



Province of the
EASTERN CAPE
EDUCATION

**NATIONAL
SENIOR CERTIFICATE**

GRADE 11

NOVEMBER 2020

**TECHNICAL MATHEMATICS P1
(EXEMPLAR)**

MARKS: 150

TIME: 3 hours



* I T M A T E 1 *

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 6.5. Write your name in the spaces provided and then hand in the diagram sheet with your ANSWER SHEET.
9. Write neatly and legibly.

QUESTION 1

1.1 Simplify the following WITHOUT using a calculator:

$$1.1.1 \quad \left(3pq^{\frac{1}{2}}\right)^2 \quad (2)$$

$$1.1.2 \quad \sqrt[6]{64p^{12}q^6} + \sqrt[3]{8p^6q^3} \quad (4)$$

$$1.1.3 \quad \frac{(4^{-1})^3 \cdot 2^{3n-2}}{4^{3n+2} \cdot \left(\frac{1}{8}\right)^{n+3}} \quad (5)$$

$$1.1.4 \quad \frac{3\sqrt{8} + \sqrt{18}}{4\sqrt{50} - 2\sqrt{2}} \quad (4)$$

$$1.1.5 \quad \frac{\log_x 27 + 3\log_x \sqrt[3]{9}}{2\log_x \sqrt{3}} \quad (5)$$

$$1.1.6 \quad \frac{x^2 - 25}{x^2 + 7x + 10} - \frac{x^2 - 2x + 4}{x^3 + 8} \quad (5)$$

1.2 Convert $110\,100_2$ to decimal notation. (2)

1.3 Evaluate $11\,000_2 - 111_2$, WITHOUT using a calculator. (2)

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QUESTION 2

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

2.1.1 $40x^{\frac{3}{4}} = 5$ (Leave the answer with a POSITIVE exponent) (4)

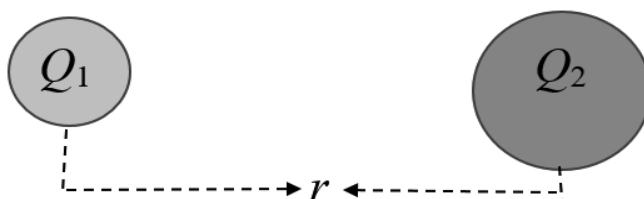
2.1.2 $\frac{3^{x+1} + 15 \cdot 3^{x-1}}{8 \cdot 9^x} = 27$ (5)

2.1.3 $\sqrt{8}(2\sqrt{x} + \sqrt{18}) = 1$ (5)

2.1.4 $\log_3(x-8) = -1$ (3)

2.2 Show that: $\log 25 + \log 8 - \log 3 = 2$ (4)

2.3 The diagram below shows two charged particles, Q_1 and Q_2 . The distance between their centres is r .



$F_e = k \frac{Q_1 \times Q_2}{r^2}$ is the Coulombs formula for the electric force between the two charges, with k as the Coulomb constant $= 9 \times 10^9 \text{ N} \cdot \text{m}^2 \cdot \text{C}^{-2}$.

2.3.1 Make Q_2 the subject of the formula in the above formula. (2)

2.3.2 If it is given that, $F_e = 3 \times 10^{-12} \text{ N}$ and the distance between the two charges $Q_1 = 2 \times 10^{-2} \text{ C}$ and Q_2 is 3 m:

Determine the value of Q_2 . (2)

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QUESTION 33.1 Solve for x :

