

**REPUBLIC OF SOUTH AFRICA  
DEPARTMENT OF MINERALS AND ENERGY  
EXAMINATION FOR THE MINE SURVEYOR'S CERTIFICATE OF COMPETENCY**

Date: 14 October 2004 (Thursday)  
TIME: 8:30 – 11:30 (3 hours)

TOTAL MARKS: 100

**SURVEY I**

**QUESTION 1**

The following levels were taken at 15 metre intervals in a straight line across a valley. A level bank 3.0 metres wide with sides sloping at 45 degrees is to be thrown across the valley to the height of the point B.M.

- a) Determine the elevation of each station, assuming the elevation of point B.M. to be +1 067.000m.
- b) Calculate the total volume of filling necessary to construct this embankment.
- c) Calculate the total cost of the project if the cost of filling is R0.95 per cubic metre.

| Station | Distance from Start | B/S   | I/S   | F/S   |
|---------|---------------------|-------|-------|-------|
| BM      | Nil                 | 1.070 |       |       |
| A       | 15m                 |       | 1.982 |       |
| B       | 30m                 |       | 2.593 |       |
| C       | 45m                 | 0.613 |       | 5.032 |
| S       | 60m                 |       | 3.052 |       |
| W       | 75m                 |       | 4.886 |       |
| D       | 90m                 |       | 2.441 |       |
| G       | 105m                | 5.031 |       | 0.303 |
| H       | 120m                |       | 3.202 |       |
| J       | 135m                |       | 2.293 |       |
| K       | 150m                |       |       | 1.379 |

25 marks

## QUESTION 2

- Define the term "Contour Line".
- What are contour lines used for?
- In your own words, describe two methods of interpolation of contour intervals
- For what purposes are Topographical maps used.
- What is Photogrammetry?

15 marks

## QUESTION 3

Point A is a beacon on top of a hill. In order to obtain the elevation of points B and C on the side of the hill, a surveyor set up a theodolite at point B. the staff was held vertically on the beacon A and then vertically on the point C, and the following readings were taken: -

| READINGS ON STAFF |                 |                    |                    | VERTICAL ANGLES |
|-------------------|-----------------|--------------------|--------------------|-----------------|
|                   | Top stadia hair | Middle stadia hair | Bottom stadia hair |                 |
| To Point A        | 1.984           | 1.527              | 1.070              | +05°46'10"      |
| To Point C        | 1.780           | 1.347              | 0.914              | -06°18'05"      |

Height of instrument at B : 1.134m  
Elevation of beacon at A : +1 316.976m  
Multiplying constant : 100

- Calculate
- The elevation of points B and C
  - The horizontal distances AB and BC

10 marks

#### QUESTION 4

- a) What is meant by balancing a traverse.
- b) The following is an extract from a direction sheet of a traverse with a closure onto a point of origin

Given

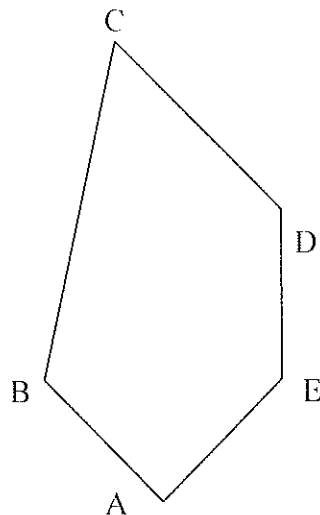
- a) Co-ordinates point A - 962.490      + 868.230
- b) Direction A – X for orientation  $50^{\circ}27'30''$

|                 |                      |                            |          |
|-----------------|----------------------|----------------------------|----------|
| Direction A – B | $230^{\circ}43'20''$ | distance                   | 233.450m |
| Direction B – C | $267^{\circ}53'40''$ | distance                   | 199.740m |
| Direction C – D | $298^{\circ}04'00''$ | distance                   | 170.470m |
| Direction D – E | $28^{\circ}45'30''$  | distance                   | 260.470m |
| Direction E – F | $58^{\circ}24'10''$  | distance                   | 166.240m |
| Direction F – A | $132^{\circ}22'00''$ | distance                   | 357.100m |
| Direction A - B | $230^{\circ}43'20''$ | distance                   | 233.450m |
| Direction A– X  | $50^{\circ}28'40''$  | (for bearing closure only) |          |

Calculate the adjusted co-ordinates of all points in the traverse.

18 marks

#### QUESTION 5



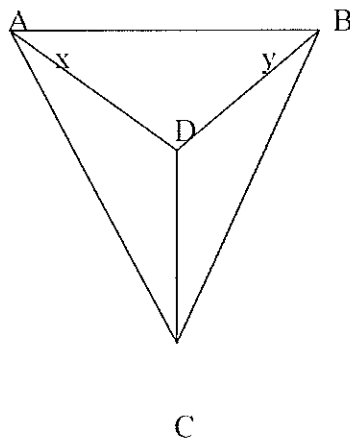
Calculate the area of figure ABCDE, given the following co-ordinates.

Co-ordinates of A : +259.060      +578.870  
 Co-ordinates of B : +348.700      +421.980  
 Co-ordinates of C : +140.040      +6.190  
 Co-ordinates of D : + 4.410      +328.840  
 Co-ordinates of E : + 71.260      +526.140

15 marks

**QUESTION 6**

(a) From the figure below prove:  $\frac{\sin y}{\sin x} = \tan K$



(b) Using tan K formula and given the following:

|           |      |        |
|-----------|------|--------|
| Distance  | AB   | 80.00m |
| Angle BCD | 25°  |        |
| Angle ACD | 35°  |        |
| Angle ADB | 120° |        |
| Angle BDC | 115° |        |
| Angle ADC | 125° |        |

Calculate: distance DC

17 marks  
[Total 100 marks]