



Province of the  
**EASTERN CAPE**  
EDUCATION

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 11**

**MATHEMATICS – FIRST PAPER  
NOVEMBER 2009**

**MARKS: 150**

**TIME: 3 hours**

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This question paper consists of 9 pages, 1 diagram sheet and a formula sheet.

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**INSTRUCTIONS AND INFORMATION**

Read the following instructions carefully before answering the questions.

1. This question paper consists of 9 questions. Answer ALL the questions.
2. Show clearly ALL calculations, diagrams, graphs, etcetera, 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 question paper.
6. Diagrams are NOT necessarily 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 9. Write your name in the space provided and then hand the diagram sheet in with your ANSWER sheets.

**QUESTION 1**1.1 Solve for  $x$ :

$$1.1.1 \quad \frac{x}{2x+1} = \frac{2}{x+3} \quad (5)$$

$$1.1.2 \quad (x-3)(2x+1) = 5 \quad (5)$$

$$1.1.3 \quad 2x - 2 < -3x^2 - 6x - 6 \quad (4)$$

1.2 The equation  $rx^2 + sx + t = 0$  has roots  $\frac{7 \pm \sqrt{49 - (4)(6)}}{4}$ .  
Determine possible values for  $r$ ,  $s$  and  $t$ . (3)

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

$$2x = y - 8 \quad \text{and} \quad y + 16 = 2x^2 + 10x \quad (7)$$

**[24]**

**QUESTION 2**

2.1 Simplify without using a calculator:

$$\sqrt{\frac{2^{x+2} + 2^x}{2^{x-3}} + 9} \quad (4)$$

2.2 Given:  $P = \sqrt{\frac{2x+4}{5}} - \frac{1}{x}$

2.2.1 Determine the value(s) of  $x$  for which  $P$  is undefined. (1)2.2.2 For which value(s) of  $x$  will  $P$  be non-real? (2)

2.3 The sides containing the right-angle of a right-angled triangle are  $(\sqrt{5} + 1)$  units and  $(\sqrt{5} - 1)$  units in length. Calculate the length of the hypotenuse, leaving the answer in simplest surd form. (4)

**[11]**

**QUESTION 3**

3.1 Given the sequence:  $7 ; 3 ; -1 ; \dots$

3.1.1 Write down the next two terms of the sequence, if the sequence behaves consistently. (2)

3.1.2 Find the general term,  $T_n$ . (3)

3.1.3 What is the value of  $T_{11}$ ? (2)

3.1.4 Which term in the sequence is equal to -233? (2)

3.2  $T_n = 2^{n-1}$

3.2.1 Write down the first FOUR terms of the sequence. (4)

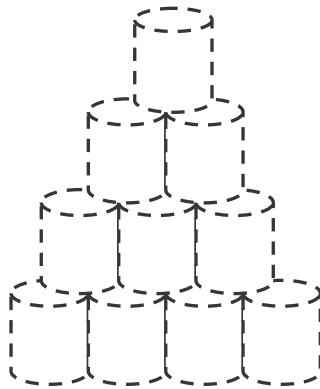
3.2.2 What will the sum of the first FOUR terms be? (1)

3.2.3 Which term will be equal to 64? (3)

**[17]**

**QUESTION 4**

The owner of a supermarket has asked you to stack 231 cans as shown in the diagram below.



You need to know how many cans to place in the bottom row to ensure that you end up with one can at the top.

You start by drawing up the following table:

Number of layers	Number of cans in the bottom row	Total number of cans used in the display
1	1	1
2	2	3
3	3	6
4	4	10

- 4.1 Determine the second difference between the terms of the sequence:  
1 ; 3 ; 6 ; 10 ... (1)
- 4.2 Find the general term for the total number of cans in the display for a given number of rows. (6)
- 4.3 How many cans should you place in the bottom layer as you start stacking? (4)
- [11]**

