SA

26/09/23

- ☆ Importance of surveying
- ☆☆ Source of errors

Next week: leveling

Levelling

Elevation of any points w.r.t a datum.

Reduced Level (RL): elevation from a benchmark / reference point

Leveling instruments

Total station

Level machine ⟶ Eye piece

Tripod Object glass

Level ~~senab~~ stuffs

Line of sight / Line of colligation / L of C

Adjust bubble position

Level / Instrument station

Reading station

** Parallax and ~~d~~rimation

~~Horizontal String~~

Horizontal surface, vertical line

Mean syllable

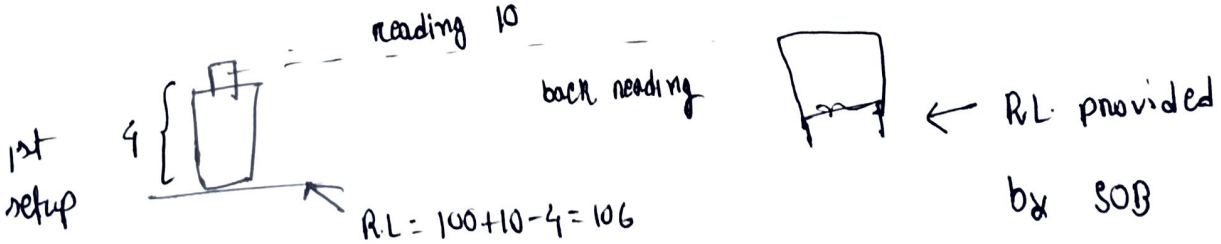
Let, CMH ~~gate~~ R.L- 100

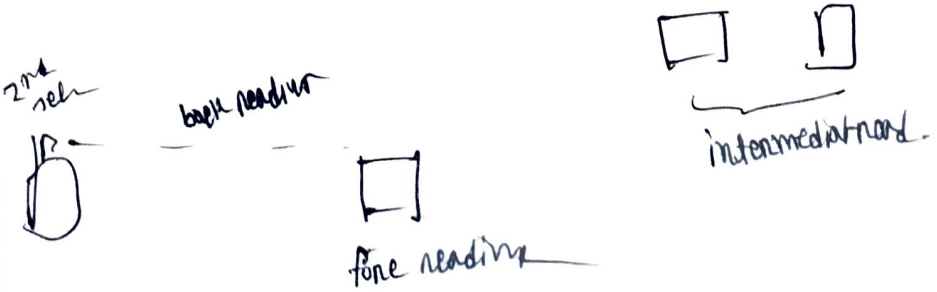
gate reading 10

another corner 15

LOS, ~~Light~~
Line of ~~sight~~'s R.L

Back, fone, intermediate reading





Field Book

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Classification of levelling

Reciprocal levelling

Methods

Height of instrument method

Rise & Fall method

Connection for Earth's curvature & refraction

Curvature & Refraction correction

In exam, explain w/ figure

$C_c \rightarrow$ subtractive $\rightarrow \frac{d^2}{2R}$

$C_R \rightarrow$ additive $\rightarrow 1/7\, C_c \rightarrow 1/7 \frac{d^2}{2R}$

