



mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

MINE SURVEYOR'S CERTIFICATE OF COMPETENCY EXAMINATION

MATHEMATICS

DATE: 02 MAY 2017

**TOTAL MARKS: 100
TO PASS: 50**

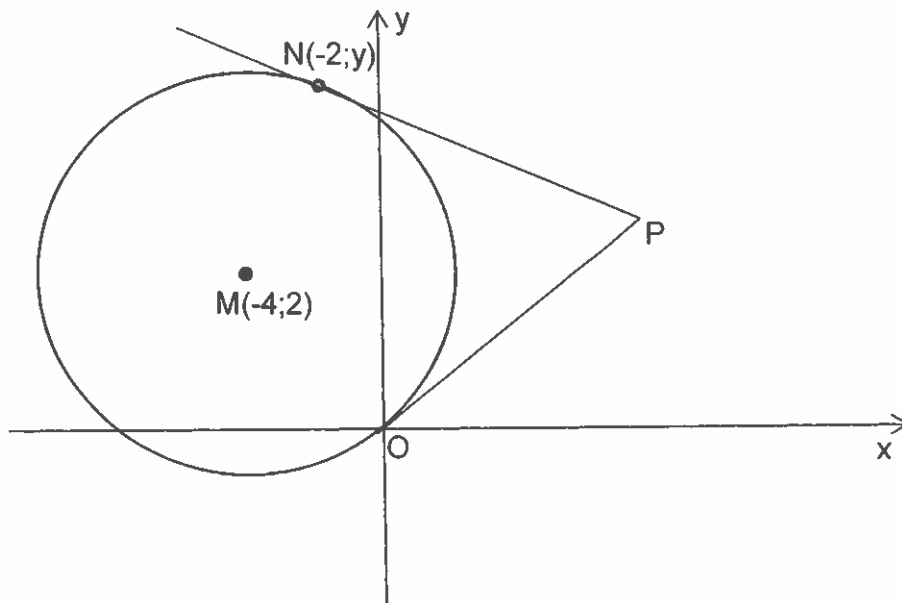
**TIME ALLOWED: 3 HOURS
(08h30 to 11h30)**

NOTE:

- This question paper consists of **FIVE** pages including cover page.
- All questions must be answered.
- All answers and sketches to be presented in a neat and decipherable manner. Papers will not be marked if not decipherable.
- Restrict the use of highlighters.
- Do not use a red pen.
- Read the instructions on the front page of your answer book carefully.
- No cellular phones shall be allowed in the examination venue.
- The use of computers, laptops and palmtops is prohibited.
- The make and model of your calculator must be shown on the front cover of your answer book.
- All steps must be shown.

QUESTION 1

A circle with centre $M(-4;2)$ has the points $O(0;0)$ and $N(-2;y)$ on the circumference. The tangents at O and N meet at P .



Determine:

- | | |
|--------------------------------|-----|
| (a) the equation of the circle | (4) |
| (b) the value of y | (2) |
| (c) the equation of OP | (3) |
| (d) the co-ordinates of P . | (7) |

[16 marks]

QUESTION 2

Given the function $f(x) = x^2 + 3x + 2$, determine:

(a) $\frac{f(x+h) - f(x)}{h}$ (6)

(b) $f'(x)$, the derivative of $f(x)$ (2)

(c) $f'(-1)$, the derivative of $f(x)$ at $x = -1$. (2)

[10 marks]

QUESTION 3

Determine whether the points are collinear (lie on a straight line):

(a) A(-1;0) and B(1;2) and C(3;4) (3)

(b) P(-1;0) and Q(2;-1) and R(5;5) (3)

(c) M(-3;4) and N(-1;3) and O(1;0) (3)

[9 marks]

QUESTION 4

Solve for x :

(a) $\frac{3}{x-4} + \frac{x-3}{x} = 2$ (5)

(b) $125^{3x-2} = 25^{4x+10}$ (4)

(c) $3^x - 3^{x-2} = 72$ (4)

(d) $\frac{x^2 - 2x - 3}{x - 3} = 2$ (6)

[19 marks]

QUESTION 5

Evaluate:

(a) $\frac{25^n \cdot 36^{n+1}}{81 \cdot 30^{2n}}$ (4)

(b) $\lim_{x \rightarrow 6} \frac{(x^2 - 36)}{(x^2 - 6x)}$ (3)

[7 marks]

QUESTION 6

(a) Express the following series in sigma (Σ) notations:

(i) $1 + 5 + 9 + \dots + 21$

(ii) $2 + 6 + 18 + \dots + 162$

(6)

(b) For the series $\sum_{k=1}^n (22 - 2k)$, determine:

(i) the first three terms of the series (2)

(ii) the hundredth term (T_{100}) of the series (3)

(iii) the value of n if $\sum_{k=1}^n (22 - 2k) = 80$ (6)

[17 marks]

QUESTION 7

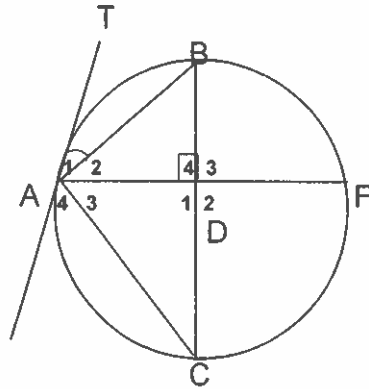
In the diagram below, BC is a diameter of the circle.

AF is a chord intersecting BC at D.

TA is a tangent to the circle at A.

AF is perpendicular to BC.

Let angle $A_1 = x$.



Prove that:

- (a) angle $A_2 = x$ (5)
- (b) $\triangle ADB \parallel \triangle CDA$ (3)
- (c) $DF^2 = DB \cdot CD$ (3)

[11 marks]

QUESTION 8

- (a) Calculate, without using a calculator, the value of $\sin(90^\circ + 2\theta)$ if $3\cos\theta = 1$ (6)

- (b) Prove the following identity:
 $\sin(45^\circ + x) \cdot \sin(45^\circ - x) = \frac{1}{2}\cos 2x$ (5)

[11 marks]

TOTAL [100 marks]