

MATHEMATICS

Level One

Trig Heights #1

Setting: One of the many varied tasks that a surveyor might be asked to do is to find the height and position of a number of points. One of the techniques for heighting is to set a total station (a measurement instrument) up over a point of known height, measure the instrument height above the point, and then measure the vertical angle and distance to a target (set up at a known height over the point to be positioned). The position and the height of this second point can then be determined by using simple geometry and trigonometry.

Task One: The following observations were taken from station A to station B.

At station A to B

Height of Instrument (HI) = 1.49m

Elevation (height at A) = 117.3m

Height of Target (HT) = 1.50m

Angle from zenith = 91.29°

Slope Distance (SD) = 1863.12m

(Note: The zenith is vertically above the instrument, so a vertical angle of 91.29° will be 1.29° lower than the horizontal)

- 1) Using the above information draw a diagram representing the information
- 2) Calculate the horizontal distance from A to B
- 3) Calculate the change in height from the mark in the ground at A to the mark in the ground at B
- 4) Calculate the elevation (height) of B

Task Two:

When measuring a distance using a total station, corrections are often made to these measurements both to account for the fact that the surface of the Earth is curved (it is approximately spherical in shape), and to allow for the fact the signal is refracted (distorted) as it passes through the Earth's atmosphere. We call these the curvature and refraction effects.

The formula for curvature and refraction is.... $\left\{ \frac{0.86 \times SD^2}{2R} \right\}$

Where R is the radius of the earth (6,374,000m)

This correction is **added** to the overall height difference

- 5) Calculate the correction.
- 6) Calculate the corrected elevation of B.

- 7) Calculate this correction for every 200m, from 0m up to 3000m. Record your answers in a table.
- 8) Draw the results on a graph, with distance on the x axis and size of correction on the y axis.
- 9) What type of function/graph is it?