$C \rightarrow C_c + C_R \rightarrow 6/7 \frac{d^2}{2R}$

Distance to visible horizon $d = 3.853\sqrt{h}$ km

Prob 9.9/

Reciprocal levelling

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Tacheometry

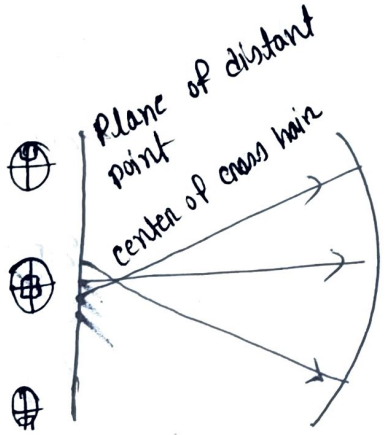
K -> multiplying const

δ -> additive const

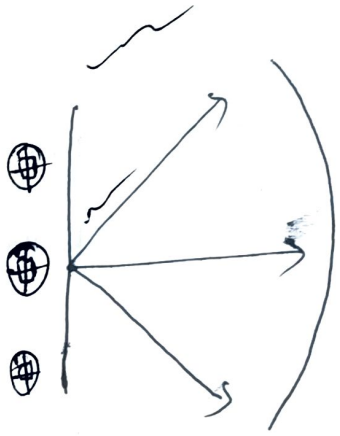
Rough / CT - 2

Parallax

If the image formed by an objective lens is not in the same plane with crosshair, any movement of eye likely to cause an apparant movement of the image w.r.t the cross hair.



Position of target moves



remains same

Elimination of parallax

Station, BS, I.S. FS, HI, R.L, R

Ht of instr. method:

Station	B.S	I.S.	F.S.	H.I	R.L	Remarks
1	0.780			219.53	218.750	B.M
2		1.535			217.995	
3		1.955			217.575	
4		2.430			217.1	
5	1.155	~~3.480~~	3.480	217.205	216.05	CP1
6	~~1.960~~	1.960			215.245	
7		2.365			214.84	
8	0.935	~~3.640~~	3.640	214.500	213.565	CP2
9	~~1.045~~	1.045			213.455	
10		1.630			212.870	
11			2.545		211.955	
Sum	2.870		9.~~685~~			

Check: $9.665 - 2.870 = 6.795$

$218.75 - 211.955 = 6.795$

Rise & Fall method:

Station	B.S	I.S	F.S	Rise	Fall	R.L	Remarks
1	0.4					100	B.M
2	~~0.765~~	0.765			0.365	99.635	
3		1.270			0.505	99.130	
4		3.22			1.95	97.180	
5	0.390		3.95		0.73	96.45	CP1
6		1.690			1.300	95.15	
7	0.8		3.5		1.810	93.34	CP2
8		1.920			1.120	92.22	
9		2.45			0.530	91.690	
10			3.98	0	1.530	90.16	
Sum	1.59		11.43				

Check: 11.43 - 1.59 = 9.84

100 - 90.16 = 9.84

$C_c = \frac{d^2}{2R}$ → 6370

$C_R = \frac{1}{7} C_c$

$C = C_c - C_R$ (subtractive)

Prob 9.9/

(a) $C = \frac{6}{7} \frac{d^2}{2R} = \frac{6}{7} \frac{3400^2}{2 \times 6370000}$

$= 0.7778 \text{ m}$

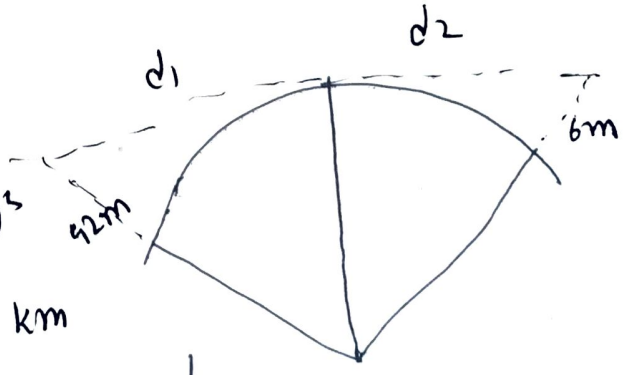
(b) $C = \frac{6}{7} \times \frac{1.29^2}{2 \times 6370} = 0.112 \text{ m}$

9.12/

~~$d^2 = (6370)^2$~~

$d_1^2 = (6370000+42)^2 - (6370000)^2$

$\therefore d_1 = 23131.8 \text{ m} = 23.13 \text{ km}$



$d_2^2 = (6370000+6)^2 - 6370000^2$

$\therefore d_2 = 8743 \text{ m} = 8.743 \text{ km}$

$d = d_1 + d_2$

$= 31.873 \text{ km}$

Reciprocal levelling

from X: $Y_1 - e - X_1 = (Y_1 - X_1) - e$ —(1)

