

**REPUBLIC OF SOUTH AFRICA
DEPARTMENT OF MINERAL RESOURCES
EXAMINATION FOR THE MINE SURVEYOR'S CERTIFICATE OF COMPETENCY**

DATE: 11 April 2012 (Wednesday)
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

A body moves according to the equation: $s = 25t - t^2$, where s is the distance in metres from a reference point A.

Find:

- (a) the velocity of the body at $t = 3$ seconds, (4)
- (b) the acceleration, (2)
- (c) the time when the velocity becomes zero. (3)

[9 marks]

QUESTION 2

Differentiate with respect to x :

- (a) $y = 4e^{(7x^2-3x+1)}$ (2)
- (b) $y = 7e^{\sin x}$ (2)
- (c) $y = \frac{x^4}{4} - \frac{x^3}{3} + \frac{x^2}{2} - x + 3$ (3)
- (d) $y = x^2(x + 5 + 1/x)$ (3)

[10 marks]

QUESTION 3

The first three terms of an arithmetic sequence are $3p-4$; $4p-3$ and $7p-6$.
Determine:

- (a) the value of p , (7)
- (b) the first 3 terms of the sequence, (2)
- (c) the value of the 16th term. (3)

[12 marks]

QUESTION 4

Solve for x :

- (a) $\log_2(1-x) = 3 - \log_2(5+x)$ (6)
- (b) $2^{2x} - \frac{9 \cdot 2^x}{8} + \frac{1}{8} = 0$ (4)
- (c) $4^{(x+1)(x-3)} = 8^{-x}$ (5)
- (d) $3^{x+1} - 3^{x+3} = -11 + 3^{x+2}$ (5)

[20 marks]

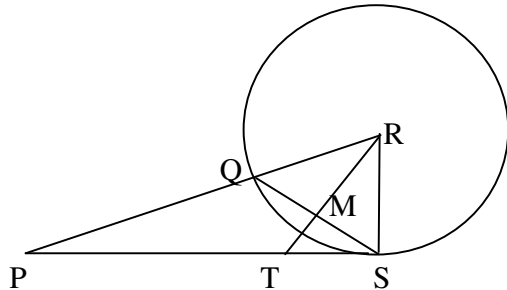
QUESTION 5

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

- (a) $2x^3 - 18x$,
 $3x^3 - 9x^2$,
 $x(x^3 - 27)$ (6)
- (b) $3px^2 + 3px - 18p$,
 $15px^2 - 60px + 60p$,
 $2px - 4p$ (6)

[12 marks]

QUESTION 6



Triangle SPR is right-angled at S. The circle with centre R passes through S and cuts PR at Q.
 $RM \perp SQ$.

Prove:

- (a) $\text{angle PSQ} = \frac{1}{2} \times \text{angle SRQ}$ (3)
- (b) $\text{angle SRT} = \text{angle PRT}$ (5)
- (c) $\triangle PSQ \sim \triangle PRT$ (5)
- (d) If $PS = 80\text{mm}$ and $SR = 60\text{mm}$, find PR and PT. (7)

[20 marks]

QUESTION 7

Use the fundamental identities to prove the following:

- (a) $\frac{1 - \cos\theta}{\sin\theta} = \frac{\sin\theta}{1 + \cos\theta}$ (5)
- (b) $\frac{\tan x \cdot \operatorname{cosec} x}{\tan x + \cot x} = \sin x$ (6)
- (c) $\frac{1 - 2\sin^2 x}{\sin x \cdot \cos x} = \cot x - \tan x$ (6)

[17 marks]

TOTAL [100 Marks]