Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 11

NOVEMBER 2010

MATHEMATICS P1

MARKS: **150**

TIME: **3 hours**

This question paper consists of 7 pages, a formula sheet and 2 diagram sheets.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 8 questions. Answer ALL questions.

2. Clearly show ALL calculations, diagrams, graphs, et cetera that 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 question paper.

6. Diagrams are NOT drawn to scale.

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

8. An information sheet with formulae is attached.

9. A diagram sheet is supplied for QUESTION 6.2 and QUESTION 8. Write your name in the space provided and then hand the diagram sheet in with your ANSWER sheets.

QUESTION 1

1.1 Solve for x:

1.1.1 $x^2 + 3x - 2 = 0$ (3)

1.1.2 $\frac{1}{2x} + \frac{x}{x+1} = \frac{5x+1}{4(x+1)}$ (4)

1.1.3 $3^x - 3^{x-1} = \frac{2}{27}$ (4)

1.1.4 $6 - x^2 + x \leq 0$ (4)

1.2 Solve for x and y in the following simultaneous equations:

$2y - x = 3$ and $x^2 - 2xy + 4y^2 = 7$ (7)

[22]

QUESTION 2

2.1 Write $\frac{(\sqrt{3}+2)^2+2}{\sqrt{3}}$ in the form $a + b\sqrt{c}$ where a, b and c are integers, without using a calculator. (3)

2.2 For which values of x will y be real if: $y = \frac{1}{\sqrt{x+4}}$? (2)

2.3 The sides of a rectangle are x mm and y mm in length. The perimeter of the rectangle is 280 mm and the area is 4 800 mm^2. Calculate the length of the longest side. (5)

[10]

QUESTION 3

3.1 You are given the following two sequences:

P = -8 ; -4 ; …
Q = -8 ; -4 ; …

where P has a linear pattern with a constant first difference and Q has an exponential pattern with a constant ratio between terms.

3.1.1 Write down the next term of P and hence determine the n^{th} term. (3)

3.1.2 Which term of P is the number 328? (3)

3.1.3 Determine the common ratio in Q and hence write down the next term. (2)

3.1.4 Determine the n^{th} term of Q. (2)

3.1.5 What is the value of the 11^{th} term of Q? (3)

3.2 A sequence has a common second difference of 4 between terms. The first two terms are 3 and 12.

3.2.1 Write down the 3rd and 4th terms. (2)

3.2.2 Determine the n^{th} term. (6)

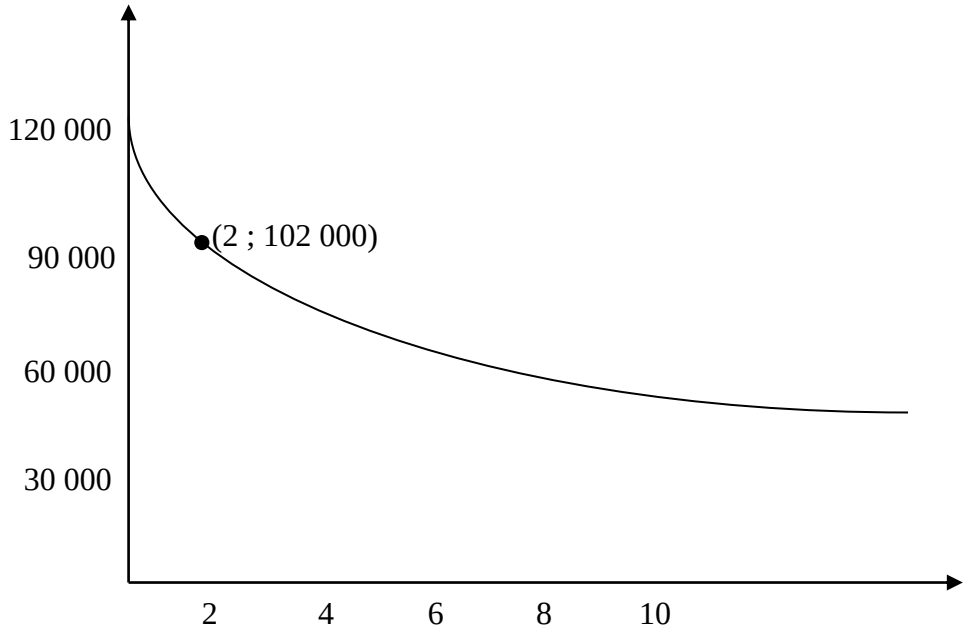
3.2.3 Hence, determine the 50th term. (2)

3.2.4 Calculate how many terms have a value less than 228. (5)

[28]

QUESTION 4

4.1 Babalwa bought a car. The graph shows how the value of the car decreases yearly.



4.1.1 What was the initial value of the vehicle? (1)

4.1.2 What was the value of the car after 2 years? (1)

4.1.3 What type of depreciation is this? (1)

4.1.4 Determine the rate of depreciation as a percentage. (4)

4.1.5 Calculate what the car will be worth after 10 years. (2)

4.2 R4 200 is deposited into a savings account. Immediately after three years are completed, R3 000 is added to the savings. For the first two years the interest was compounded monthly at 8% p.a. Thereafter, the interest rate changed to 10% p.a. compounded half-yearly.