" Y: ~~$(X_2 - e) - Y_2 = (X_2 - Y_2) - e$~~

$Y_2 - (X_2 - e) = (Y_2 - X_2) + e$ —(11)

(1) + (11) → $2d = (Y_1 - X_1) + (Y_2 - X_2)$

Prob:

(a) $d = \frac{(2.748 - 1.824) + (1.606 - 0.928)}{2}$ m = 0.801 m; P is higher

∴ true RL of Q = 126.686 − 0.801 m

= 125.585 m

(b) $C = 6/7 \frac{d^{1.2}}{2 \times 6370000} = 0.069$ m

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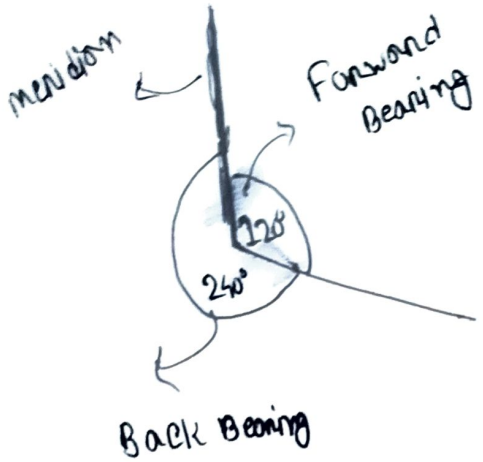
Tacheometry survey

Stadia method

Example: 1:

Example 2:

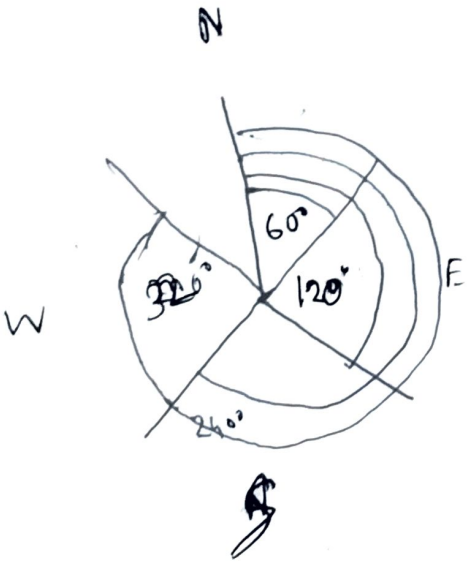
Tangential method



Bearing → F.B
→ BB

meridian → Arbitrary
→ Magnetic - -
→ True m- - -

fixed N-S



WCB → whole bearing
→ circle

RB → reduced bearing

120° → 30° from east to south

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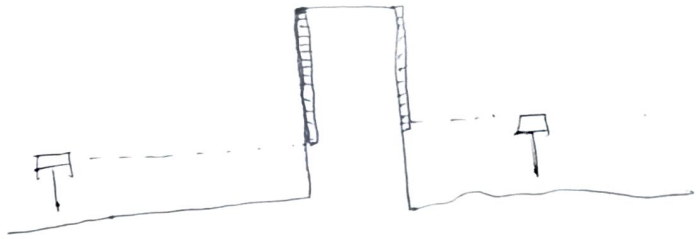
impo for midterm

Problems in levelling

4. Across pond, too wide to be sighted across

→ RL of water level

6. Levelling past high wall



Calc vols & area

(a) average

(b) trapezoidal rule } area

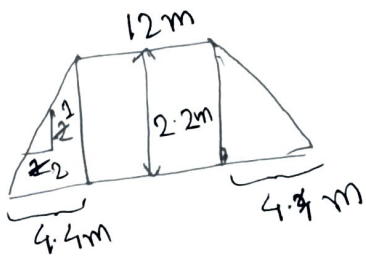
(c) simpson's rule*

Simpson's rule is applicable to odd numbers of ordinates. calc upto last odd the avg for last 2

Capacity of Reservoir

Example (the railway embankment)

Book area & vol chapter



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Rough / midterm

Methods of calculation when bounded by irregular lines

- Average ordinate rule
- Mid-ordinate rule
- Simpson's rule
- Trapezoidal rule

Avg & mid-ordinate rule:

avg height of divisons * total len

Simpson's rule:

(1st ordinate + last ordinate) + 2x odd ordinate + 4x even ordinates) x $\frac{1}{3}$ of division len

Applicable for even number of divisions, or ~~the~~ up to an even num of divisions.

