



Province of the
EASTERN CAPE
EDUCATION

**NATIONAL
SENIOR CERTIFICATE**

GRADE 11

NOVEMBER 2019

TECHNICAL MATHEMATICS P1

MARKS: 150

TIME: 3 hours



This question paper consists of 11 pages, including 1 answer 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 your answers.
4. An approved scientific calculator (non-programmable and non-graphical) may be used, unless stated otherwise.
5. If necessary, ALL answers should be rounded off to TWO decimal places, unless stated otherwise.
6. Number the answers correctly according to the numbering system used in this question paper.
7. Diagrams are NOT necessarily drawn to scale.
8. An ANSWER SHEET is attached for QUESTION 5.4. Write your name in the spaces provided and hand in with your ANSWER BOOK.
9. Write neatly and legibly.

QUESTION 1

1.1 Simplify the following WITHOUT using a calculator:

$$1.1.1 \quad \frac{12^{x+1}}{6^x \cdot 2^{x+1}} \quad (3)$$

$$1.1.2 \quad \frac{5^{n+1} + 6 \cdot 5^{n-1}}{5^{n+1} + 5^n} \quad (4)$$

$$1.1.3 \quad \frac{\sqrt{75} - \sqrt{12}}{\sqrt{48}} \quad (3)$$

$$1.1.4 \quad \left(2 - \frac{\sqrt{7}}{2}\right)^{\frac{1}{2}} \cdot \left(2 + \frac{\sqrt{7}}{2}\right)^{\frac{1}{2}} \quad (5)$$

$$1.1.5 \quad \log_4 64 - 4(\log_4 2 - \log_7 1) \quad (5)$$

1.2 Prove that:

$$\log_9 \left(\frac{1}{9}\right) + \log 100 = 1 \quad (3)$$

1.3 Convert 53 to a binary number. (2)

1.4 Simplify, showing all calculations, the following binary operation:

$$11011_2 \times 111_2 \quad (4)$$

1.5 Simplify, $\frac{(4,8 \times 10^3)(3^2 \times 10^{-2})}{2,4 \times 10^4}$ in **scientific notation** without any rounding. (2)

[31]

QUESTION 2

2.1 Solve for $x \in \mathbb{R}$, WITHOUT using a calculator:

$$2.1.1 \quad \frac{6}{(x)^{\frac{2}{3}}} = 54 \quad (3)$$

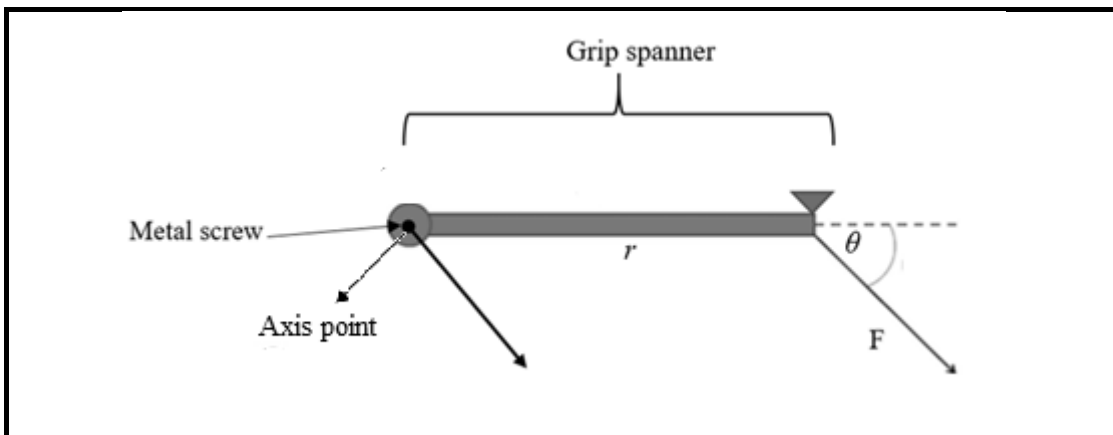
$$2.1.2 \quad \frac{4^{2x+1} - 16^{x-1}}{63} = \frac{1}{4} \quad (5)$$

$$2.1.3 \quad 7 = x - \sqrt{x+5} \quad (5)$$

$$2.1.4 \quad \log_8(x-8) + \log_8(x+2) = \log_8 11 \quad (5)$$

$$2.1.5 \quad \log x = \frac{\log_5\left(\frac{1}{5}\right) - \log_2 4}{\log 2 + \log 5} \quad (5)$$

2.2 The diagram below shows a grip spanner of length r turning a metal screw that is fixed at the axis point.



The formula for torque (T), the turning effect that causes rotation of the spanner, is

defined by:
$$r = \frac{T}{F \cdot \sin \theta}$$

Where:

T is Torque

F = Linear force applied to the object

r = The distance measured from the axis of rotation to where the linear force is applied

θ = The angle of rotation of the grip spanner

2.2.1 Make F the subject of the formula. (1)

2.2.2 Determine the amount of force exerted to the edge of the spanner, if the spanner, 2 units long, has its torque equal to 4 at an angle of 57° . (2)

[26]

QUESTION 3

3.1 Solve for x :

3.1.1 $0 = (4x + 1)(x + 1)$ (2)

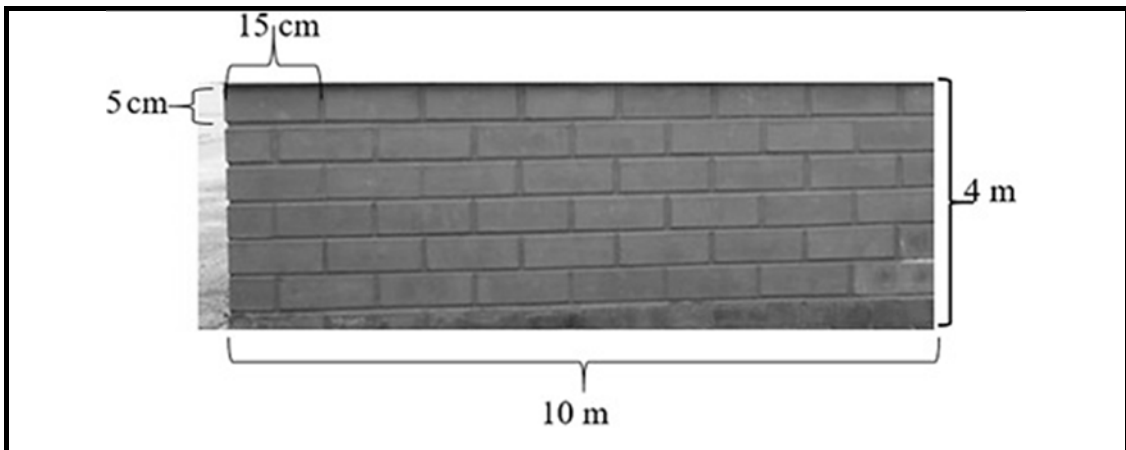
3.1.2 $x^2 - 7x - 1 = 0$ (correct to TWO decimal places) (4)

3.1.3 $2x^2 - 1 \geq x$, also represent the solution on a number line. (5)

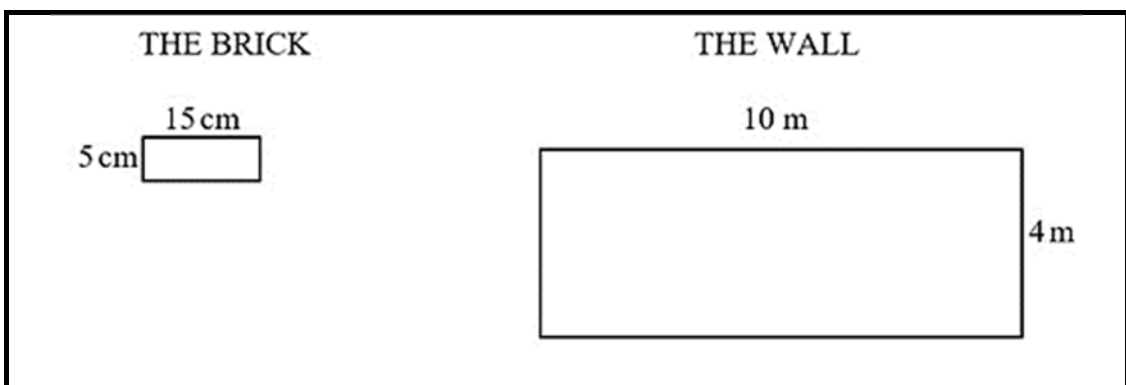
3.2 Solve for x and y simultaneously in the following equations:

$x - y = 1$ and $2x^2 + 3y + 3 = 0$ (7)

3.3 The picture below shows the wall that was built using $15\text{ cm} \times 5\text{ cm}$ bricks. The length of the wall is 10 metres and the height of the wall is 4 metres.



The diagrams below model the brick and the wall:



$\text{Area}_{\text{rectangle}} = \text{length} \times \text{breadth}$

Determine the total number of bricks used to build the above wall without any shortage of bricks if a single line of bricks was used to build the wall. (Round answer to a full brick.)

