



Province of the
EASTERN CAPE
EDUCATION

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

SEPTEMBER 2011

MATHEMATICS P1

MARKS: 150

TIME: 3 hours



This question paper consists of 8 pages.

INSTRUCTIONS AND INFORMATION

1. This question paper consists of 12 questions.
Answer ALL the questions.
2. Clearly show ALL calculations, diagrams, graphs, etc that 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. Number the answers EXACTLY as the questions are numbered.
6. Diagrams are not necessarily drawn to scale.
7. An information sheet with formulae included at the end of the paper.
8. Write legibly and present your work neatly.
9. Answers only will not necessarily be awarded full marks.

QUESTION 1

1.1 Solve for x , correct to TWO decimal places:

$$1.1.1 \quad (x + 2)(2x - 1) = -2 \quad (3)$$

$$1.1.2 \quad 4 - x(x - 3) = 5 \quad (5)$$

$$1.1.3 \quad (2x - 3)^2 < 4 \quad (5)$$

1.2 Solve for x and y simultaneously:

$$\begin{aligned} x + 2y - 3 &= 0 \\ x^2 - 2xy - 4y &= 0 \end{aligned} \quad (7)$$

1.3 Simplify completely without the use of a calculator:

$$\sqrt[3]{3}(\sqrt[3]{243} - \sqrt[3]{9}) \quad (2)$$

[22]

QUESTION 2

Consider the sequence:

8; 18; 30; 44; ...

2.1 Write down the next TWO terms of the sequence, if the pattern continues in the same way. (1)

2.2 Calculate the n^{th} term of the sequence. (5)

2.3 Which term of the sequence is 330? (3)

[9]

QUESTION 3

3.1 The 3rd term of a geometric series is 18, and the 5th term is 162. Determine the sum of the first 7 terms, where $r < 0$. (7)

3.2 Write the series $\frac{3}{1} + \frac{5}{2} + \frac{7}{4} + \frac{9}{8} + \dots$, to n terms, in sigma notation. (4)

[11]

QUESTION 4

4.1 Given: $\sum_{r=1}^{\infty} 30(3)^{1-r}$

4.1.1 Write down the first 2 terms of the series. (2)

4.1.2 Determine the sum of the series. (2)

4.2 For which value(s) of p is the infinite series $2(p - 5) + 2(p - 5)^2 + 2(p - 5)^3 + \dots$, convergent? (3)

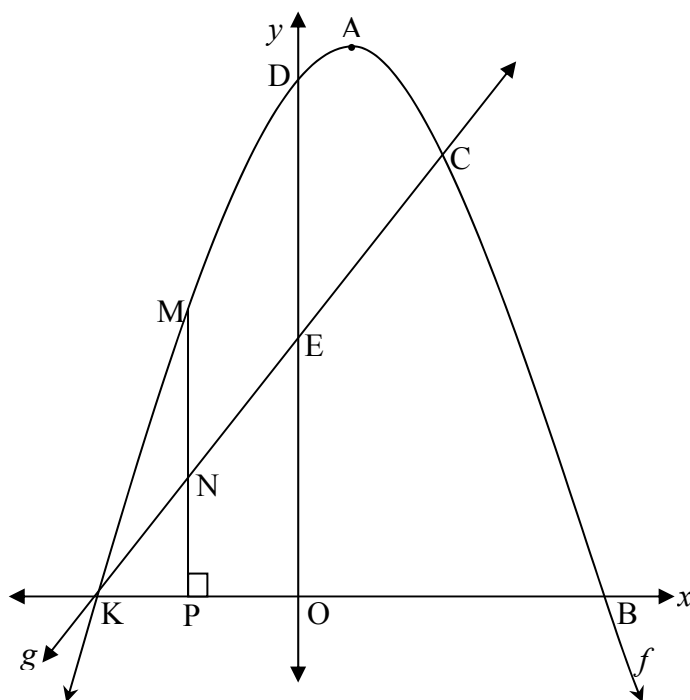
[7]

QUESTION 5

- 5.1 What do we call a graph defined by: $y = \frac{a}{x+p} + q$? (1)
- 5.2 Determine the value of p and q if the equations of the horizontal and vertical asymptotes are $y = -2$ and $x = 3$ and also write down the equation of the graph in terms of a . (3)
- 5.3 Determine the value of a if $T(1 ; -4)$ is a point on the curve. (2)
- 5.4 Write down the axis of symmetry of the curve. (2)

[8]**QUESTION 6**

The sketch is not drawn to scale, represents the graphs of:
 $f = \{(x ; y) : y = -x^2 + x + 6\}$ and $g = \{(x ; y) : y = 2x + 4\}$

