

REPUBLIC OF SOUTH AFRICA
DEPARTMENT OF MINERALS AND ENERGY
EXAMINATION FOR THE MINE SURVEYORS CERTIFICATE OF COMPETENCY

DATE: 19 April 2007 (Thursday)
TIME: 8:30 to 11:30 (3 Hours)

TOTAL MARKS: 100
TO PASS: 50

MATHEMATICS

- Note:**
- (1) The make and model number of your calculator must be shown on the front cover of your answer book.
 - (2) All steps must be shown.

QUESTION 1

If $f(x) = x^3 - 3x^2 - 9x + 12$, determine

- (a) $f'(x)$ using differentiation rules (3)
- (b) the co-ordinates of all stationary points of f , and clearly indicate local minima and maxima (6)
- (c) the average gradient between points (1;1) and (2;-10) (3)
- (d) the gradient of the tangent to the curve at point (1;1) (1)
- (e) $f''(x)$ using differentiation rules. (2)

[15 marks]

QUESTION 2

Determine the following integrals:

- (a) $\int (x^2 + 3x + 4) dx$ (2)
- (b) $\int x^{-3} dx$ (2)
- (c) $\int -\frac{1}{3}x^5 dx$ (2)
- (d) $\int (x-3)(x+3) dx$ (3)

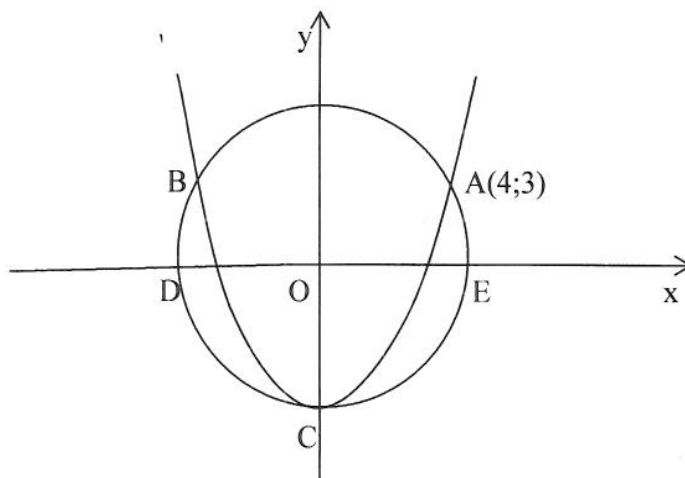
[9 marks]

QUESTION 3

- (a) Given the series $2 + 5 + 8 + \dots + 62$, determine
- (i) the number of terms in the series using the relevant formula (3)
 - (ii) the sum of the series. (3)
- (b) The first 3 terms of an arithmetic sequence are $t-2$, $2t-6$ and $4t-8$. Find
- (i) t (5)
 - (ii) the common difference (2)
 - (iii) the sum of the first 10 terms. (3)

[16 marks]

QUESTION 4



- (a) Determine the co-ordinates of B (1)
- (b) Calculate length OA (2)
- (c) Determine the co-ordinates of C, D and E (3)
- (d) Determine the equation of the parabola f and that of the circle g . (5)

[11 marks]

QUESTION 5

Solve for x:

(a) $\sqrt{2x+6} + 1 = x$ (7)

(b) $2^x + 2^{x+2} = 40$ (5)

[12 marks]

QUESTION 6

Solve for x, y and z

(a)
$$\begin{aligned} x + y + z &= 6 \\ x - y + 2z &= 5 \\ x + y + 3z &= 12 \end{aligned}$$
 (5)

(b)
$$\begin{aligned} x + 2y + 3z &= -7 \\ 3x - y + 4z &= -4 \\ -2x + 2y - z &= -2 \end{aligned}$$
 (5)

[10 marks]

QUESTION 7

If $\tan \left[\frac{x}{2} \right] = t$, express the following in terms of t:

(a) $\tan x$ (3)

(b) $\cos x$ (4)

(c) $\sin x$ (3)

[10 marks]

QUESTION 8

Prove that :

(a) $(1 + \tan^2 A)(1 - \sin^2 A) + \cot^2 A = \operatorname{cosec} A$ (6)

(b) $\frac{\tan B + \cot B}{\operatorname{cosec} B} = \sec B$ (6)

(c) $\frac{1 - \cos \theta}{\sin \theta} = \frac{\sin \theta}{1 + \cos \theta}$ (5)

[17 marks]

TOTAL [100 Marks]