(6)
[24]

QUESTION 4

Given :

$$f(x) = 4x^2 - x + 3$$

- 4.1 Determine the numerical value of $b^2 - 4ac$ for f . (2)
- 4.2 Hence, describe the nature of the roots of f . (1)
- 4.3 Determine, showing all calculations, the value(s) of the constant term for which f will have equal roots. (3)

[6]

QUESTION 5

Given:

$$f(x) = \frac{1}{x} - 3$$

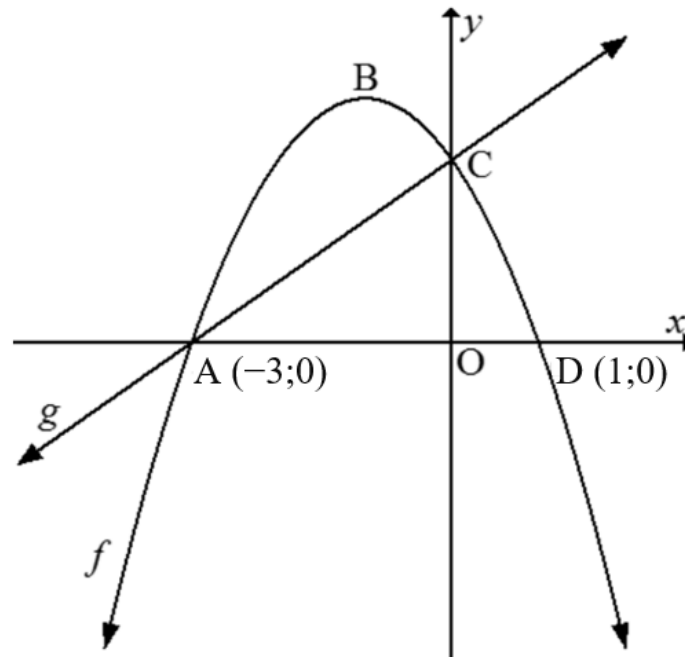
- 5.1 Write down the equations of the asymptotes of f . (2)
- 5.2 Determine the x - intercept of f . (2)
- 5.3 Show whether the point $\left(-2; -\frac{7}{2}\right)$ lies on the graph of f or not. (3)
- 5.4 Sketch the graph of f on the ANSWER SHEET provided. Clearly show all the asymptotes and intercepts with the axes. (3)
- 5.5 Write down the range of f . (1)
- 5.6 Write down the values of x for which $f(x) \geq 0$. (3)
- 5.7 Write down the equation of the function defined by $g(x)$, a reflection of $f(x)$ about the y -axis. (2)

[16]

QUESTION 6

The graphs of functions f and g defined by $f(x) = ax^2 + bx + c$ and $g(x) = mx + c$ are drawn below.

- A $(-3;0)$ and D $(1;0)$ are x -intercepts of f
- B is the turning point of f .
- C is the y -intercept of both f and g respectively.



Determine:

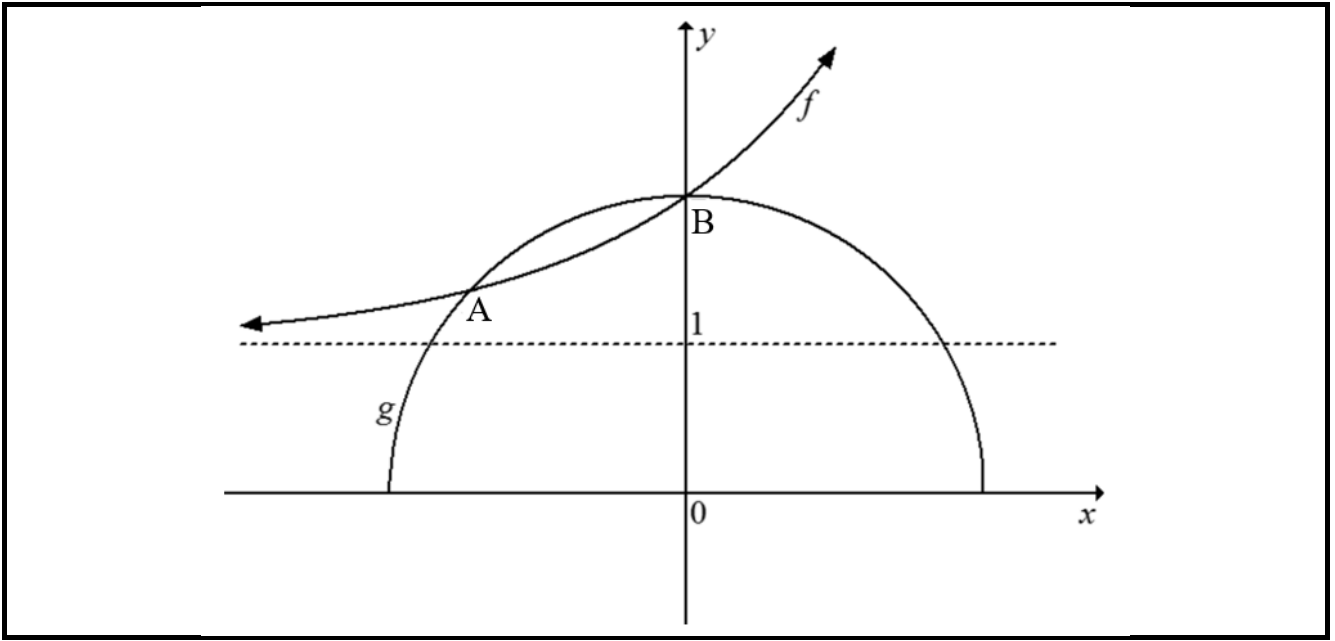
- 6.1 The equation of the axis of symmetry of f (2)
- 6.2 The coordinates of C, if the area of $\triangle AOC$ is equal to 6 square units (3)
- 6.3 Numerical values of a , b and c in f (5)
- 6.4 The y -coordinate of the turning point B (2)
- 6.5 The equation of g (3)
- 6.6 The y -intercept of $h(x)$, if $h(x)$ is a reflection of $f(x)$ about the x -axis and then shifted up 2 units (3)

