



mineral resources

Department:  
Mineral Resources  
REPUBLIC OF SOUTH AFRICA

## MINE SURVEYOR'S CERTIFICATE OF COMPETENCY EXAMINATION

### MATHEMATICS

DATE: 09 OCTOBER 2013

TOTAL MARKS: 100

TO PASS: 50

TIME ALLOWED: 3 HOURS  
(08h30 to 11h30)

#### NOTE:

- This question paper consists of **FOUR** pages including cover page.
- All questions must be answered.
- All answers and sketches to be presented in a neat and decipherable manner. Papers will not be marked if not decipherable.
- Restrict the use of highlighters.
- Do not use a red pen.
- Read the instructions on the front page of your answer book carefully.
- No cellular phones shall be allowed in the examination venue.
- The use of computers, laptops and palmtops is prohibited.
- The make and model of your calculator must be shown on the front cover of your answer book.
- All steps must be shown.

### QUESTION 1

Determine values for A, B and C in the identity

$$\frac{2x^2 - 17x + 39}{(x - 3)^3} = \frac{A}{(x - 3)^3} + \frac{B}{(x - 3)^2} + \frac{C}{(x - 3)}$$

[10 marks]

### QUESTION 2

Express completely using Binomial theorem, that is,

$$(a + x)^n = a^n + na^{n-1}x + \frac{n(n-1)}{2!} a^{n-2}x^2 + \frac{n(n-1)(n-2)}{3!} a^{n-3}x^3 + \dots + x^n$$

(a)  $(2x + y)^4$  (5)

(b)  $(1 - \frac{1}{2}x)^4$  (5)

[10 marks]

### QUESTION 3

Solve for x, y and z

(a)  $6x + 2y - z = -5$   
 $2x - 3y + 4z = -4$   
 $3x + 2y + 2z = 4$  (5)

(b)  $x + 2y + 3z = -7$   
 $3x - y + 4z = -4$   
 $-2x + 2y - z = -2$  (5)

[10 marks]

#### QUESTION 4

A group of twelve Mine Surveying students must be divided into groups of three for a practical project.

Given that  ${}^n C_r = \frac{n!}{(n-r)! r!}$ , find the number of possible groups that can be formed.

[5 marks]

#### QUESTION 5

(a) How many terms of the series  $5 + 8 + 11 + \dots$  must be added to yield a sum of 440 ?

(8)

(b) Calculate the value of  $\sum_{r=5}^{40} (7 - 3r)$

(5)

(c) In an Arithmetic series consisting of 15 terms,  $S_n = n^2 - 2n$ . Determine

(i) the sum of the first 8 terms

(ii) the eighth term

(iii) the sum of the last 3 terms

(8)

[21 marks]

#### QUESTION 6

Solve for x

(a)  $\frac{3x^2 + x - 1}{1} + \frac{1}{3x^2 + x - 3} = 0$

(8)

(b)  $\sqrt{14 + 17x - 2x^2} = x + 2$

(5)

[13 marks]

### QUESTION 7

(a) Prove that  $\frac{\sin x}{1 + \cos x} + \cot x = \frac{\cot x}{\cos x}$  (8)

(b) Prove the following identities:

(i)  $\cot^2 p - \cos^2 p = \cot^2 p \cdot \cos^2 p$  (5)

(ii)  $\frac{\cos p}{1 - \sin p} - \frac{\cos p}{1 + \sin p} = 2 \tan p$  (5)

[18 marks]

### QUESTION 8

Points A(5;5) , B(-7;1) , C(1;-7) are the vertices of triangle ABC.

(a) Show that triangle ABC is isosceles. (4)

(b) Determine the equation of the circle with origin as centre and passing through point A. (4)

(c) Determine the equation of the line through point A parallel to BC. (5)

[13 marks]

TOTAL [100 marks]