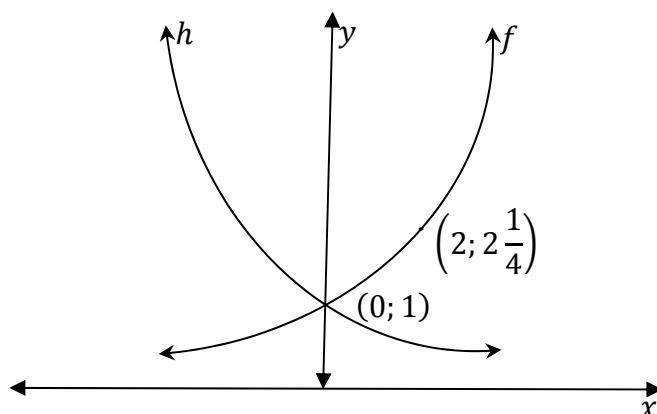


- 6.1 Calculate the coordinates of K , B and A , the turning point of the parabola. (4)
- 6.2 Calculate the length of DE . (2)
- 6.3 If $MN = 2$, calculate the possible length(s) of OP . (4)
- 6.4 Solve, for x , if $f(x) > g(x)$ (5)

[15]

QUESTION 7

In the graph f represents the function $f(x) = a^x$, ($a > 0$). h is symmetrical to f about the y -axis. The point $(2; 2\frac{1}{4})$ lies on the curve of f .



- 7.1 Find the value of a . (2)
- 7.2 If $g(x) = f^{-1}(x)$, the inverse function of f , determine the equation of g . (3)
- 7.3 Write down the domain of g . (1)
- 7.4 Determine the equation of h . (2)
- 7.5 Write down the range of h . (1)
- [9]**

QUESTION 8

A loan of R120 000 is approved by Super Save Bank at an interest rate of 13% per annum compounded monthly. The recipient of this loan has to repay the loan by making equal deposits into the account, for a period of 4 years.

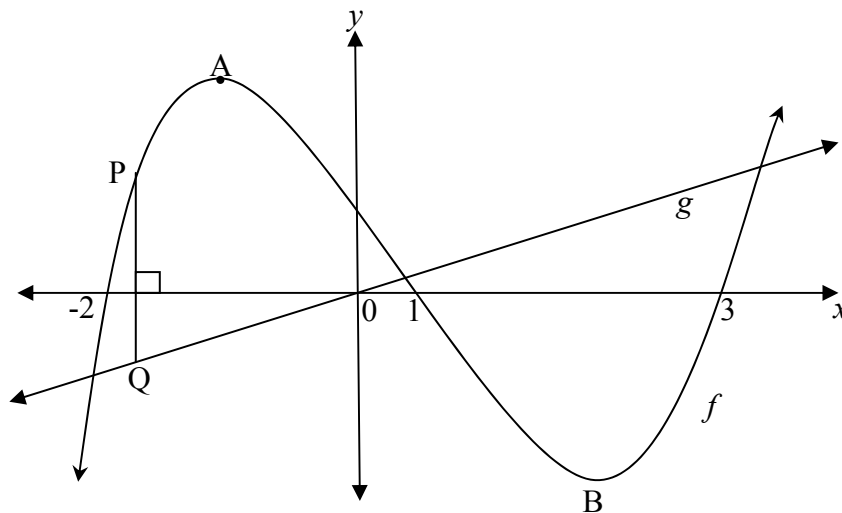
- 8.1 Determine the size of the monthly payment if the first payment is due at the end of the first month. (3)
- 8.2 If the recipient decided to pay R4 000 per month instead of the amount calculated in QUESTION 8.1, how long will it take to pay back the loan? (4)
- 8.3 How will you advise the loan recipient regarding the loan payments, based on the information above? (4)
- 8.4 After how many years will a share that cost R450 be worth R900 if it increases in value by 7,5% p.a.? (4)
- 8.5 If the share increases in value by 7,5% p.a. but inflation is set at around 6%, how does this affect the value of the share? (1)

[16]

QUESTION 9

9.1 If $f(x) = \frac{1}{2}x^2 - 2x$ determine the derivative, $f'(x)$, from first principles. (5)

9.2 Determine: $\frac{d}{dx} \left(4\sqrt{x} - \frac{8}{\sqrt{x}} + \pi x^3 \right)$ (4)
[9]

QUESTION 10

$$f(x) = x^3 + bx^2 + cx + d \text{ and } g(x) = 2x$$

The graph of f cuts the x -axis at $x = -2$, $x = 1$ and $x = 3$. The turning points of f are A and B. PQ cuts the x -axis, with P on f and Q on g , $x_p < 0$