[18]

QUESTION 7

In the diagram, drawn below, is an exponential function f defined by $f(x) = 2^{x+k}$ and a semi-circle g defined by $g(x) = \sqrt{r^2 - x^2}$.

- $y = 1$ is the asymptote of $f(x)$
- A and B are the points of intersection of f and g



Determine the:

- 7.1 Numerical value of k (1)
 - 7.2 Coordinates of B (2)
 - 7.3 Equation of the semi-circle (2)
 - 7.4 Domain of g (3)
 - 7.5 y -coordinate of A if the x -coordinate is $-1,466$ and the average gradient of AB is $0,44$ (3)
- [11]

QUESTION 8

8.1 Andrea bought a plasma television at R3 500 hire purchase price. She paid 15% deposit and continued to pay the balance on a monthly basis over 24 months.

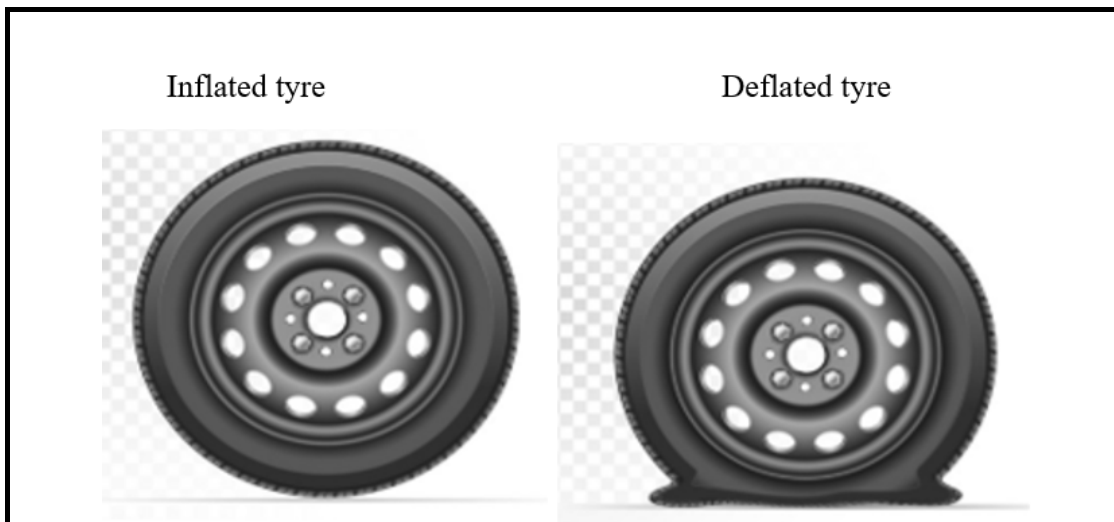
Determine:

8.1.1 The amount Andrea paid as a deposit (1)

8.1.2 The total amount paid at the end of 24 months if the interest rate charged was 8% per annum (4)

8.2 Calculate the nominal interest rate of an investment if the effective interest rate is 7,5% per annum compounded quarterly. (4)

8.3 The air pressure of a tyre deflated from 220 kPa at a depreciation rate of 4,5 % kPa per minute.



8.3.1 Write down the initial air pressure of the tyre. (1)

8.3.2 Determine the air pressure of the tyre after 15 minutes. (3)

8.4 Elrich is saving money to buy equipment for his small company to be established in 5 years' time. He deposits an initial amount of R18 000 into a savings account at 8,5% per annum compounded monthly. At the end of the third year he deposits R15 595 into the account at the same rate.

Calculate the value of his investment at the end of 5 years. (5)
[18]

TOTAL: 150

ANSWER SHEET

Name and Surname:

School:

QUESTION 5.4

