



Education and Sports Development

**Department of Education and Sports Development
Department van Onderwys en Sport Ontwikkeling
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NORTH WEST PROVINCE**

NATIONAL SENIOR CERTIFICATE

GRADE 12

TECHNICAL MATHEMATICS PAPER 1

JUNE 2019

MARKS : 150

TIME : 3 hours

**This question paper consists of 7 pages, 2 answer sheets and
information sheet consisting of 2 pages.**



NW/JUNE/TEC-MATH/ EMIS/6*****

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 9 questions.
2. Answer ALL the questions.
3. Answer **QUESTION 5.1.3** and **QUESTION 8.5** on the ANSWER SHEETS provided.
Hand in the ANSWER SHEETS with your ANSWER BOOK.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Clearly show ALL calculations, diagrams, graphs etc. that you have used in determining your answers.
6. Answers only will NOT necessarily be awarded full marks.
7. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
8. If necessary, round off answers to TWO decimal places, unless stated otherwise.
9. Diagrams are NOT necessary drawn to scale.
10. Write neatly and legibly.

QUESTION 11.1 Solve for x :

1.1.1 $(x+2)(x-6) = 0$ (2)

1.1.2 $5x(x-2) = 3$ (correct to TWO decimal places) (5)

1.1.3 $x(x+3) \geq 0$ and represent the solution on a number line. (5)

1.2 Solve for x and y simultaneously:

$y - x = 2$ and $x^2 + xy = y^2 - 4$ (7)

1.3 The formula below represents the gravitational force (F), G as gravitational constant, m_1 as mass of the first object, m_2 as mass of the second object and r as the distance between two objects.

$$F = \frac{Gm_1m_2}{r^2}$$

1.3.1 Make m_1 the subject of the formula. (2)1.3.2 Calculate the value of m_1 if $F = 665 \text{ N}$, $G = 6,67 \times 10^{-11}$,
 $m_2 = 5,98 \times 10^{24}$ and $r = 6,38 \times 10^6$. (2)

1.4 Express 98 as a binary number. (2)

[25]**QUESTION 2**2.1 Consider the expression: $x = \frac{\sqrt{1-x}}{5x}$ Determine the value(s) of x for which the roots are:

2.1.1 Equal to 0 (2)

2.1.2 Real (3)

2.1.3 Non-real (3)

[8]

QUESTION 3

- 3.1 Simplify the following by showing all the calculations, WITHOUT THE USE OF A CALCULATOR:

$$3.1.1 \quad \frac{9^{n-1} \times 27^{3-2n}}{81^{2-n}} \quad (6)$$

$$3.1.2 \quad \sqrt{12} + 4\sqrt{75} \text{ (Leave your answer in surd form)} \quad (2)$$

$$3.1.3 \quad \log_3(1) + \log_k(k) \quad (2)$$

$$3.1.4 \quad 2\log 10 + 4\log 100 - \log_3 9 \quad (3)$$

3.2 Solve for x : $\log(x+3) + \log(x-6) = 1$ (6)
[19]

QUESTION 4

- 4.1 Simplify and leave your answer in the form of $a + bi$:

$$4.1.1 \quad 2 - 4i + 2i - 1 \quad (2)$$

$$4.1.2 \quad (2 - 3i)(i - 4) \quad (4)$$

4.2 Express the complex number $z = -\sqrt{3} - 2i$ in the polar form $z = r\text{cis}\theta$ (5)

4.3 Solve for x and y if: $2x - 12i = 2 + 8yi$ (4)
[15]

QUESTION 5

5.1 Given: $f(x) = \frac{4}{x} - 1$

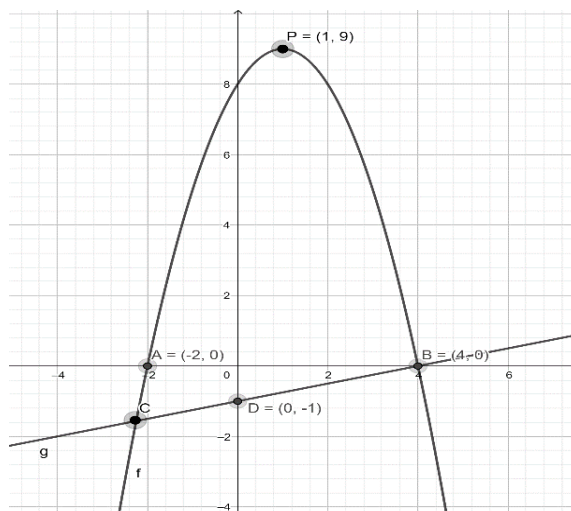
5.1.1 Write down the asymptote(s) of f . (2)

