

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

DATE: 20 April 2006 (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**

Two road runners set off at 07h00 in opposite directions. One runs at an average speed of 12 km/h and the other at 8 km/h.  
At what time will they be 90 km apart?

[6 marks]

**QUESTION 2**

Find  $\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$  if:

- (a)  $f(x) = x - 1$  (4)
- (b)  $f(x) = x^2$  (5)

[9 marks]

**QUESTION 3**

If  $f(x) = x^3 + 3x^2$ , make use of differentiation to determine the following :

- (a) the gradient of  $f(x)$  at  $x = 2$  (3)
- (b) the turning point of  $f(x)$ . (5)

[8 marks]

#### QUESTION 4

Solve for x:

(a)  $\log_2(1-x) = 3 - \log_2(5+x)$  (6)

(b)  $2^{2x} - \frac{9 \cdot 2^x}{8} + \frac{1}{8}$  (4)

(c)  $4^{(x+1)(x-3)} = 8^{-x}$  (5)

(d)  $3^{x+1} - 3^{x+3} = -11 + 3^{x+2}$  (5)

[20 marks]

#### QUESTION 5

(a) If  $7x+1$  ;  $2x + 2$ ;  $x-1$  forms a geometric sequence, determine the value of x. (6)

(b) The sum of the first three terms of a geometric series is 42 and the sum of the next three terms is  $5\frac{1}{4}$ .  
Determine the common ratio. (6)

[12 marks]

#### QUESTION 6

A(-5;1) , B(1;6), C(7;-2) are points in a Cartesian plane.  
Determine :

(a) the length of AC (3)

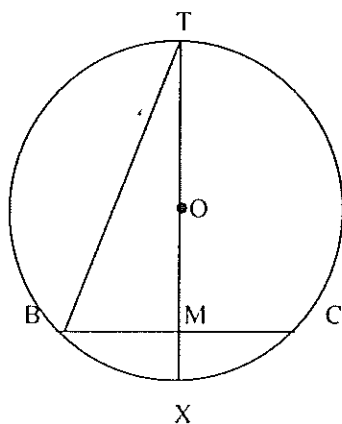
(b) the equation of the line BC (5)

(c) the co-ordinates of midpoint P of AB (2)

(d) the equation of the line parallel to AC and passing through the point (-1;3). (3)

[13 marks]

### QUESTION 7



TOMX is a diameter of the circle with centre O and chord  $BC = 30\text{m}$ .  
If TOMX is perpendicular to BC and  $OM = 2MX$ , calculate :

- (a) TB (8)
- (b) the radius of the circle. (2)

[10 marks]

### QUESTION 8

Without using a calculator, evaluate :

$$\frac{3\sec^2 150^\circ \sec 180^\circ}{\tan 315^\circ - \cos^2 240^\circ}$$

[7 marks]

### QUESTION 9

- (a) Simplify :

$$\frac{\tan(180^\circ - x) \cdot \cot(360^\circ - x) - \sin^2(180^\circ + x)}{\sec(x - 180^\circ) \cdot \operatorname{cosec}(90^\circ + x) + \tan(-x) \cdot \cot(90^\circ + x)} \quad (5)$$

(b) Prove that :

$$(i) \frac{\cos(90^\circ-x)}{\operatorname{cosec}(x)\sin(-90^\circ)} + \frac{\cos^2(360^\circ+x)\tan 200^\circ}{\cot 290^\circ} = -1 \quad (6)$$

$$(ii) \frac{\sin(180^\circ+A)\cot(90^\circ+A)}{\sin(90^\circ-A)} = \tan^2 A \quad (4)$$

[15 marks]

TOTAL [100 Marks]