10.1 Prove that the equation of f is given by: $f(x) = x^3 - 2x^2 - 5x + 6$ (3)

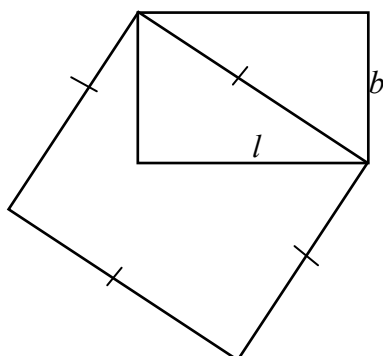
10.2 One of the tangents to the graph of f has a gradient of -1. Explain, in one sentence, why the point of contact of the tangent lies between A and B. (1)

10.3 Determine the coordinates of B. (6)

10.4 Determine the maximum length of the line PQ. (7)
[17]

QUESTION 11

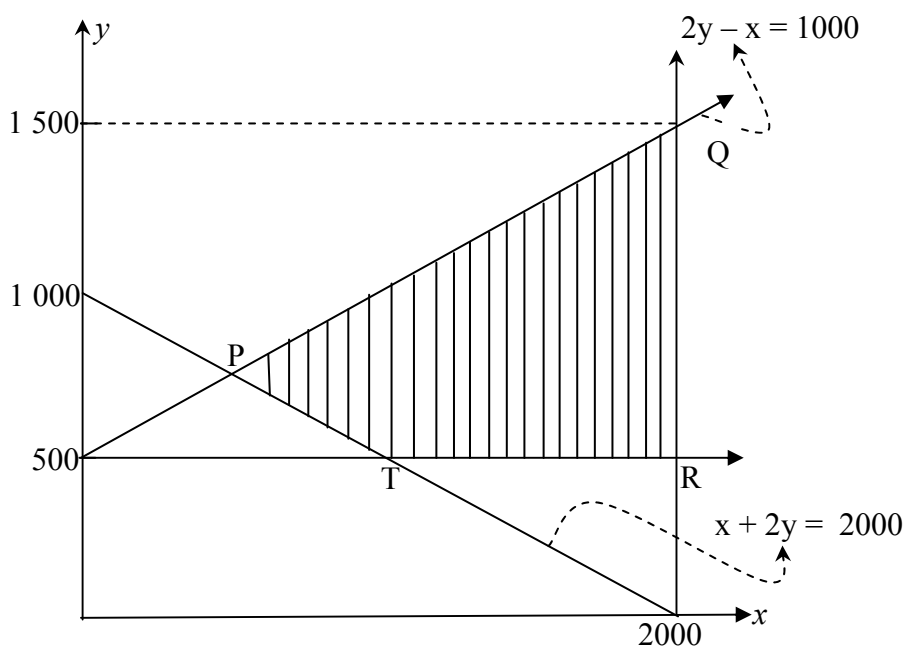
A rectangle of perimeter $2\sqrt{5}$ has a diagonal which is also the side of a square. The area of the square is three times the area of the rectangle. Determine the dimensions of the rectangle.



[9]

QUESTION 12

An entrepreneur manufactures two types of furniture pieces: chairs and tables. The costs are R250 per chair and R200 per table. He sells each chair for R300 and each table for R400. He makes x chairs and y tables each month, so that the points $(x ; y)$ lie only in the shaded(feasible) region below.



- 12.1 Write down the inequalities which describe the feasible region. (4)
- 12.2 Determine the coordinates of P and T. (6)
- 12.3 Determine the minimum total cost. (3)
- 12.4 Determine the maximum profit.. (3)
- 12.5 If the production cost for a table increases to R500, what would the minimum cost be? (2)

[18]

TOTAL: 150

INFORMATION SHEET: MATHEMATICS/INLIGTINGSBLAD: WISKUNDE

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

$$A = P(1 + ni)$$

$$A = P(1 - i)^n$$

$$\sum_{i=1}^n 1 = n$$

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

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

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

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

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

$$y = mx + c$$

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

$$\text{In } \triangle ABC: \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \quad a^2 = b^2 + c^2 - 2bc \cdot \cos A$$

$$\text{area } \triangle ABC = \frac{1}{2} ab \cdot \sin C$$

$$\sin(\alpha + \beta) = \sin \alpha \cdot \cos \beta + \cos \alpha \cdot \sin \beta$$

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

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

$$\sin 2\alpha = 2 \sin \alpha \cdot \cos \alpha$$

$$A = P(1 - ni)$$

$$A = P(1 + i)^n$$

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

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

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

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

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

$$m = \tan \theta \quad (x-a)^2 + (y-b)^2 = r^2$$

$$\sin(\alpha - \beta) = \sin \alpha \cdot \cos \beta - \cos \alpha \cdot \sin \beta$$

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

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