THE HASHEMITE UNIVERSITY

Faculty of Engineering

Civil Engineering Department

Report of Experiment

STUDENT

Abdullah Khalid Al.Massri **ID# : 1639799**

Section # : 1 **Group# : 5**

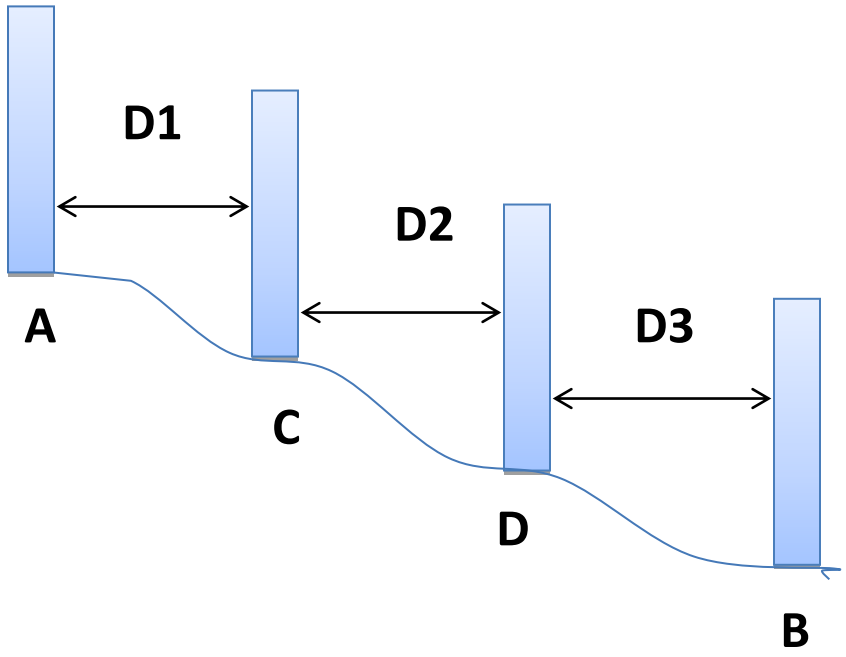
DEPARTMENT OF CIVIL ENGINEERING

Academic Year

2018

DATE 25 / 9 / 2018

EX1: Horizontal Taping Over Sloping Ground:-



Length	Forward (AB)	Backward (BA)	Average Horizontal distance
D1	1.90	1.98	**1.94**
D2	1.86	1.84	**1.85**
D3	1.61	1.62	**1.615**
Total	5.37	5.44	**5.405**

Forward: 1.90+1.86+1.61=5.37m

Backward: 1.98+1.84+1.62=5.44m

AVG horizontal distance:-

(FWD+BWD)/2= (1.86+1.84)/2=1.85m

Accuracy relative distance to AB:-

***Error =**|FWD – BWD|= |5.37-5.44|= 0.07

*Accuracy = Error/ True value(FWD)

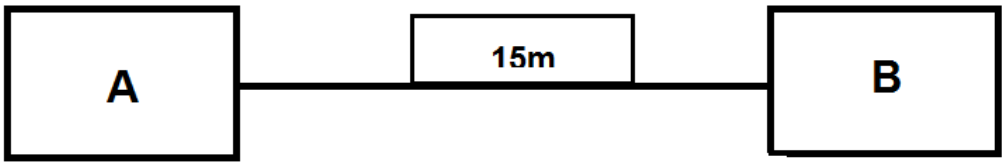
=0.07/5.37=1/77

Accuracy relative distance to BA:-

***Accurate =** Error/ True value(BWD)

= 0.07/5.44 =1/78

EX2:Pace length:-



	NUMBERS OF PACES						
NAME/ID#	Ahmad Adel 1632434	Ahmad ALsaie 1639748	Wael Ghassan 1737712	Issedddin Ashoor 1637371	Marah Baniissa 1632497	Rama Haithem 1731065	Abdullah Al-Masri 1639799
A-B	23	24	22	25	26	26	22
B-A	23	25	21	24	25	27	22
SUM	46	49	43	49	51	53	44
Pace Length	0.652	0.612	0.698	0.612	0.588	0.566	0.682

