

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

DATE: 14 April 2011 (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

- (a) Is the following sequence arithmetic ? (3)  
 $1/2 ; 5/6 ; 7/6 ; 3/2 ; \dots$
- (b) Is the following sequence geometric ? (3)  
 $8 ; 4 ; 2 ; 1 ; \dots$
- (c) Determine the value of  $x$  if the sequence  $2x - 1 ; 3x + 1 ; 7x - 1 ; \dots$  is geometric . (6)
- (d) How many terms of the series  $5 + 10 + 20 + \dots$  must be added to give a sum of 315? (6)

[18 marks]

QUESTION 2

Simplify :

- (a)  $\frac{2 \cdot 2^{x+3}}{(2^x)^{x-1}} \div \frac{4^{x+1}}{(2^{x+1})^{x-1}}$  (4)
- (b)  $\frac{6^{6x} \cdot 9^{3x}}{54^{4x} \cdot (1/4)^{2-x}}$  (5)
- (c)  $3^{x+1} - 3 \cdot 3^{3x-1} + 3^x$  (3)

[12 marks]

### QUESTION 3

The distance between two towns P and Q is 300 km. R is a third town exactly half-way between P and Q.

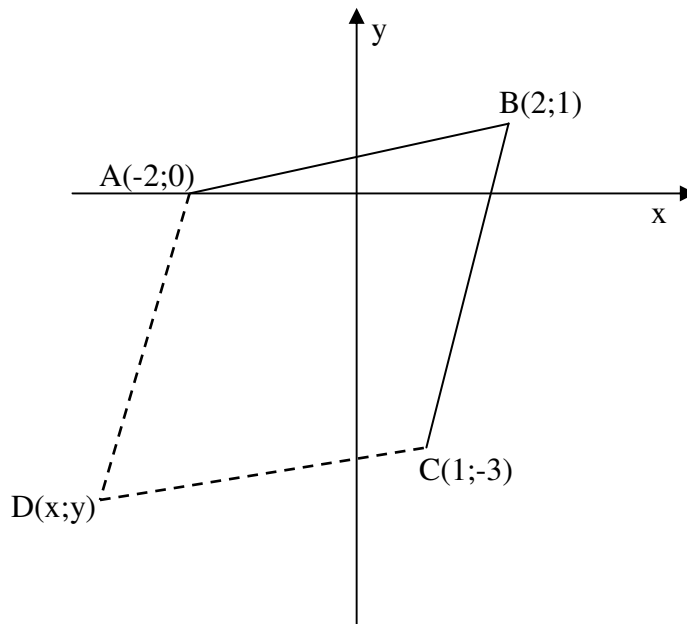
At 6H00 a cyclist travelling at a uniform speed of  $x$  kilometres per hour leaves Q for R and at 7H 00 a second cyclist travelling 5km/h faster than the first leaves P for R.

The two cyclists reach R at the same time.

- (a) Write down, in terms of  $x$ , the time taken by each cyclist. (3)  
(b) Find the speed of each cyclist. (7)

[10 marks]

### QUESTION 4



- (a) Find the fourth vertex of the parallelogram ABCD in which the vertices A, B and C are  $(-2;0)$ ,  $(2;1)$  and  $(1;-3)$  respectively. (10)  
(b) Show that the diagonals of this parallelogram bisect each other at right angles. (5)

[15 marks]

### QUESTION 5

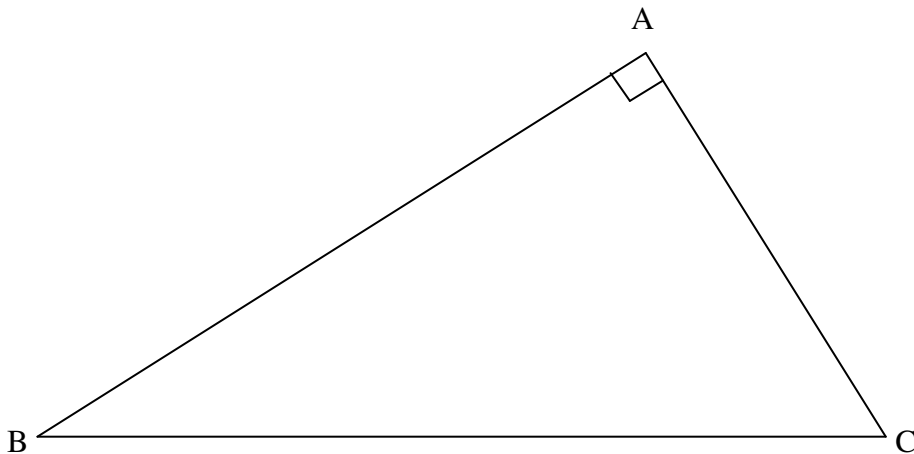
Solve for  $x$ ,  $y$  and  $z$  :

$$\begin{aligned} \text{(a)} \quad & x + 2y + 3z = -7 \\ & 3x - y + 4z = -4 \\ & -2x + 2y - z = -2 \end{aligned} \tag{5}$$

$$\begin{aligned} \text{(b)} \quad & x + y + z = 6 \\ & x - y + 2z = 5 \\ & x + y + 3z = 12 \end{aligned} \tag{5}$$

[10 marks]

### QUESTION 6



Prove that in a right-angled triangle ABC, the square on the hypotenuse is equal to the sum of the squares on the other two sides, that is,  $BC^2 = AB^2 + AC^2$ .

[17 marks]

### QUESTION 7

Prove the following:

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

(b)  $\frac{\sin(4x + \Theta) + \sin(4x - \Theta)}{\cos(2x + \Theta) + \cos(2x - \Theta)} = 2\sin 2x$  (6)

[12 marks]

### QUESTION 8

If  $f(x) = 2x - 1/x$ , determine  $f'(x)$  using first principles

[6 marks]

TOTAL [100 Marks]