GX492

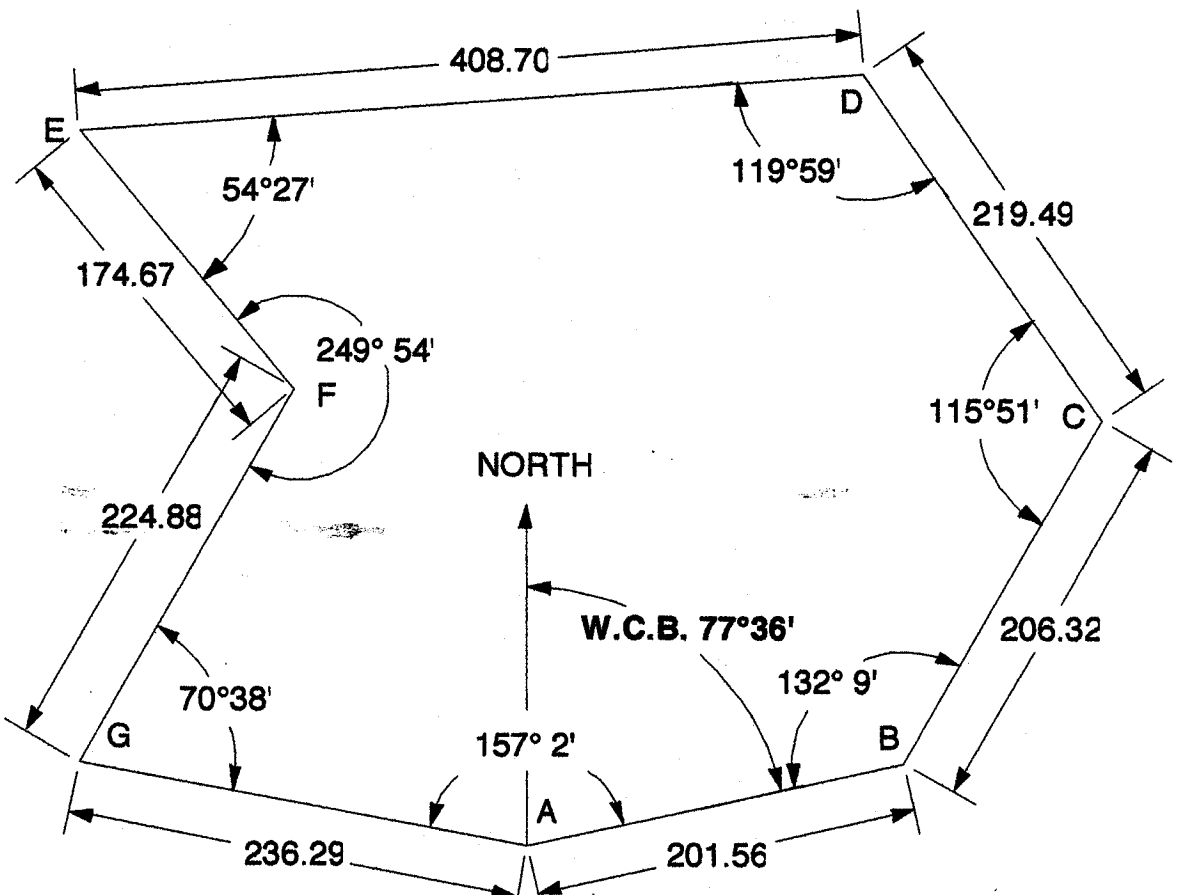
OLLSCOIL na hÉIREANN, GAILLIMH
NATIONAL UNIVERSITY OF IRELAND, GALWAY

SEMESTER 1 EXAMINATIONS, 2000
FIRST CIVIL & ENVIRONMENTAL ENGINEERING
SECOND CIVIL & ENVIRONMENTAL ENGINEERING

SURVEYING
Professor R. Falconer;
Professor P. E. O'Donoghue;
Dr. M. J. Brennan.

Time allowed: 2 hours. Calculators are required. Answer ***all*** questions.
The allocation of marks is noted after the question number

1.(50%) The measured lengths and included angles of a seven sided traverse are shown below:



With the meridian passing through the station "A", the whole circle bearing (W.C.B.) of the line AB is 77° 36′.
(a) Working to three decimal places, determine the easting and northing of each line and compute the closing error. (Note that Σ included angles is equal to 900°.)
(b) Distribute the closing error and tabulate the corrected eastings and northings using Bowditch's method:

$$\Delta E_{AB} = dE \times \frac{\textit{length of side AB}}{\textit{perimeter of the traverse}}$$

$$\Delta N_{AB} = dN \times \frac{\textit{length of side AB}}{\textit{perimeter of the traverse}}$$

2. You are required to set out a horizontal distance measuring 20 m exactly on an incline of 1 in 8. The 30 m long steel measuring tape was calibrated at a temperature of 20°C but the tropical ambient air temperature is anticipated to be 40°C during the setting out operation. The coefficient of linear expansion if the steel tape is 12×10^{-6} per °C.

Calculate:

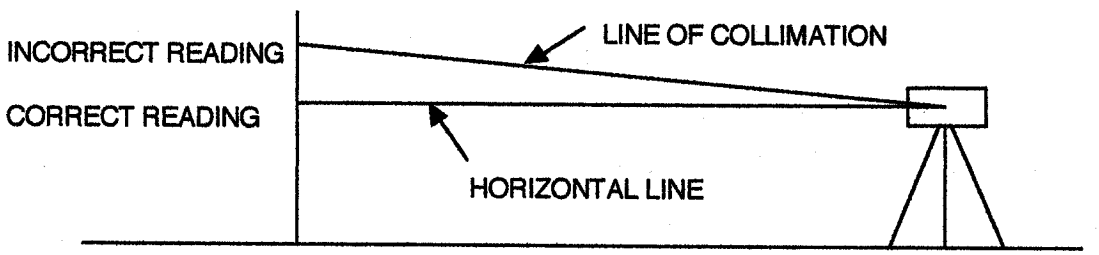
(a)(5%) the actual distance, to the nearest millimetre, that must be set out on the incline; and

(b)(5%) the distance, to the nearest millimetre, that must be measured out to allow for the extension of the steel tape.

3. (10%) A dumpy level and a tilting level are out of adjustment: the line of collimation is not parallel to the bubble tube axis as illustrated below when the bubble is in the centre of its run. For the dumpy level, it has been established that the bubble tube is perpendicular to the vertical axis.

For each instrument, note the adjustments that should be made using the capstan screws, tilting screw and diaphram screws to correct the line of collimation.

(Of the 10% total, 5% is allocated for noting the correct adjustment to each instrument)



4.(15%) The accuracy of an electronic distance meter (EDM) is expressed as

$$\pm e \text{ mm} \pm p \text{ mm/km},$$

where e is the standard error attributable to the electrical components and p is the standard error due to the inaccuracy of the modulation mechanism. Given that the certification of an instrument is

$$\pm 3 \text{ mm} \pm 1 \text{ mm/km},$$

what is the overall standard error in a measurement that is 4 km long?

5.(15%) Derive Simpson's rule for computing the area between the boundary of a survey area and a chain line, given five offsets ($0_1, 0_2, 0_3, 0_4, 0_5$) and an offset interval equal to x:

$$area = \frac{x}{3}(X + 2O + 4E)$$

where X=∑ first and last offsets, O=∑ remaining odd offsets and E=∑ even offsets.