



Province of the  
**EASTERN CAPE**  
EDUCATION

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 11**

**NOVEMBER 2018**

**TECHNICAL MATHEMATICS P1**

**MARKS:** 150

**TIME:** 3 hours

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This question paper consists of 10 pages, including 1 diagram sheet.

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**INSTRUCTIONS AND INFORMATION**

Read the following instructions carefully before answering the questions:

1. This question paper consists of EIGHT questions. Answer ALL the questions.
2. Clearly show 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 ALL answers should be rounded off to TWO decimal places, unless stated otherwise.
5. Number your answers correctly, according to the numbering system used in this question paper.
6. Diagrams are NOT necessarily drawn to scale.
7. A diagram sheet has been provided for QUESTION 6.4.  
Write your name in the space provided then hand in the diagram sheet with your ANSWER SHEET(S).

**QUESTION 1**

1.1 Simplify the following WITHOUT the use of a calculator:

1.1.1  $\left(\frac{2}{3^{-2}}\right)^{-1}$  (Leave your answer with POSITIVE exponents) (3)

1.1.2  $\left(3 - \frac{1}{x}\right)\left(9 + \frac{3}{x} + \frac{1}{x^2}\right)$  (2)

1.1.3  $\frac{\sqrt{32} + \sqrt{8}}{6\sqrt{2}}$  (4)

1.1.4  $\frac{3 \cdot 3^x - 4 \cdot 3^{x+2}}{2 \cdot 3^x - 3^{x+1}}$  (4)

1.2 Given:

$$A = \log \left( \frac{9c^3}{100} \right)$$

1.2.1 Expand A. (2)

1.2.2 Hence, determine the value of  $\log \left( \frac{9c^3}{100} \right) - 3 \log c$ , if  $\log 3 = \frac{12}{5}$  (3)

1.3 The Bank of South Africa uses a Digital Coded Decimal Locks (DCDL) to open all its entry doors.

The diagram below models the DCDL used by the Bank.



Determine the decimal code for DCDL with binary code =  $100001_2 - 1111_2$  (4)

1.4 Show that:

$$1.4.1 \quad \frac{x^2 + xy}{2x^3 - x^2y - 3xy^2} - \frac{1}{2x - 3y} = 0 \quad (3)$$

$$1.4.2 \quad \log 6 + 2\log 20 - \log 3 - 3\log 2 = 2 \quad (4)$$

[29]

## QUESTION 2

2.1 Solve for  $x$ :

$$2.1.1 \quad (\sqrt{x} + \sqrt{2})(\sqrt{x} - \sqrt{2}) = 0 \quad (2)$$

$$2.1.2 \quad 4x^{\frac{5}{2}} = 128 \quad (3)$$

$$2.1.3 \quad \frac{3^x + 3^{x+1}}{6^x \cdot 3} = \frac{2}{3} \quad (6)$$

$$2.1.4 \quad \log_3 x + \log_3 4 = \log_7 \left( \frac{1}{49} \right) \quad (6)$$

2.2 Given:

$$F = \frac{k \cdot Q_1 \times Q_2}{r^2}$$

2.2.1 Make  $r$  the subject of the formula. (2)

2.2.2 If  $Q_1 = 8 \times 10^{-7}$ ,  $Q_2 = 8 \times 10^{-7}$ ,  $F = 8,64 \times 10^{-3}$  and  $k = 9 \times 10^9$  ...  
determine  $r$ . (2)

[21]

## QUESTION 3

3.1 Solve for  $x$  if:

$$3.1.1 \quad x(x + 6) = 0 \quad (2)$$

$$3.1.2 \quad 3x^2 - 5x = 2 \quad (4)$$

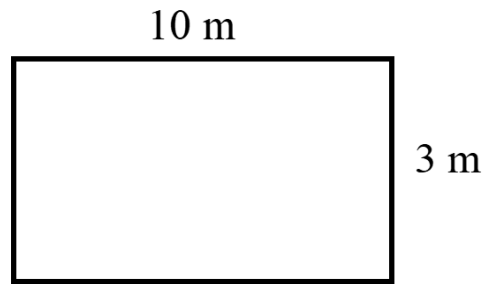
$$3.1.3 \quad 2x - \frac{1}{x} = 3 \text{ (correct to ONE decimal place)} \quad (6)$$

$$3.1.4 \quad x^2 - 7x + 10 < 0 \quad (3)$$

3.2 Solve for  $x$  and  $y$  simultaneously in the following equations: (6)

$$y + 2x - 3 = 0 \text{ and } y = x^2 + 2x + 3$$

- 3.3 The length of a rectangle is 10 m and the width is 3 m as shown in the diagram below:



Determine the amount by which the length and the width must be increased to double the area of the rectangle.

