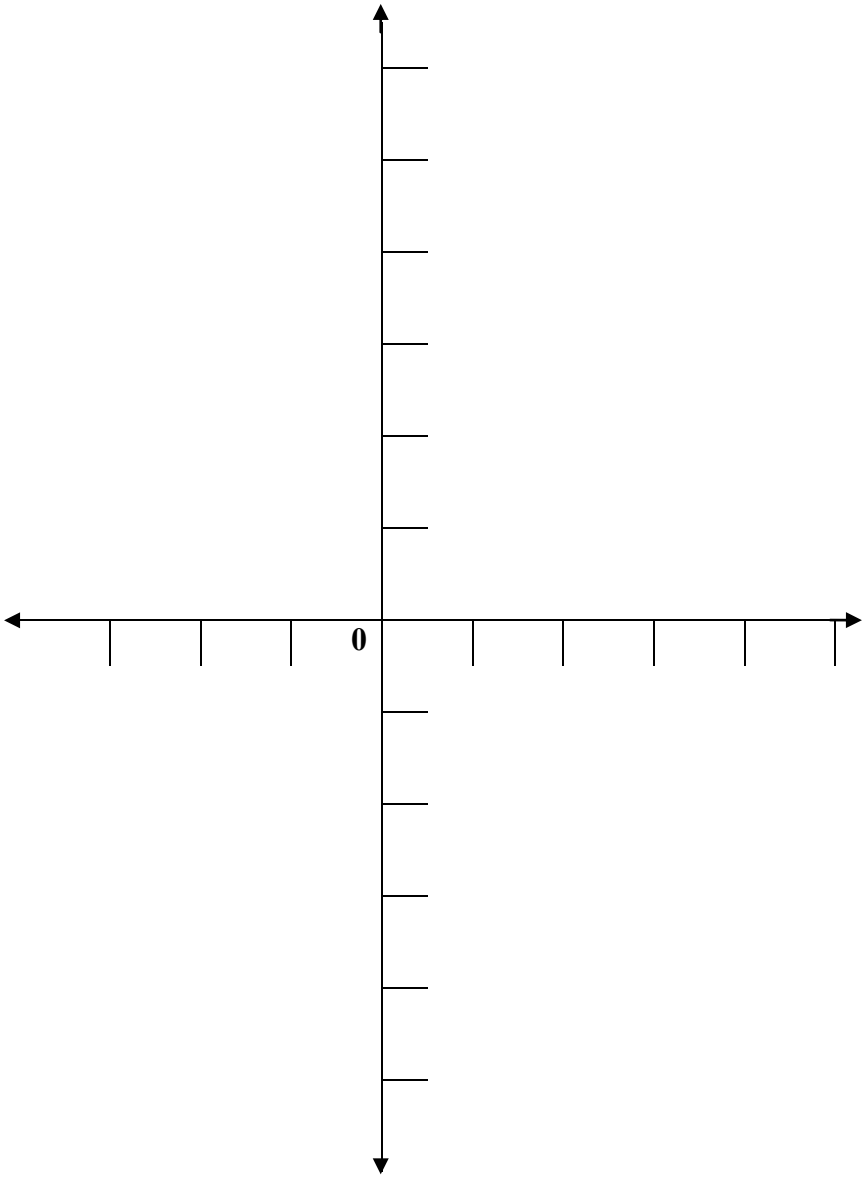


DIAGRAM SHEET

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QUESTION 8.2