5.1.2 Determine the coordinates of the x -intercept of f . (3)

5.1.3 Sketch the graph of h on the ANSWER SHEET provided. Clearly show the asymptote(s) and the intercepts with the axes. (4)

5.2 Below is graphs of a parabola f and a straight line g .

$P(1;9)$ is the turning point of f . f and g intersect the y -axis at $(0;-1)$. B and C intersects for f and g . B is the point on the on the x -axis.

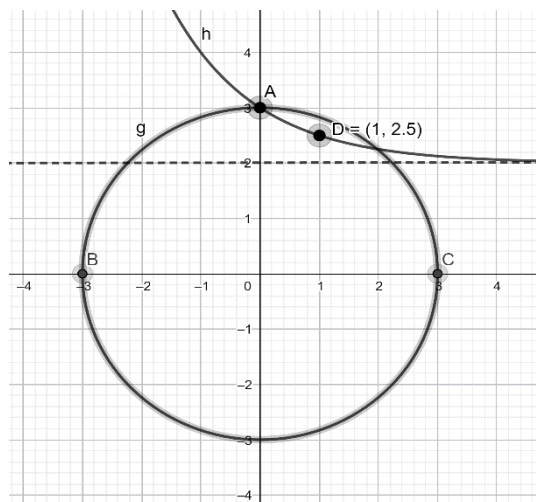


5.2.1 Show that $f(x) = -x^2 + 2x + 8$ the equation of the function is. (4)

5.2.2 Calculate the average gradient of $f(x)$ between $x = 2$ and $x = 4$. (4)

5.3 Sketched below are the graphs of g and h .

$D(1;2.5)$ is a point on the graph of h .



5.3.1 Write down the coordinates of A, B and C. (3)

5.3.2 Determine the equation of g . (3)

5.3.3 Write down the equation of the asymptote of h . (1)

5.3.4 Determine the equation of h in the form $y = a.b^x + q$ ($a \neq 0$). (5)

[29]

QUESTION 6

- 6.1 Roy invests R8 000 into a savings account and the bank gave a nominal interest rate of 12% p.a. compounded monthly.
- 6.1.1 Determine the effective annual rate. (Rounded to 2 decimal places) (4)
- 6.1.2 Use the effective rate to calculate the value of Roy's investment over 3 years. (3)
- 6.2 A young entrepreneur deposited R70 000 into an account which offers an interest rate of 11,5% compounded quarterly. After 12 months the entrepreneur deposits an additional R30 000 into the account and 3 years later withdraws R20 000. How much will he have in his account after 10 years? (7)
- [14]**

QUESTION 7

- 7.1 Determine $f'(x)$ using FIRST PRINCIPLES if $f(x) = 5x - 3$ (5)
- 7.2 Determine:
- 7.2.1 $\frac{d}{dx}(-2x^3 + x^2 - 3x + 4)$ (3)
- 7.2.2 $\frac{dy}{dx}$ if $y = 2\sqrt{x} - \frac{1}{x}$ (3)
- 7.3 Determine the equation of the tangent to the curve of the function defined by $f(x) = 2x^2 + 3x$ at the point $(2;5)$. (5)
- [16]**

QUESTION 8

Given: $f(x) = x^3 - 3x^2 - x + 3$

- 8.1 Determine the y -intercept. (1)
- 8.2 Prove that $x - 1$ is a factor of $f(x)$. (2)
- 8.3 Hence, determine the x -intercept(s). (4)
- 8.4 Determine the stationary points / turning points. (5)
- 8.5 Sketch the graph of f on the ANSWER SHEET provided. Clearly show ALL the intercepts with the axis and the turning points. (5)