(6)  
[27]

#### QUESTION 4

- 4.1 Classify the following numbers as, **Integers, Imaginary, Irrational numbers and Rational:**

$$\sqrt{-4} ; \sqrt{6} ; -\sqrt{121} \quad (4)$$

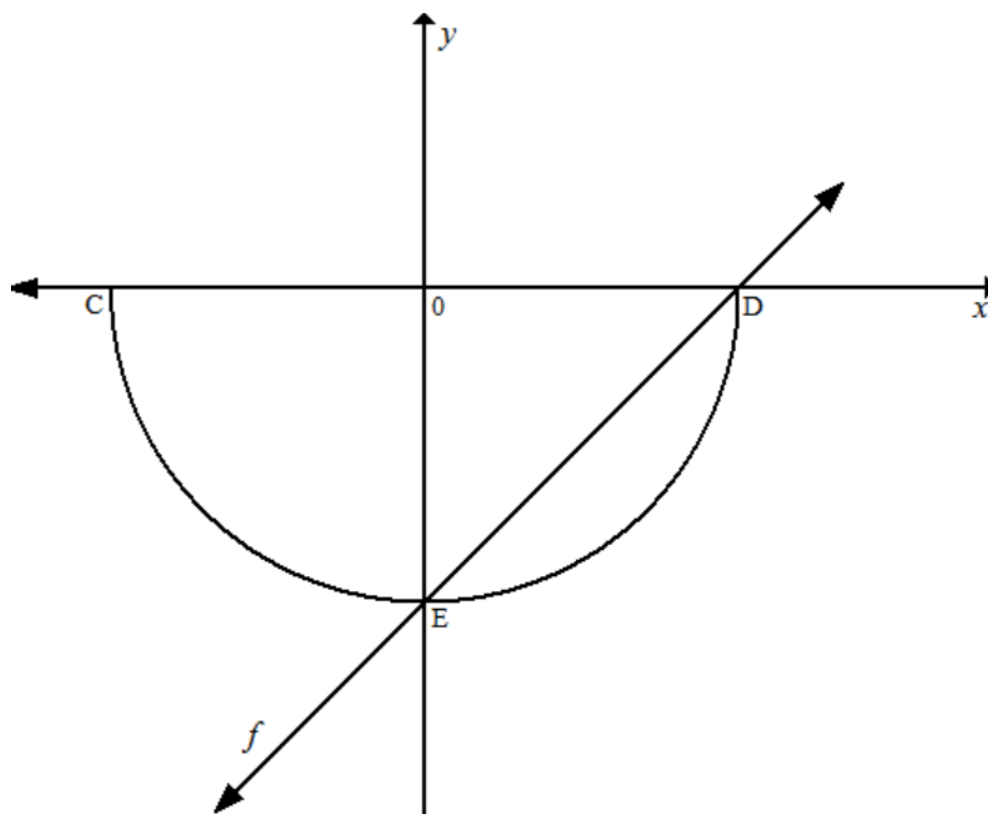
- 4.2 Determine the nature of roots of  $g(x) = 2x^2 + 5x + 3$  (4)

- 4.3 Calculate the value(s) of  $p$  for which  $h(x) = 2x^2 + px + 3$  will have equal roots. (4)  
[12]

**QUESTION 5**

The diagram below represents a linear function,  $f(x) = ax + q$  and the semi-circle,  $y = -\sqrt{9 - x^2}$ .

- Points C and D are  $x$ -intercepts of the semi-circle.
- E is the  $y$ -intercept of semi-circle.
- The linear function and the semi-circle intersect at points E and D.



- 5.1 Determine the value of  $q$ . (3)
- 5.2 Write down the value of  $a$ . (1)
- 5.3 Hence, write down the equation of  $f$ . (2)
- 5.4 Determine the length of DE. (3)
- [9]**

