

**REPUBLIC OF SOUTH AFRICA
DEPARTMENT OF MINERALS AND ENERGY
EXAMINATION FOR THE MINE SURVEYOR'S CERTIFICATE OF COMPETENCY**

DATE: 09 October 2008 (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

Simplify:

(a) $4^x - 2^{2x-1}$ (4)

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

(c) $3^{x+1} - 3 \cdot 3^{3x-1} + 3^x$ (3)

[10 marks]

QUESTION 2

Solve for x:

(a) $\frac{x-3}{x^2+3x+2} - \frac{5}{x^2-4} = \frac{4}{-x-1}$ (6)

(b) $\sqrt{x+6} = x$ (6)

(c) $3^x + 3^{x-2} = 90$ (6)

[18 marks]

QUESTION 3

If 10; a; 24; b; 38; ... is an arithmetic progression, determine:

(a) the values of a and b (4)

- (b) the first six terms (2)
- (c) the value of the 10th term (3)
- (d) which term is equal to 150. (4)

[13 marks]

QUESTION 4

- (a) If $\log 72 = a$ and $\log 36 = b$, find $\log 2$ and $\log 3$ in terms of a and b . (7)
- (b) Find without the use of a calculator (5)
- $$\frac{\log 16 - \log 9}{\log 4 - \log 3}$$

[12 marks]

QUESTION 5

Factorise fully:

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

[8 marks]

QUESTION 6

Use the fundamental identities to prove the following:

- (a) $\tan^2 \theta - \sin^2 \theta = \tan^2 \theta \sin^2 \theta$ (6)
- (b) $\frac{1 - 2\cos^2 \theta}{\sin \theta \cos \theta} = \tan \theta - \cot \theta$ (6)

[12 marks]

QUESTION 7

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

(a) $\tan x$ (4)

(b) $\cos x$ (4)

(c) $\sin x$ (3)

[11 marks]

QUESTION 8

(a) Find the derivative from first principles if:

$f(x) = x^2 - 2x$ (4)

(b) Using rules for differentiation, find the derivatives of the following:

(i) $3x^3 - 4x^2 + 5x + 6$ (3)

(ii) $2x^2(x - 1)$ (3)

(iii) $\frac{4}{x} + \sqrt{x}$ (3)

(c) Determine the gradient of the tangent to $y = 3x^2 - x - 2$ at the point $(-1; 2)$. (3)

[16 marks]

TOTAL [100 Marks]