[17]**QUESTION 9**

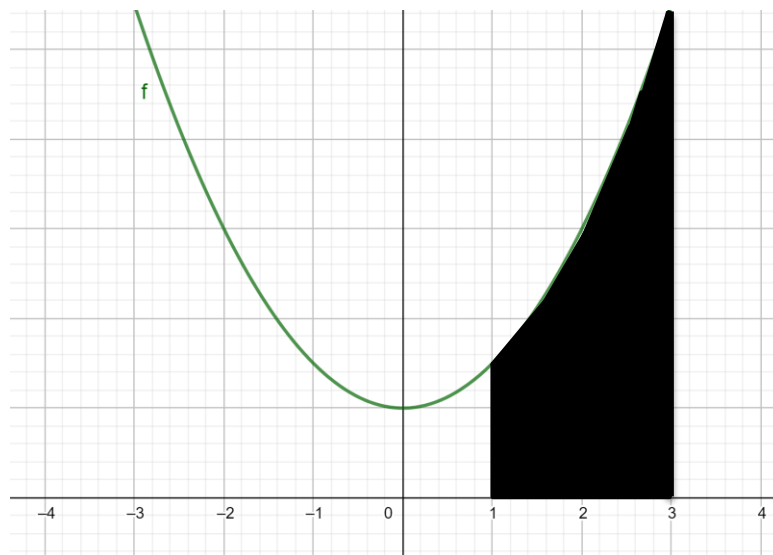
9.1 Determine the following integral:

$$\int 5x \, dx \quad (2)$$

9.2 Below is a sketch representing the bounded area under the curve of the function defined by: $f(x) = 2x^2 + 1$.

Determine the area of the shaded part. (5)