**QUESTION 6**

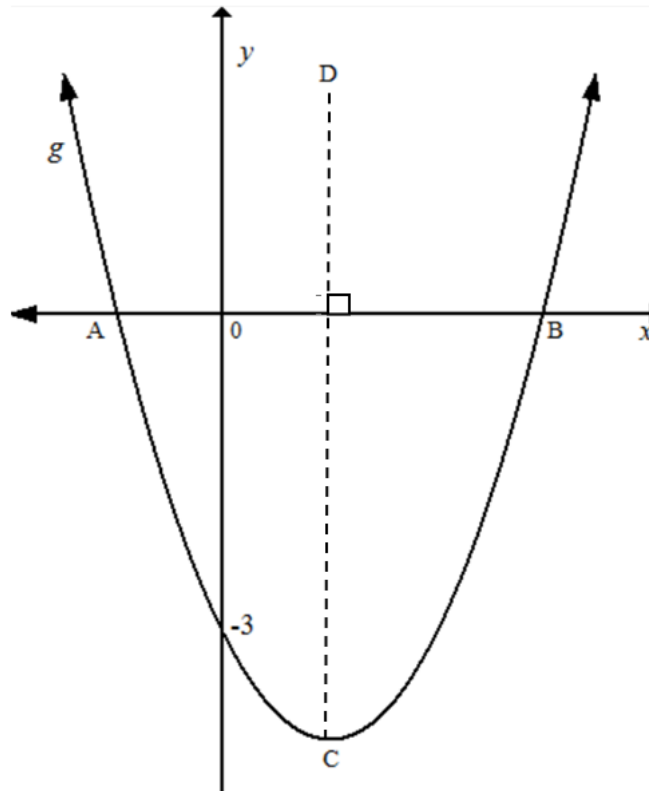
Given the graphs of functions  $f$  and  $h$  defined by  $f(x) = \frac{2}{x} + 1$  and  $h(x) = 2^x$ .

- 6.1 Determine the  $x$ -intercept of  $f$ . (2)
- 6.2 Write down the  $y$ -intercept of  $h$ . (1)
- 6.3 Write down the equations of asymptotes of  $f$ . (2)
- 6.4 On the DIAGRAM SHEET provided, sketch the graph of  $f$  and  $h$  on the same set of axes. Clearly show all the asymptotes and the intercepts on the axes. (5)
- 6.5 Write down the domain of  $f$ . (2)
- 6.6 The graphs of  $f$  and  $h$  intersect at points A and B (1, 33; 2, 51).
- 6.6.1 Label points A and B on the graphs drawn in QUESTION 6.4. (1)
- 6.6.2 Determine the POSITIVE values of  $x$  for which  $h(x) > f(x)$ . (2)
- 6.7 Determine the equation of  $g$  if  $g$  is a result of a reflection of  $f$  about the  $x$ -axis. (1)

**[16]**

**QUESTION 7**

- 7.1 The graph of a function  $g$  defined by  $g(x) = x^2 - 2x - 3$  is drawn below.
- The graph of  $g$  intersects the  $y$ -axis at  $-3$  and the  $x$ -axis at point A and point B.
  - C is the turning point of  $g$ .



- 7.1.1 Write down the value of  $x$  for which  $g(x) = -3$ . (1)
- 7.1.2 Determine the coordinates of A and B. (3)
- 7.1.3 Determine the coordinates C. (4)
- 7.1.4 Write down the range of  $g$ . (2)
- 7.1.5 The graph of  $g(x)$  is shifted vertically resulting to  $h(x)$  that has non-real roots.  
Determine ALL possible values of the constant term of  $h(x)$ . (4)
- 7.2 Determine the average gradient of  $f(x) = x^2 + x - 1$  between  $x = 1$  and  $x = 3$ . (5)

**[19]**



**QUESTION 8**

- 8.1 Olwethu buys a spray-painting machine for R5 600 on a hire-purchase, she pays equal monthly payments over 3 years for the machine.

- The interest rate charged is 11, 5% per annum.
- She also takes out an insurance premium of R12 per month, to cover the cost of damage or theft.

Determine:

8.1.1 the actual amount she paid for the spray-painting machine. (3)

8.1.2 the amount she paid each month. (3)

- 8.2 A car with a value of R200 000 depreciates, on a reducing balance, to a quarter of its original price after 5 years.

Determine the rate at which the car depreciated. (4)

- 8.3 Sima invests a certain amount of money for 10 years. She receives an interest rate of 11% p.a. compounded monthly for the first 6 years. The interest rate changes to 13% p.a. compounded quarterly for the remaining 4 years of the term. The money grows to R300 000 at the end of the investment period.

Calculate:

8.3.1 The effective interest rate p.a. during the first 6 years. (3)

8.3.2 The initial amount of money Sima invested. (4)

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**TOTAL: 150**

**DIAGRAM SHEET****LEARNER NAME:** ..... **CLASS:** .....**SCHOOL NAME:** .....**QUESTION 6.4**