



mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

MINE SURVEYOR'S CERTIFICATE OF COMPETENCY EXAMINATION

MATHEMATICS

DATE: 30 SEPTEMBER 2015

**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) Express the following series in sigma (Σ) notation:

(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

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

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

(11)

[17 marks]

QUESTION 2

$f(x) = ax^2 + bx$. C is a parabola that passes through the points $A(-1;0)$, $B(0;6)$, C and $D(3;0)$. C is the turning point.

$g(x) = dx + e$ is a straight line that passes through the points D , C and E .

Determine by calculation:

(a) the values of a , b and c

(6)

(b) the length of OF and FC

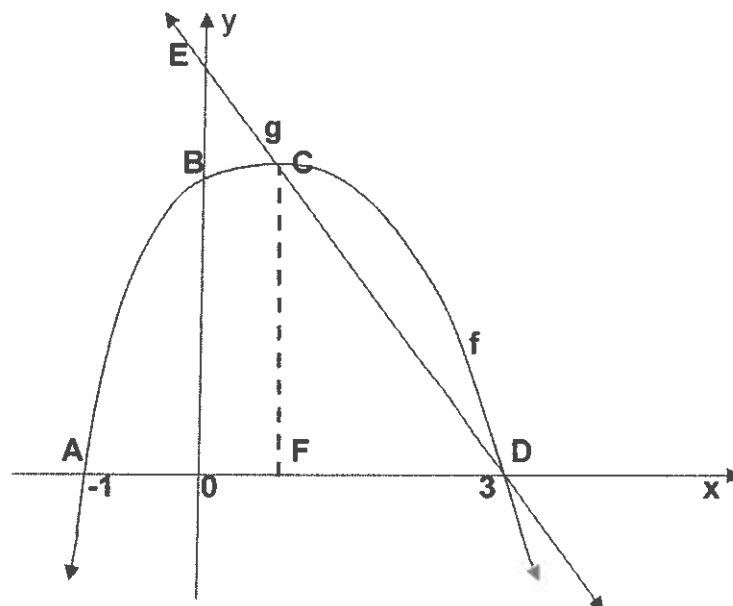
(6)

(c) the values of d and e

(4)

(d) the length of BE .

(2)



[18 marks]

QUESTION 3

Given : $g(x) = 2x^2$

Determine the average gradient of g between the points with $x = -3$ and $x = 5$.

[5 marks]

QUESTION 4

Determine :

(a) $\frac{d}{dx} (\frac{1}{3}x^3 + 2\sqrt{x})$ (3)

(b) $f'(2)$ if $f(x) = x^3 + x^{-2}$ (3)

(c) $\frac{dy}{dt}$ if $y = \frac{t^2 - 1}{2t + 2}$ (4)

[10 marks]

QUESTION 5

Solve for x :

(a) $5^{2x+1} + 5^{x+1} - 5^x = 1$ (7)

(b) $9 \cdot 3^{2x} + 1 = 6 \cdot 3^x$ (6)

[13 marks]

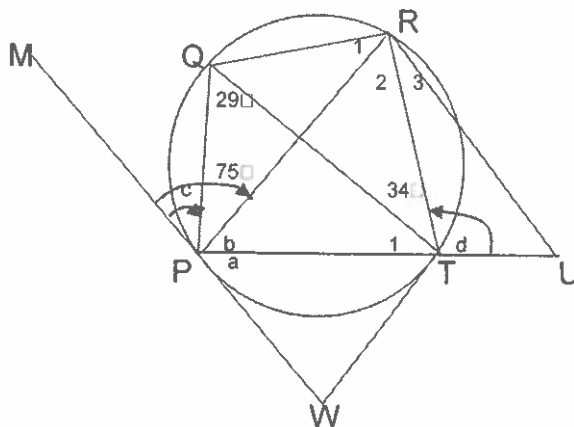
QUESTION 6

Factorise fully:

- (a) $3ax + bx - 3ax^2 - 6x^2 + 3ax^3 + bx^3$ (3)
 (b) $2px^2 - 3qx^2 + x^2 - 6p + 9q - 3$ (3)
 (c) $a^2 + a(3 + b) + 3b$ (3)

[9 marks]

QUESTION 7



In the diagram points P, Q, R and T lie on the circumference of a circle. MW and TW are tangents to the circle at P and T respectively. PT is produced to meet RU at U. Angle MPR = 75° , angle PQT = 29° , angle QTR = 34° .

If angle TPW = a, angle RPT = b, angle MPQ = c and angle RTU = d, calculate with reasons, the values of a, b, c and d.

[10 marks]

QUESTION 8

(a) If $5 \sin x = 3$ and $x + y = 90^\circ$, calculate without a calculator the value of:

(i) $\cos y$

(ii) $\tan x + \tan y$

(6)

(b) Prove the following identities:

(i) $\frac{\sin 2x}{\sin x} \cdot \frac{\cos 2x}{\cos x} \cdot \frac{\tan 2x}{\tan x} = 4 \cos^2 x$

(ii) $\frac{1 - \cos 2x - \sin x}{\sin 2x - \cos x} = \tan x$

(12)

[18 marks]

TOTAL [100 marks]