

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

DATE: 12 October 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**

Determine:

(a)  $\lim_{h \rightarrow 0} \frac{(3+h)^2 - 9}{h}$  (4)

(b)  $\lim_{h \rightarrow 2} \frac{x^3 - 8}{x^2 - 4}$  (4)

(c)  $\lim_{h \rightarrow 2} \frac{2x - 4}{x^3 - 2x^2}$  (3)

[11 marks]

**QUESTION 2**

Determine the  $dy/dx$  of the following :

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

(b)  $y = x^2(x + 5 + \frac{1}{x})$  (3)

(c)  $y = \sin x \cos x$  (3)

[9 marks]

### QUESTION 3

The equation of a straight line is given by  $y = 3x + 4$ .

Determine :

- (a) the equation of a line ( $L_1$ ) parallel to  $y$  and passing through the point (2;2). (4)
- (b) the equation of a line ( $L_2$ ) perpendicular to  $y$  and passing through the point (2;2). (4)
- (c) the x-intercept for the line ( $L_1$ ) in (a) above. (2)
- (d) show that the two lines ( $L_1$  &  $L_2$ ) in (a) and (b) above, are perpendicular to each other. (2)

[12 marks]

### QUESTION 4

- (a) Insert 4 terms between 1 and  $\frac{32}{243}$  such that the six terms form a geometric sequence. (6)
- (b) Find the 1<sup>st</sup> and 8<sup>th</sup> terms of the geometric sequence whose 4<sup>th</sup> and 5<sup>th</sup> terms are 4 and 6 respectively. (7)

[13 marks]

### QUESTION 5

Prove that  $\log_2 5 \log_4 3 \log_{25} 16 = \log_2 3$

[5 marks]

### QUESTION 6

Simplify:

- (a)  $\frac{2 \cdot 2^{x+3}}{(2^x)^{x-1}} \div \frac{4^{x+1}}{(2^{x+1})^{x-1}}$  (4)
- (b)  $\left[ \frac{16x^{-5/6}}{81\sqrt{x}} \right]^{-3/4}$  (4)

(c)  $\frac{\sqrt{x+1} - \sqrt{x-1}}{\sqrt{x+1} + \sqrt{x-1}}$

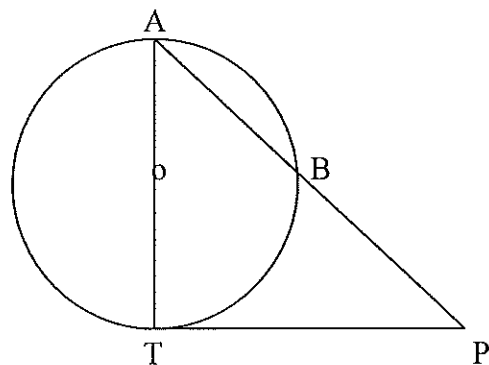
(5)

[13 marks]

**QUESTION 7**

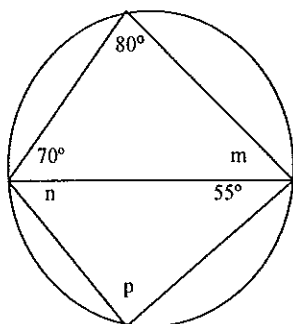
(a) In the figure below, a tangent and a secant meet at point P.

Prove that  $PA \cdot PB = PT^2$



(7)

(b) Find the values of m, n and p with reasons.



(6)

[13 marks]

### QUESTION 8

Simplify :

(a)  $\frac{\sin(-120^\circ).\cos660^\circ.\tan315^\circ}{(\cos310^\circ.\sin140^\circ) + \sin^2410^\circ}$  (7)

(b)  $\frac{\sin(180^\circ-x).\tan(90^\circ-x)}{\operatorname{cosec}(90^\circ-x).\cos(360^\circ-x).\cot(180^\circ-x)}$  (7)

[14 marks]

### QUESTION 9

Prove the following identity :

$$\frac{\cos x}{\sin x - 1} - \frac{1}{\tan x - \operatorname{cosec} x \cdot \sec x} = -\sec x$$

[10 marks]

TOTAL [100 Marks]