

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

**DATE:** 11 October 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**

Find the derivatives from first principles of the following:

(a)  $-3x^2 + 4x$  (6)

(b)  $3x^2 - 6x - 1$  (6)

[12 marks]

**QUESTION 2**

Simplify:

(a)  $\frac{\sqrt{x+1} - \sqrt{x-1}}{\sqrt{x+1} + \sqrt{x-1}}$  (5)

(b)  $\frac{2^{2n-1} \cdot 4^{n+1} \cdot 2}{16^n}$  (5)

[10 marks]

**QUESTION 3**

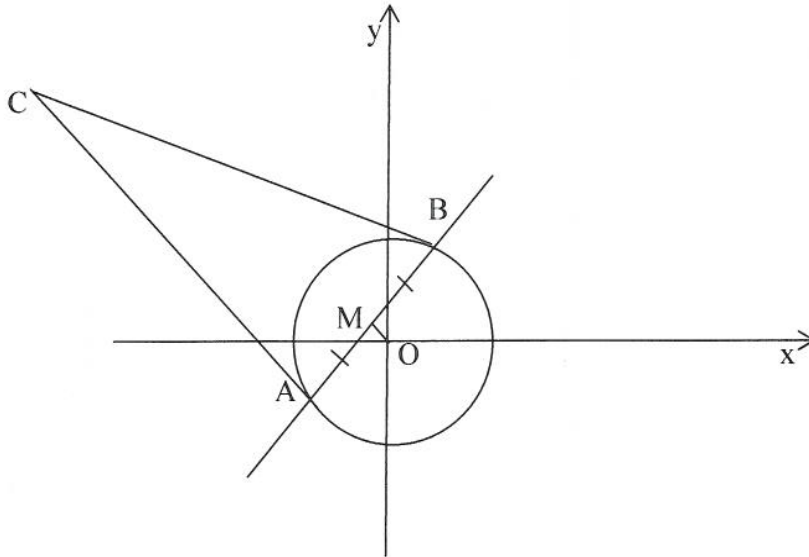
Solve for x:

(a)  $3^{x+2} - 3^{x-1} = 78$  (6)

(b)  $\sqrt{x+2} + 4 = x$  (5)

[11 marks]

#### QUESTION 4



A straight line  $y = x + 2$  cuts the circle  $x^2 + y^2 = 20$  at A and B.

- (a) Determine the co-ordinates of A and B. (5)
- (b) Determine the length of chord AB. (2)
- (c) Determine the co-ordinates of M the midpoint of chord AB. (2)
- (d) Determine the equation of the tangent to the circle at A. (4)

[13 marks]

#### QUESTION 5

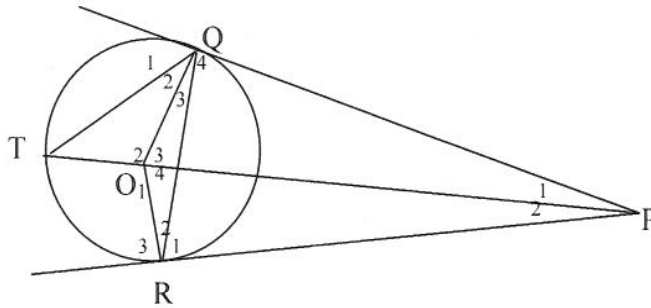
Find the Highest Common Factor (HCF) of the following:

- (a)  $2x^3 - 18x$ , (5)  
 $3x^3 - 9x^2$ ,  
 $x(x^3 - 27)$
- (b)  $3px^2 + 3px - 18p$ , (5)  
 $15px^2 - 60px + 60p$ ,  
 $2px - 4p$

[10 marks]

**QUESTION 6**

(a)



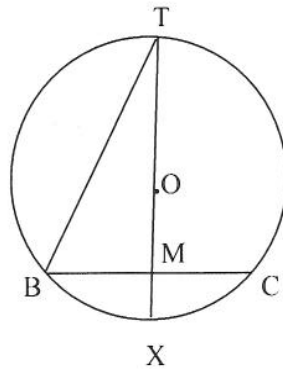
PQ and PR are tangents to the circle.  
 O is the centre of the circle.  
 POT is a straight line.  
 Angle  $O_1 = 100^\circ$  and angle  $R_2 = 10^\circ$ .

Find with reasons :

Angles  $Q_1, Q_2, Q_4, R_1$  and  $P_2$ .

(14)

(b)



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

(i) Length of TB

(8)

(ii) The radius of the circle.

(2)

[ 24 marks]

### QUESTION 7

If  $x$  and  $y$  are both acute angles, solve for  $x$  and  $y$ :

$$\sin(x+y) = 1 \text{ and } \tan(x-y) = 1/\sqrt{3}$$

[8 marks]

### QUESTION 8

Prove the following identities:

$$(a) \quad \tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \cdot \tan B} \quad (6)$$

$$(b) \quad \frac{\cot x \cdot \sec x}{\tan x + \cot x} = \cos x \quad (6)$$

[12 marks]

**TOTAL [100 Marks]**