

# MATHEMATICS ANSWERS

## Level Three

### Control Stations

- 1) a) Calculate the horizontal distance of TR

$$\begin{aligned}\text{Distance TR} &= \cos(6^\circ 48' 25'') \times 1425.0241\text{m} \\ &= 1414.979\text{m}\end{aligned}$$

Calculate the horizontal distance of GR

$$\begin{aligned}\text{Distance GR} &= \cos(6^\circ 43' 46'') \times 1406.6943 \\ &= 1397.003\text{m}\end{aligned}$$

Horizontal distance between T and G calculated by computing the  $\Delta N$  and  $\Delta E$  between the two coordinate and using Pythagoras Theorem to calculate the distance.

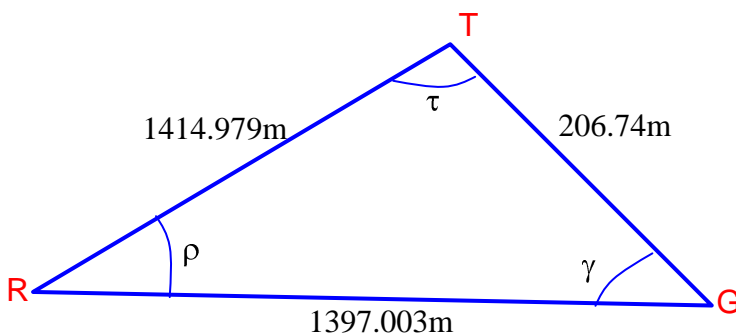
$$1117.797 - 958.461 = 159.336\text{m } \Delta E$$

$$782.848 - 914.580 = -131.732\text{m } \Delta N$$

$$\text{Therefore the distance TG} = \sqrt{(159.336)^2 + (131.732)^2}$$

$= 206.74\text{m}$  and at a bearing of  $129^\circ 34' 57''$  (using rectangular to polar on your calculator)

- b) To calculate the interior angles we use the cosine rule using the horizontal values we have just calculated:



$$\cos \tau = \frac{206.74^2 + 1414.979^2 - 1397.003^2}{2 \times 206.74 \times 1414.979}$$

$$\begin{aligned}\cos \tau &= 0.159452 \\ \tau &= 80^\circ 49' 30''\end{aligned}$$

$$\cos \gamma = \frac{206.74^2 + 1397.003^2 - 1414.979^2}{2 \times 206.74 \times 1397.003}$$

$$\cos \gamma = -0.013515$$

$$\gamma = 90^\circ 46' 28''$$

$$\text{Similarly, } \rho = 8^\circ 24' 02''$$

c) TG bearing set at  $129^\circ 34' 57''$  therefore bearing of GR =  $218^\circ 48' 29''$

And bearing of TR =  $210^\circ 24' 27''$

2) a) Length of pipe:  $= \sqrt{(85 - 12)^2 + (85 - 12)^2}$

$$= 103.238\text{m}$$

b) Volume =  $103.238 \times 1.2 \times 1.5 = 185.83\text{m}^3$

3) a) Length of the curve : -  $S = Rq$

$$\text{where } q = 32^\circ 40'$$

$$= 350 \times 0.570141$$

$$= 199.55\text{m}$$

b)  $q = 32^\circ 40''$

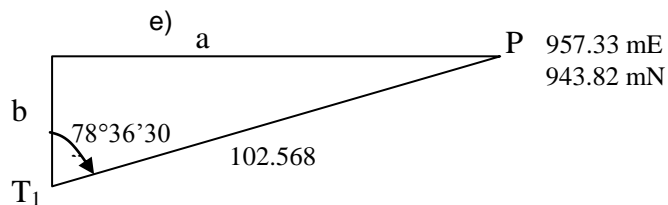
$$\text{Tangent} = 350 \times \tan 0.28507 \text{ radians}$$

$$= 102.568\text{m}$$

c) Chord =  $2R \sin \frac{1}{2} q$

$$= 700 \times \sin (16^\circ 20'')$$

$$= 196.858\text{m}$$

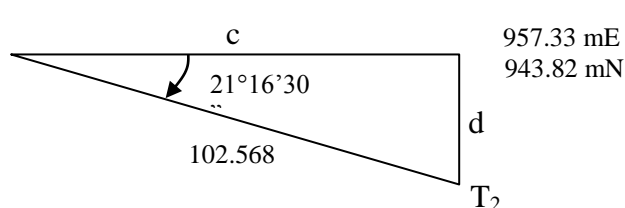


$$a = 100.55\text{mE}$$

$$b = 20.259\text{mN}$$

$$T_1 = 856.78\text{mE}$$

$$= 923.56\text{mN}$$



$$c = 95.58\text{m}$$

$$d = 37.22\text{m}$$

$$T_2 = 1052.91 \text{ mE}$$

$$= 906.60 \text{ mN}$$