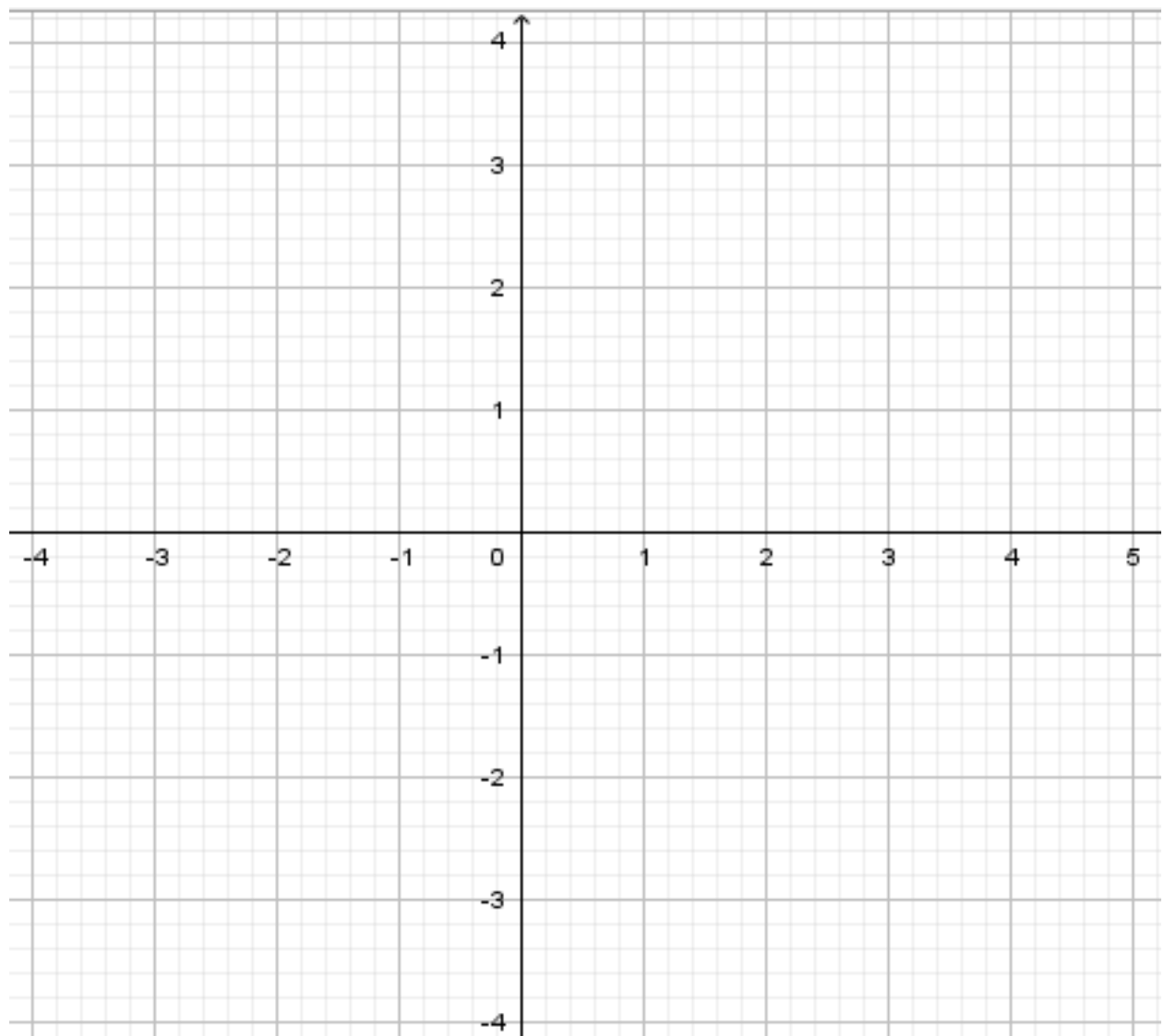
$$f(x) = 2x^2 + 1$$

**[7]****TOTAL: 150**

ANSWER SHEET

NAME OF LEARNER:

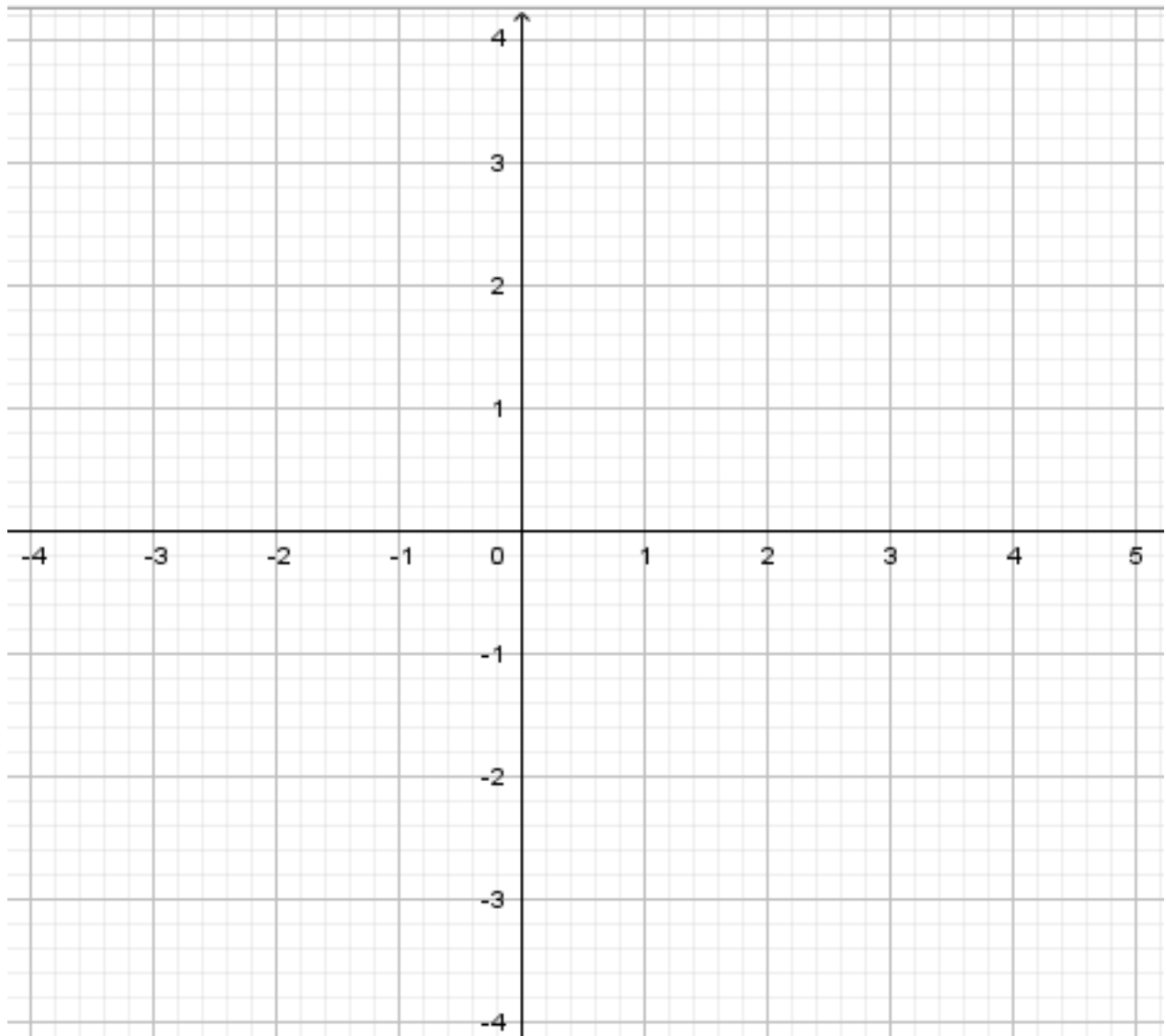
QUESTION 5.1.3



ANSWER SHEET

NAME OF LEARNER:

QUESTION 8.5



INFORMATION SHEET: TECHNICAL MATHEMATICS

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

$$x = -\frac{b}{2a}$$

$$y = \frac{4ac - b^2}{4a}$$

$$a^x = b \Leftrightarrow x = \log_a b, \quad a > 0, a \neq 1 \text{ and } b > 0$$

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

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

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

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

$$i_{eff} = \left(1 + \frac{i^m}{m}\right)^m - 1$$

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

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

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

$$y = mx + c$$

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

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

$$m = \tan \theta$$

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

$$\text{In } \triangle ABC: \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cdot \cos A$$

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

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$1 + \tan^2 \theta = \sec^2 \theta$$

$$\cot^2 \theta + 1 = \operatorname{cosec}^2 \theta$$

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

$$\int x^n dx = \frac{x^{n+1}}{n+1} + C, \quad n \neq -1$$

$$\int \frac{1}{x} dx = \ln(x) + C, \quad x > 0$$

$$\int a^x dx = \frac{a^x}{\ln a} + C, \quad a > 0$$

$$\pi \text{ rad} = 180^\circ$$

$$\text{Angular velocity} = \omega = 2\pi n = 360^\circ n \quad \text{where } n = \text{rotation frequency}$$

$$\text{Circumferential velocity} = v = \pi D n \quad \text{where } D = \text{diameter and } n = \text{rotation frequency}$$

$$s = r\theta \quad \text{where } r = \text{radius and } \theta = \text{central angle in radians}$$

$$\text{Area of a sector} = \frac{rs}{2} = \frac{r^2\theta}{2} \quad \text{where } r = \text{radius, } s = \text{arc length and } \theta = \text{central angle in radians}$$

$$4h^2 - 4dh + x^2 = 0 \quad \text{where } h = \text{height of segment, } d = \text{diameter of circle and } x = \text{length of chord}$$

$$A_T = a \left(\frac{o_1 + o_n}{2} + o_2 + o_3 + o_4 + \dots + o_{n-1} \right) \quad \text{where } a = \text{equal parts, } o_i = i^{\text{th}} \text{ ordinate and } n = \text{number of ordinates}$$

OR

$$A_T = a(m_1 + m_2 + m_3 + \dots + m_n) \quad \text{where } a = \text{equal parts, } m_1 = \frac{o_1 + o_2}{2}$$