Derived from prismoidal rule

Trapezoidal rule:

half div len x {1st ordinate + last ordinate + 2x (rest ordinates)}

Calc of vol.

Simpson's 1/3 rule:

{1st section + last section + 2(odd sections) + 4(even sections)} x 1/3 of section len

Again, section count need to be odd.

Trapezoidal rule:

1/2 of sec len {1st sec + last sec + 2(rest secs)}

Solve

Dist.	Ground	Formation	Depth
0	2048	207	2·2
100	206·2	208	1·8
200	207·5	209	1·5
300	207·2	200	2·8
400	208·3	211	2·7



—

$$\text{Area} = \frac{b+t}{2} \times h = \frac{(t+2\times 2h)+t}{2} \times h$$

$$= \frac{2t+4h}{2} \times h$$

$$\therefore (t+2h)h$$

$\therefore A_1 = 36.08\ m^2;\ A_2 = 28.08;\ A_3 = 22.5;$

$A_4 = 49.28\ m^2;\ A_5 = 46.98\ m^2$

$\therefore V_{01} = 14583.33\ m^3$

$V_T = 14139.06\ m^3$

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Contour

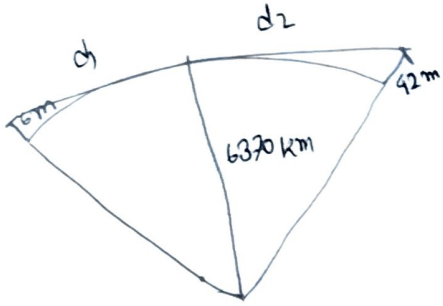
Gradient

Factors governing the selection of contour int

Rough / mid

Prob 9.x

(a)



$d_1 = 8743\ m$

$d_2 = 23132\ m$

$\therefore d = 31875\ m$

(b)

(c)

$C = \frac{6}{7}\frac{d^2}{2R} \Rightarrow d_1 = 9443.5\ m$

$\therefore d = \sqrt{\frac{7 \times 2R \times C}{6}}$ $d_2 = 24985\ m$

$\therefore d = \ldots$

Reciprocal:

(a) $\frac{(2.748 - 1.824) + (1.606 - 0.928)}{2}$ m

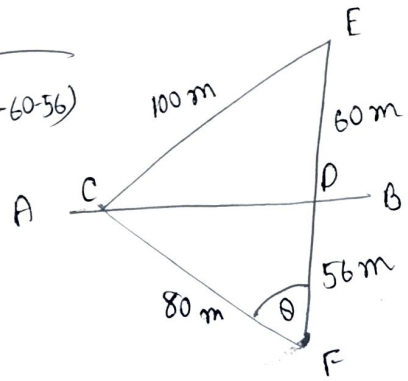
$= 0.801$ m

R.L. of Q $= 126.386 - 0.801$ m

$= \ldots$

SB

$\frac{1}{2} \times (56+60) \times CD = \sqrt{148(148-100)(148-80)(148-60-56)}$



$CD = 67.79$ m

$\frac{80^2 + (56+60)^2 - 100^2}{2 \times 80 \times (56+60)} = \frac{80^2 + 56^2 - CD^2}{2 \times 80 \times 56}$