$$3.1.1 \quad (x-1)(x+2) = 4 \quad (4)$$

$$3.1.2 \quad 3x^2 - 5 = x \text{ (correct to ONE decimal place)} \quad (4)$$

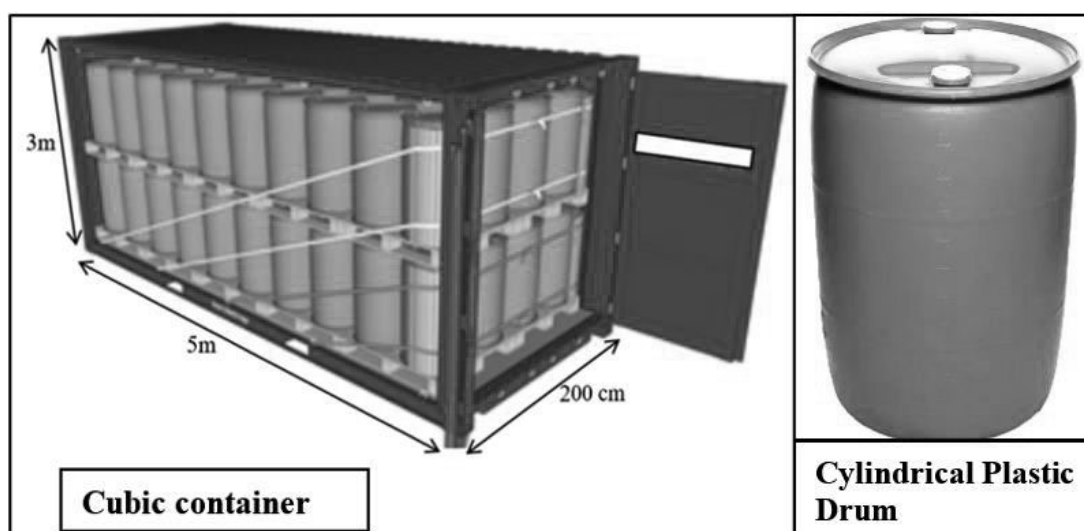
$$3.1.3 \quad -3x^2 - x + 2 \geq 0, \text{ also represent the solution on a number line.} \quad (4)$$

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

$$y - 2x = -1 \text{ and } x^2 + x + y - y^2 = 0 \quad (7)$$

3.3 The picture below shows a red cubic container fully loaded with two layers of cylindrical plastic drums that are filled to capacity with cooking oil.

The dimension of the cubic container are: Length = 5 m
 Width = 200 cm
 Height = 3 m



The following formula may be used:

$$V = l \times w \times h$$

3.3.1 Convert 200 cm to m. (2)3.3.2 Calculate the total volume of the cubic container, in m^3 . (3)

3.3.3 Determine the volume of a cylindrical plastic drum, in m^3 , if the total number of plastic drums inside the container is 80 and the volume between the plastic drums as well as the plastic drums and the closed container is $0,5 \text{ m}^3$. (4)

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QUESTION 4

Given:

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

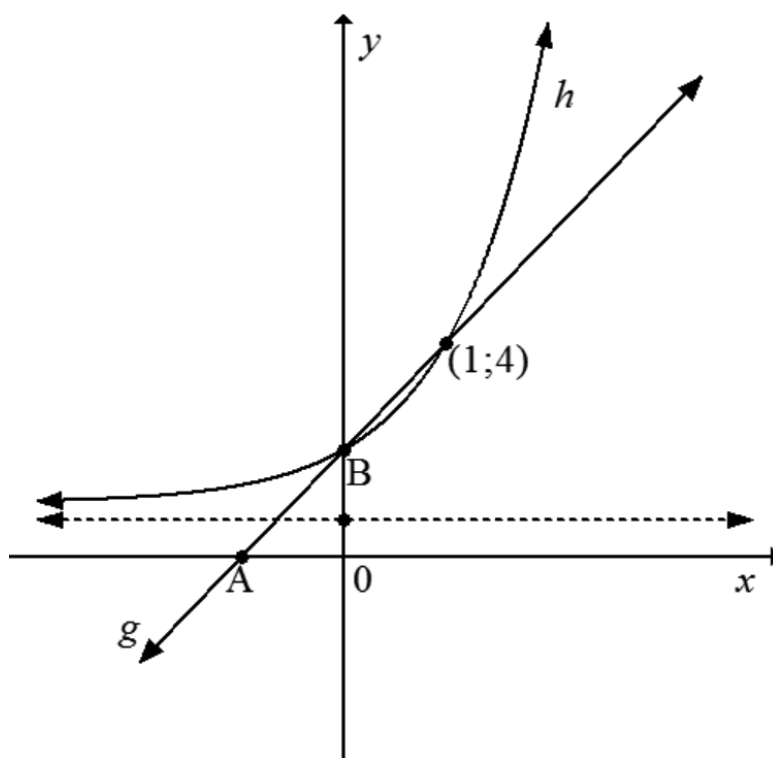
Determine:

- 4.1 The value(s) of x for which $f(x)$ will have equal roots (2)
- 4.2 The value(s) of x for which $f(x)$ will be undefined (2)
- 4.3 The nature of the value(s) of $f(x)$ if $x = 1$ (4)
- [8]**

QUESTION 5

Sketched below are the graphs of functions g and h defined by $g(x) = 2x + 2$ and $h(x) = 3^x + 1$

- The two graphs cut each other at point B and point (1; 4)
- Point A is the x -intercept of g
- The dotted line is the asymptote of h



- 5.1 Write down the coordinates of B. (2)
- 5.2 Determine the coordinates of A. (2)
- 5.3 Write down the equation of the asymptote of h . (1)
- 5.4 Write down the domain of h . (1)
- 5.5 Determine the values of x for which $g(x) < h(x)$. (2)
- 5.6 State, with reasons, whether g and h are increasing or decreasing. (2)
- 5.7 Write down the defining equation of the function $f(x)$ that resulted from shifting the graph of $h(x)$ 1 unit to the right. (2)
- 5.8 Calculate the area of $\triangle AOB$. (4)

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QUESTION 6

Given the function f defined by $f(x) = -(x-1)^2 + 4$:

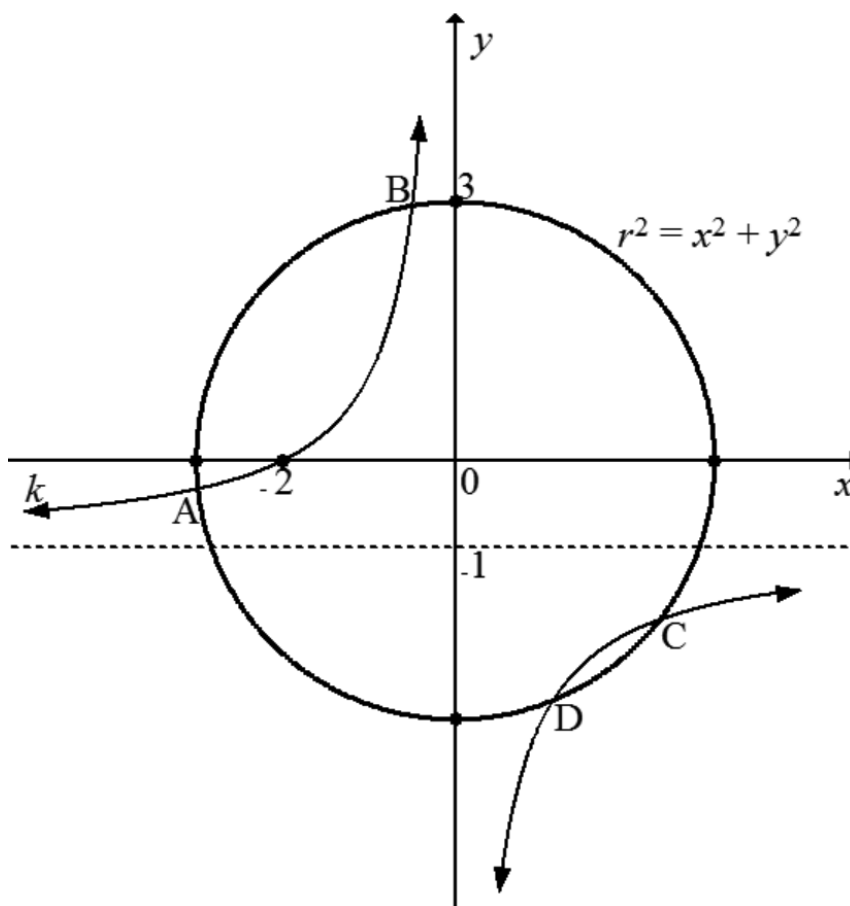
- 6.1 Write down the equation of the axis of symmetry of f . (1)
- 6.2 Calculate the y -intercept of f . (2)
- 6.3 Determine the x -intercept of f . (4)
- 6.4 Write down the coordinates of the turning point of $f(x)$ (2)
- 6.5 Sketch the graph of $f(x)$ on the DIAGRAM SHEET provided at the end. Clearly indicate the turning point and the intercepts with the axis. (4)
- 6.6 Write down the range of f . (2)
- 6.7 State, with reasons, if f has a maximum or minimum turning point. (2)