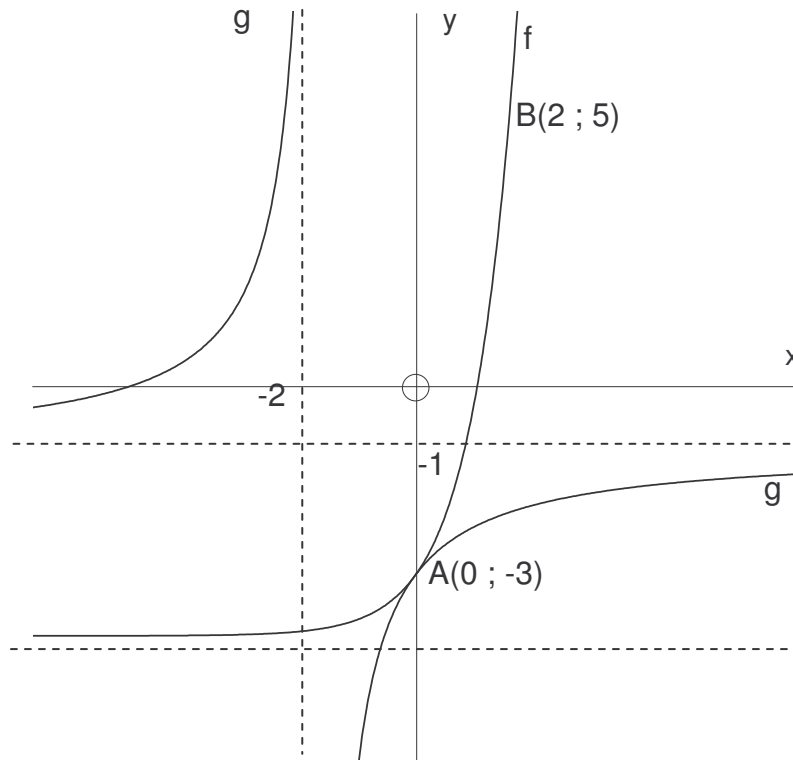
**QUESTION 5**

- 5.1 Mr George buys a car for R160 000. He pays a deposit of R50 000 and pays the rest off over three years at an interest rate of 10% p.a. compounded monthly. This amount is divided into equal monthly instalments. Calculate his monthly instalment amount. (6)
- 5.2 A fridge was originally bought for R4 800 and was sold for R1 000 five years later. Determine the rate of depreciation if it is calculated on a reducing balance. (5)
- 5.3 Vuyo wants to save for an overseas trip in 3 years time. The bank offers her an interest rate of 9,5% p.a. compounded quarterly for the first year and then 11% p.a. compounded monthly for the remaining two years.
- 5.3.1 How much must Vuyo invest NOW in order to receive R45 000 in 3 years time? (5)
- 5.3.2 What is the effective annual interest rate for the first year? (3)
- [19]**

## QUESTION 6

Given:  $f(x) = b^x + c$  and  $g(x) = \frac{a}{x+p} + q$

The graph of  $f(x)$  passes through the point  $B(2 ; 5)$  and the two graphs intersect at  $A(0 ; -3)$ .



- 6.1 6.1.1 Determine the equation of the asymptote of  $f$ . (2)
- 6.1.2 Hence, determine the equation of  $f$ . (3)
- 6.2 If  $b = 3$  and  $c = -4$ , calculate, correct to three decimal places, the value of  $f(-5)$ . (2)
- 6.3 If  $h(x) = b^x$ , describe the transformation of  $f$  to  $h$ . (1)
- 6.4 Determine the equation of  $k$  if  $k$  is a reflection of  $h$  in the  $y$ -axis. (1)
- 6.5 Write down the equations of the asymptotes of  $g$ . (2)
- 6.6 Determine the equation of  $g$ . (3)
- 6.7 Determine the value of  $x$  if  $C(x ; -2)$  lies on the graph of  $g$ . (3)

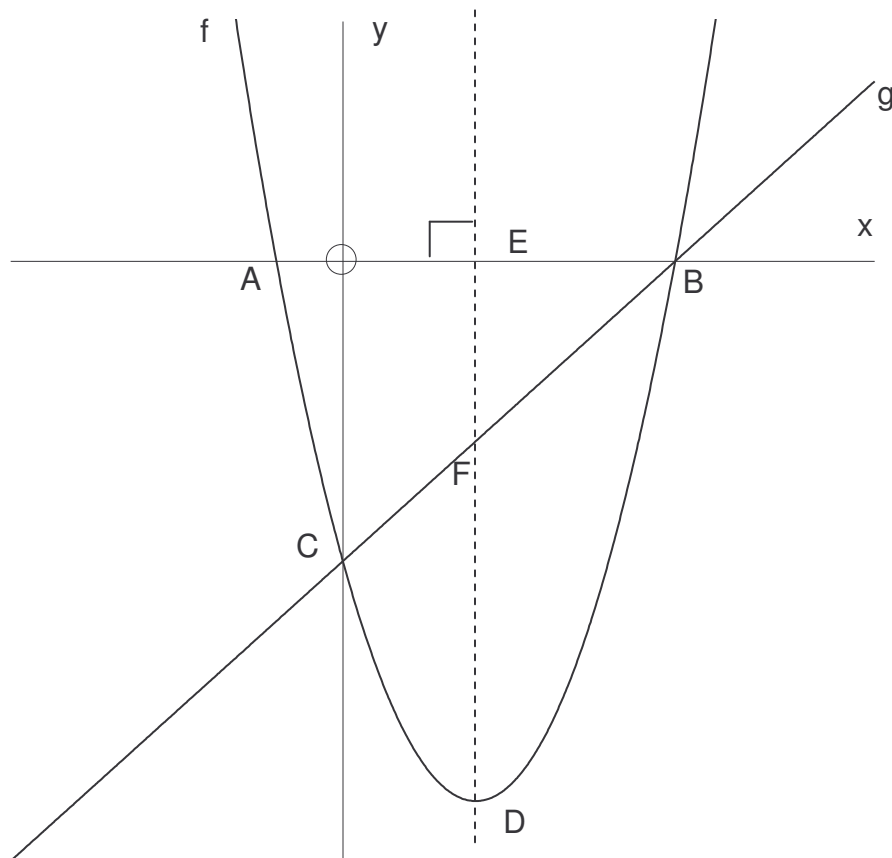
[17]

**QUESTION 7**

In the accompanying graph the following functions are represented:

$$f(x) = x^2 - 4x - 5 \quad \text{and} \quad g(x) = mx + k.$$

D is the turning point of f.