4.2.1 Calculate the effective interest rate per annum during the first year. (3)

4.2.2 Calculate the value of the savings at the end of the 7th year. (8)

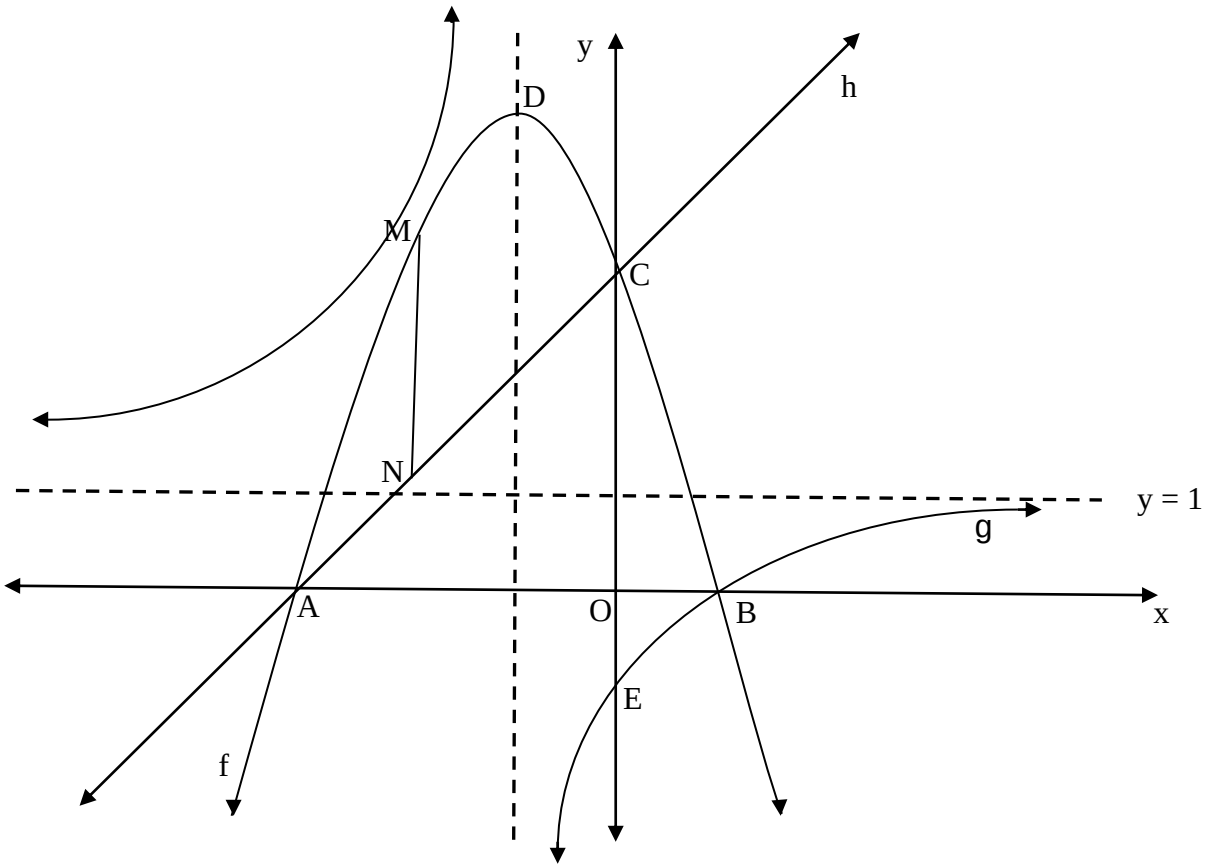
[20]

QUESTION 5

In the figure, sketch graphs of the following functions are shown:

$f(x) = -x^2 - 2x + 3$, $g(x) = \frac{-2}{x+p} + q$ and h.

D is the turning point of f.



5.1 Determine the coordinates of A and B, the x-intercepts of f. (4)

5.2 Write the equation of f in the form $y = a(x - p)^2 + q$ by completing the square, and hence determine the turning point of f. (5)

5.3 Give the coordinates of the turning point of the graph of $y = f(x + 2)$ and describe the translation that took place. (3)

5.4 What are the values of p and q? (2)

5.5 Hence, calculate the coordinates of E, the y-intercept of g. (2)

5.6 Determine the equation of the straight line, h, passing through A and C. (4)

5.7 Find the maximum distance MN between the parabola and straight line if MN is parallel to the y-axis. (5)

[25]

QUESTION 6

Consider the function $f(x) = 2^x$.

