

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

DATE: 14 April 2005 (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

Solve for x:

(a) $\log_2(x-2) + \log_2(x-3) = 1$ (6)

(b) $3^{x+1} - 3^{x-1} = 24\sqrt{3}$ (5)

[11 marks]

QUESTION 2

Evaluate without the use of a calculator:

$$\frac{\log_4 8 + \log_{16} 2}{\log_{27} 9 + \log_3 81}$$

[4 marks]

QUESTION 3

Simplify:

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

(b) $\frac{12^{x-2} \times 2^{x+2}}{8^x \times 3^{x+4}}$ (7)

[12marks]

QUESTION 4

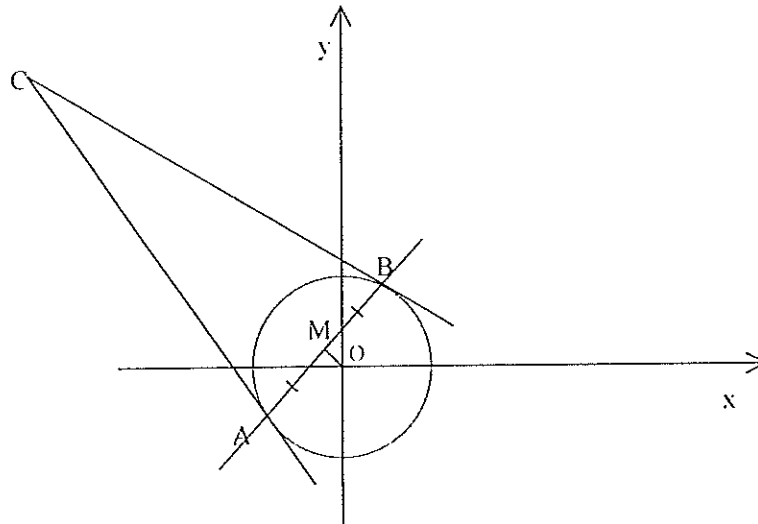
The first three terms of an arithmetic sequence are $3p-4$; $4p-3$ and $7p-6$.
Determine:

- (a) the value of p (5)
- (b) the first three terms of the sequence (2)
- (c) the value of the 16th term. (3)

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[10 marks]

QUESTION 5



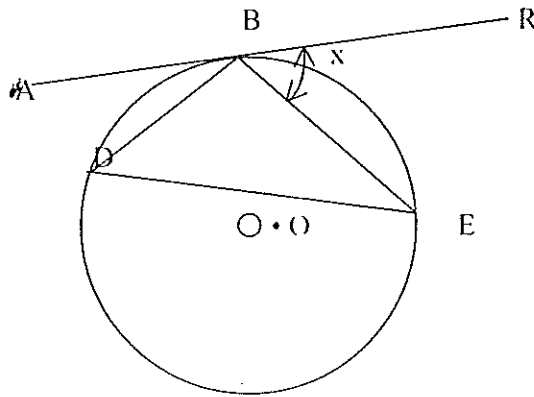
The straight line $y = x + 2$ cuts the circle $x^2 + y^2 = 20$ at A and B.

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

[13 marks]

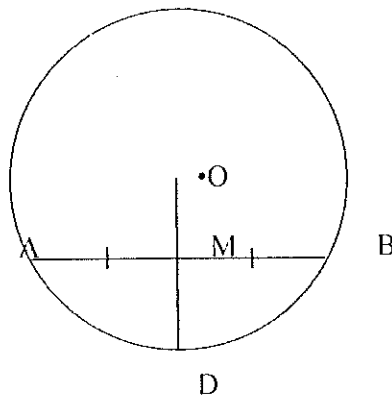
QUESTION 6

- (a) In the accompanying figure, O is the centre of the circle in B. D and E are points on the circumference of the circle. Prove that angle RBE = angle BDE.



(8)

- (b) AB is a chord of a circle with centre O and $AB = 24$ m. M is the mid-point of AB. If $MD = 8$ m, calculate the radius of the circle.



(8)

[16 marks]

QUESTION 7

Prove the following identities:

$$(a) \quad \cos(360^\circ - A) = \frac{\sin^2(180^\circ + A)}{1 - \cos(180^\circ + A)} \quad (7)$$

$$(b) \quad \frac{\sin(180^\circ - A) \cdot \tan A \cdot \sin(90^\circ + A)}{\tan(180^\circ + A) \cdot \cos(-A) \cdot \sin(-A)} = -1 \quad (6)$$

$$(c) \quad \frac{\sec 185^\circ \cdot \sin 78^\circ}{\cos 348^\circ \cdot \sec 175^\circ} = 1 \quad (5)$$

[18 marks]

QUESTION 8

Determine $\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ for each of the following:

$$(a) \quad 5x^2 \quad (5)$$

$$(b) \quad 3-4x \quad (5)$$

[10 marks]

QUESTION 9

Differentiate with respect to y:

$$(a) \quad 3y^4 + 2y^2 - 5y + 7 \quad (3)$$

$$(b) \quad (y-3)(2y+1) \quad (3)$$

[6 marks]

TOTAL [100 Marks]