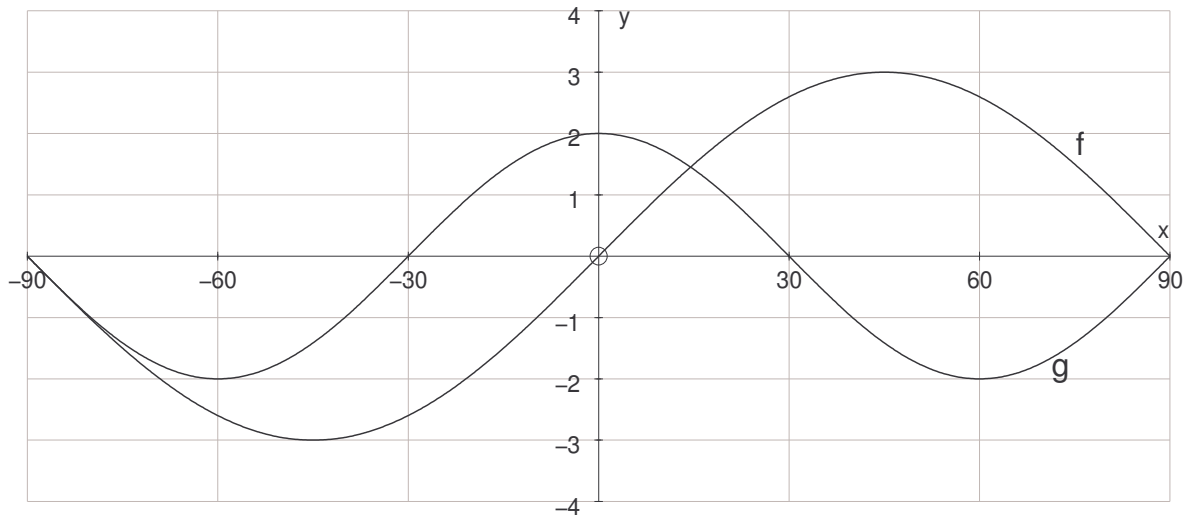


- 7.1 Change the equation to the form  $f(x) = a(x - p)^2 + q$  by completing the square, and hence deduce that the turning point of f is at (2 ; -9). (3)
- 7.2 Write down the equation of the line passing through D and E. (1)
- 7.3 Give the coordinates of the turning point of  $f(x - 2)$ . (2)
- 7.4 Determine the coordinates of C. (1)
- 7.5 Determine the average gradient of the curve f between  $x = 1$  and  $x = 0$ . (4)
- 7.6 If the point B is an x-intercept of f, determine its coordinates. (4)
- 7.7 Calculate the values of m and k. (2)
- 7.8 Find the length of FD. (4)
- 7.9 For which values of k will  $f(x) + k$  not intersect the x-axis? (2)

## QUESTION 8

The graphs represent the following functions:

$$f(x) = a \sin bx \quad \text{and} \quad g(x) = c \cos dx \quad \text{for } x \in [-90^\circ ; 90^\circ].$$



- 8.1 Write down the values of  $a$ ,  $b$ ,  $c$  and  $d$ . (4)
- 8.2 Determine the range of  $h$  if  $h(x) = f(x) - 1$ . (2)
- 8.3 Determine the period of  $k$  if  $k(x) = 2g(x)$ . (1)
- 8.4 For which values of  $x$  is  $f(x)$  increasing in value as  $x$  increases? (2)

**[9]**



**QUESTION 9**

- 9.1 If  $x$  fridges and  $y$  freezers are manufactured in the Frosty Freezer Factory monthly, express the following constraints as inequalities.
- The Frosty Freezer Factory cannot manufacture more than 240 units per month.
  - The retailers require a minimum of 20 fridges and 50 freezers every month.
  - Each fridge requires a manufacturing time of 60 hours, while freezers only need 30 hours. There is a maximum 9 000 hours available per month to the workers of the Frosty Freezer Factory.
  - The number of freezers manufactured must be at least the same as the number of fridges.
- (5)
- 9.2 Graph the inequalities on the graph paper provided on the diagram sheet. Clearly indicate the feasible region.
- (8)
- 9.3 The Frosty Freezer Factory makes a profit of R120 on each fridge and R90 on each freezer sold. Write down an expression for the monthly profit and make use of your graph to determine how many of each type should be made to ensure a maximum profit.
- (6)

**[19]****TOTAL: 150**