6.1 Determine the equation of h if h is the result of shifting the graph of f 2 units downwards. (1)

6.2 Determine the y-intercept of h. (1)

6.3 Write down the equation of the asymptote of h. (1)

6.4 On the system of axes supplied on the diagram sheet, draw neat sketch graphs of f and of h. Indicate all asymptotes and intercepts with the axes. (6)

6.5 For which values of x is $h(x) > 0$? (1)

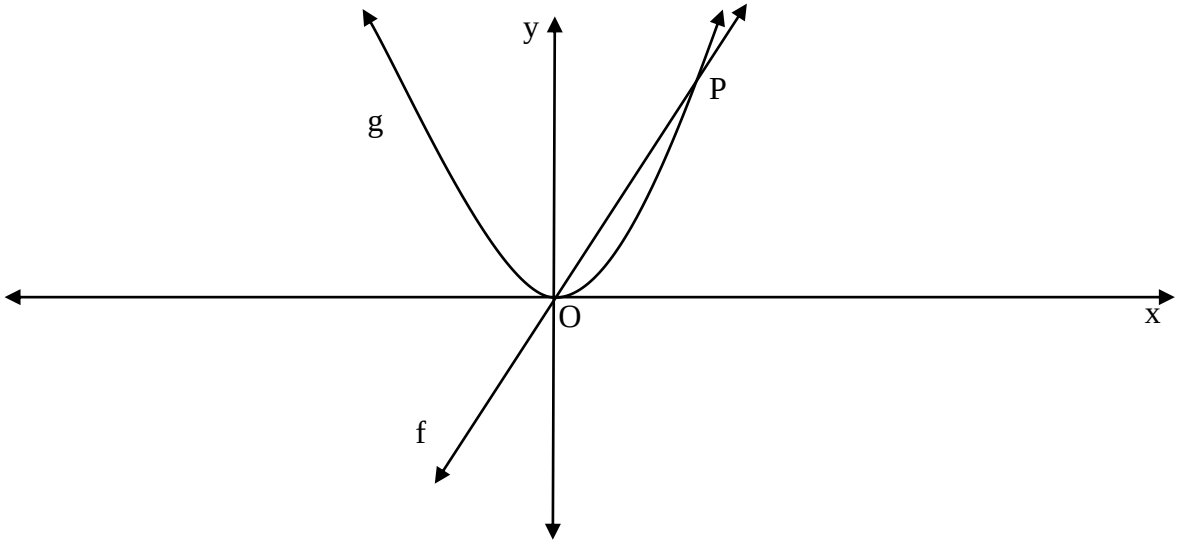
6.6 Determine the equation of k if k is the reflection of h in the y-axis. (1)

6.7 Determine, to three decimal places, the value of b if (-6 ; b) lies on the graph of f. (2)

[13]

QUESTION 7

The accompanying diagram shows the graphs of two functions defined by $f(x) = 2x$ and $g(x) = x^2$. The graphs intersect at O and P.



7.1 Calculate the coordinates of P. (4)

7.2 By using the graphs, answer the following questions:

7.2.1 Write down the range of $g(x) + 1$. (2)

7.2.2 Determine the values of x for which $x^2 > 2x$. (3)

7.2.3 For which values of x is $f(x).\ g(x) < 0$? (1)

7.3 Determine the equation of h if $h(x) = f(x + 4)$. (2)

[12]

QUESTION 8

In a certain week a manufacturer makes two types of garden furniture, chairs and tables. Let x be the number of chairs and y be the number of tables.

8.1 Write down the constraints in terms of x and y if it is given that:

8.1.1 At most 60 chairs and 100 tables can be manufactured in a week. (2)

8.1.2 At least 80 pieces of garden furniture must be produced in a week to cover costs. (1)

8.1.3 It takes 40 minutes to make a chair and 30 minutes to make a table. The factory works a maximum of 60 hours per week. (1)

8.2 Represent the constraints graphically on the graph paper provided on the Diagram Sheet. Shade the feasible region. (7)

8.3 If the profit on a chair is R40 and on a table is R80, write down the equation in terms of x and y which will represent the profit (P). (1)

8.4 Use the graph to determine the point (x ; y) in the feasible region where the profit is a maximum. (4)

8.5 The manager is informed that the workers' union plans a strike for the following week, which will result in a maximum of 50 hours being worked. How many of each type of garden furniture should then be manufactured for a maximum profit? What will the maximum profit then be for the week? (4)

[20]