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QUESTION 7

The diagram below shows graphs of $r^2 = x^2 + y^2$ and $k(x) = \frac{a}{x} + q$ intersecting at points A, B, C and D.

- The circle cuts the y -axis at 3.
- $x = -2$ is the x -intercept of k .
- $y = -1$ is the asymptote of k .



- 7.1 Determine the equation of the circle. (3)
- 7.2 Write down the numerical value of q . (1)
- 7.3 Determine the equation of k . (3)
- 7.4 Determine the equation of $f(x)$, the reflection of $k(x)$ about the x -axis. (2)

[9]

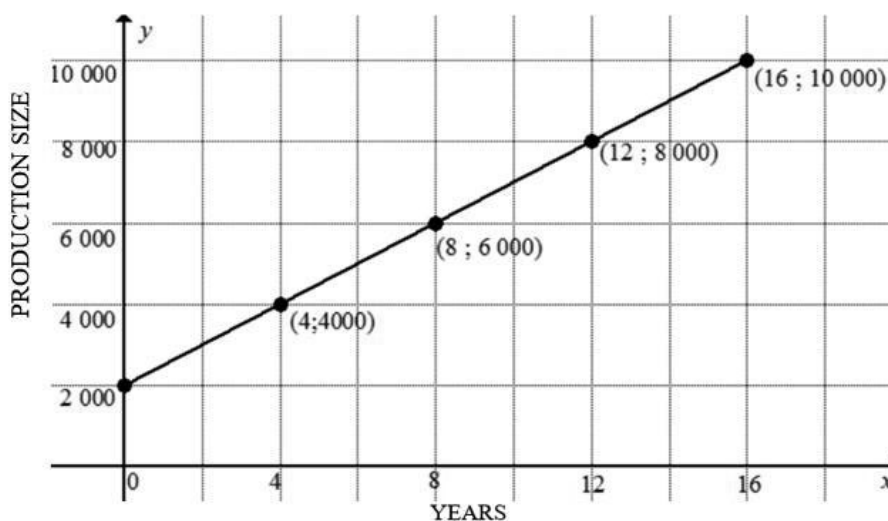
QUESTION 8

- 8.1 The value of a twin tub washing machine depreciates at a rate of 6% per annum, on a reducing balance, compounded monthly.

8.1.1 Calculate the effective interest rate of the machine. (3)

8.1.2 Determine the initial value of the machine if it depreciates to R1 200 at the end of the third year. (3)

- 8.2 The graph below represents the annual growth rate at which the production of plastic bags in a small company grows over a period of time, in years.



8.2.1 Use the graph and write down the total number of plastic bags at the beginning of the production process. (1)

8.2.2 Describe the type of growth rate per annum represented by the production process. (1)

8.2.3 Determine the rate at which the production of plastic bags grew during the first 16 years. (3)

8.2.4 Determine the number of plastic bags produced at the end of 19 years if the production of plastic bags continues to grow at the same rate. (3)

- 8.3 Jim invests R8 000 in an investment account which accumulated 7% per annum interest rate, compounded semi-annually. He further added R6 000 in the investment account at the end of 3 years. Determine how much money the account accumulated at the end of the 10-year investment period if the interest rate remained the same throughout the investment period. (4)

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TOTAL: 150

ANSWER SHEET

Name:

School:

QUESTION 6.5