$\therefore CD = 69.12$ m

$S = \frac{100 + 80 + 56 + 60}{2}$ m

$= 148$ m

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Methods of contouring

- -

*** Designation of curve

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~~XX~~ D

1·5 sets ques from curves

Curves

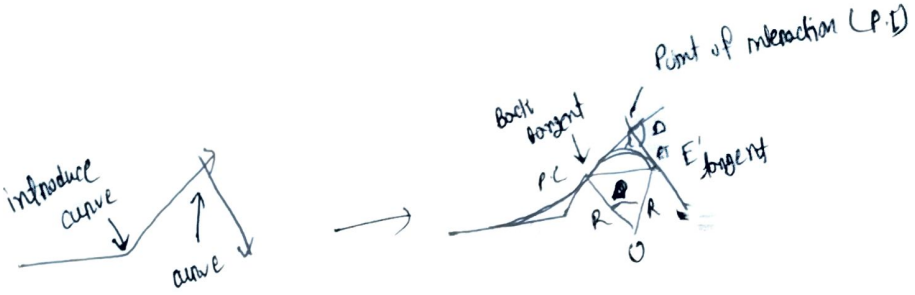
Hor. curve

vert. curve

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Recap

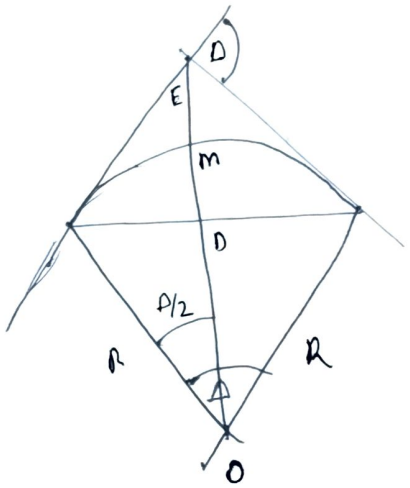


$$R = \frac{537}{D}$$

$$l = \frac{\pi R D}{180^\circ}$$

$$\frac{l}{D} = \frac{2\pi R}{360}$$

$M =$



59·6 chain = 1192 m = ~~T~~ Ch of P I

$300 \tan\left(\frac{50°30'}{2}\right) = 141.4892 = T$

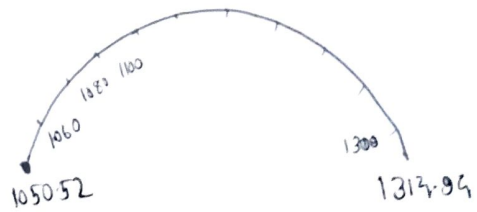
$\frac{\pi \times 300 \times 50°30'}{180°} = 264.42 \text{ m} = l$

Ch of P.C = 1192 − 141.4892 = 1050.52 m

Ch of P.T = 1050.52 + 264.42 = 1314.94 m

1st sub chord = 1060 − 1050.52 = 9.48 m

last " " = 1314.94 − 1300 = 14.94 m



1+12+1 = 14

$\theta_1 = \frac{c_1^2}{2R} = \frac{9.48^2}{2 \times 300} = .15 \text{ m}$

$\theta_2 = \frac{c(c_1+c)}{2R} =$

$\theta_3 = \theta_4 = \cdots = \theta_3 = \frac{c^2}{2R} =$

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Transition curve

may be,

True spiral

Cubic spiral

Cubic parabola

$$\frac{p}{w} = \frac{\tan\theta + f}{1 - f\tan\theta} \qquad \frac{v^2}{gR} = \frac{p}{w} = \frac{e}{B}$$

Prob 3.1: $\frac{e}{B} = \frac{v^2}{gR}$; $L = \frac{\alpha v^3}{R}$

Prob 3.2:

a)

b) $L = \frac{\pi R D_c}{180}$; $D_c = D - 2D_s$; $D_s = \frac{L}{2R}$

Vertical curve

MA AZIL
over vol
techometry
B.C

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02/01/24

Hydrographic survey

notes from Ajij

Sounding

Method of recording soundings

Traverse surveying

$20+120+120+120=360$

$180(n-2)$

Rise & Fall