TOTAL: 150

INFORMATION SHEET: MATHEMATICS

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

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

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

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

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

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

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

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

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

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

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

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

In ΔABC:

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \qquad a^2 = b^2 + c^2 - 2bc.\cos A \qquad area\Delta ABC = \frac{1}{2}ab.\sin C$$

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

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

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

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

$\bar{x} = \frac{\sum fx}{n}$ $\quad$ $\sigma^2 = \frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n}$

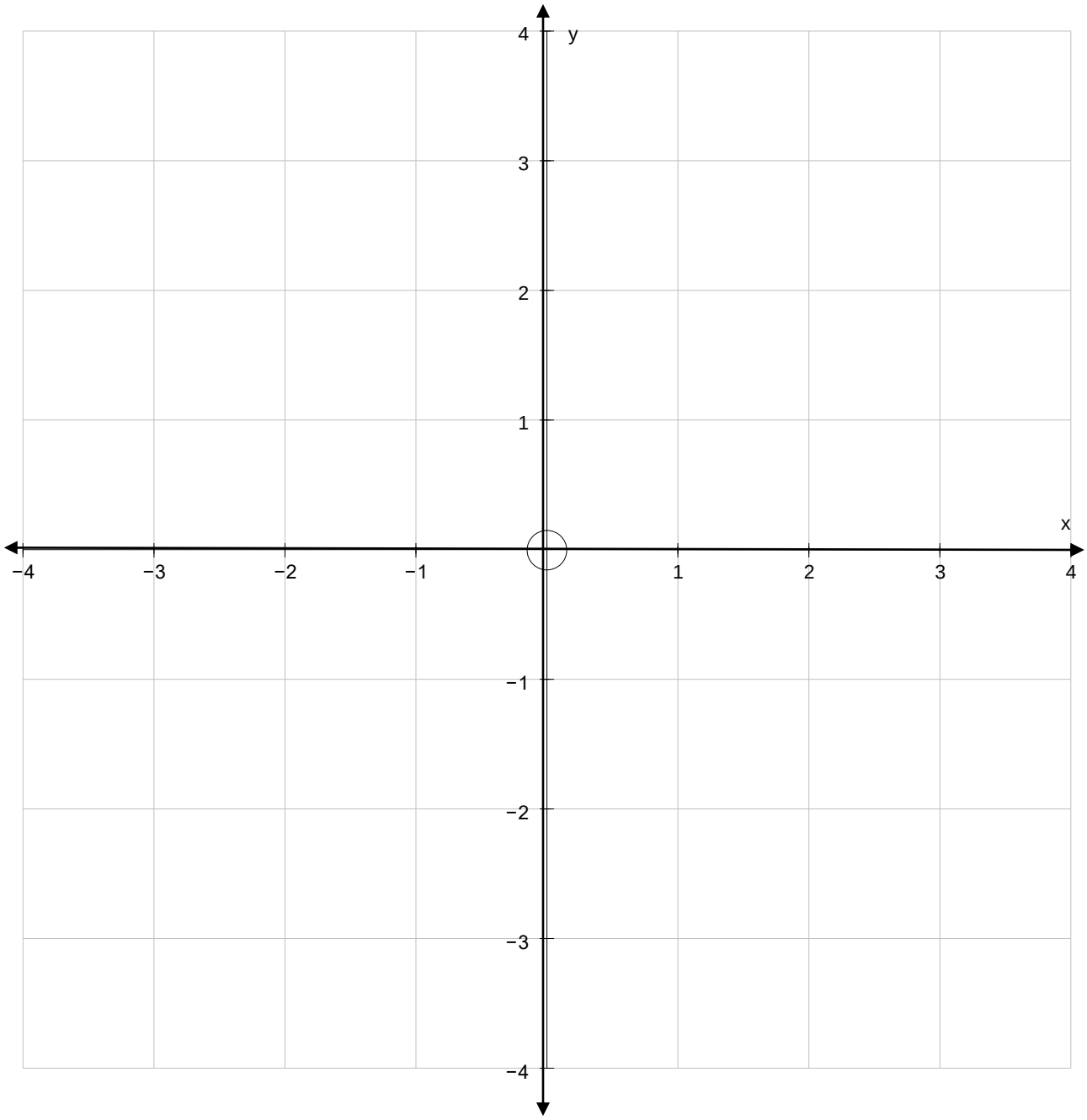
$P(A) = \frac{n(A)}{n(S)}$ $\quad$ $P(AorB) = P(A) + P(B) - P(AandB)$

NAME/EXAMINATION NUMBER:

DIAGRAM SHEET 1

QUESTION 6

6.4



NAME/EXAMINATION NUMBER:

DIAGRAM SHEET 2

QUESTION 8

8.2