*Total distance=15+15=30m

*Pace Length :total distance/number of paces

*Pace length Abdullah ALmasri for
=30/44=0.682m/pace

*Wael Ghassan has the longest pace =0.698m/pace

*Rama haithem has the shortest pace =0.566m/pace

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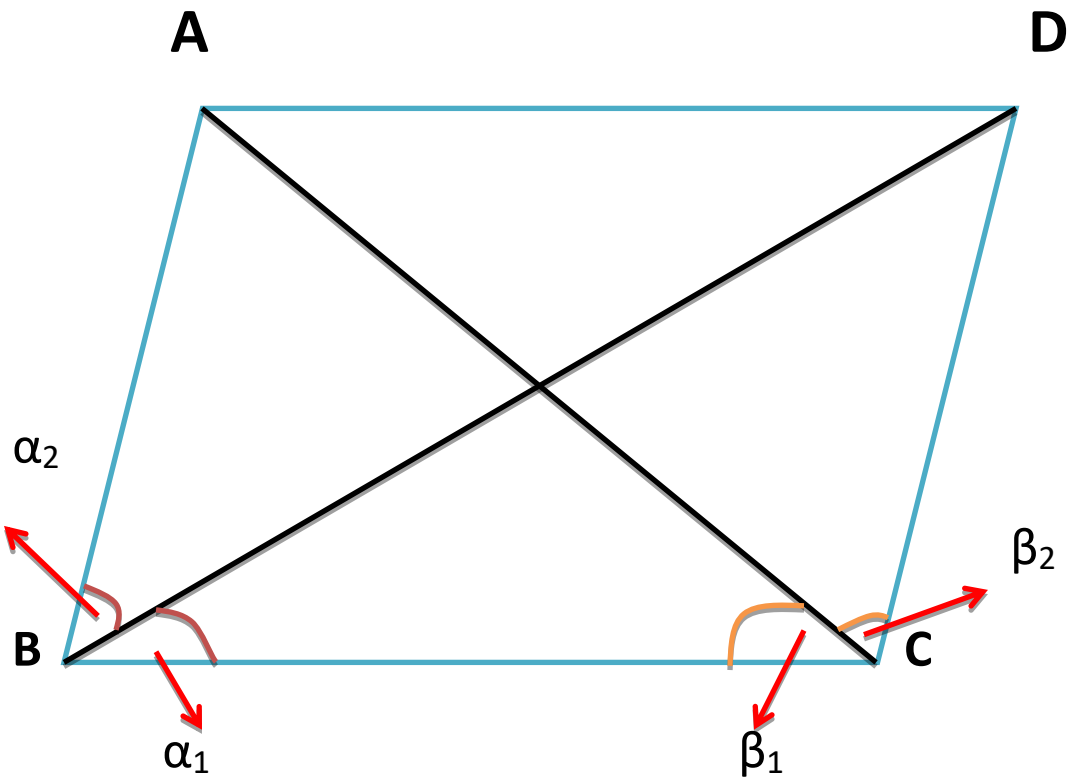
EX: Measuring the sides and the diagonals of equadrilatel:-



Track Name	FWD	BWD	AVG
AB	7.5	7.53	**7.515**
BC	8	8.22	**8.11**
CD	7.85	7.88	**7.865**
DA	7.5	7.55	**7.525**
BD	7.85	7.87	**7.86**
AC	13.8	13.6	**13.7**

***β_1:-**

$AB^2=BC^2+CA^2-2BC*AC\cos(\beta_1)$

$7.515^2=8.11^2+13.7^2-2*8.11*13.7\cos(\beta_1)$

β_1= 27.566

***β_2:-**

$DA^2=AC^2+CD^2-2AC*CD\cos(\beta_2)$

$7.525^2=13.7^2+7.865^2-2*13.7*7.865\cos(\beta_2)$

β_2=26.462°

***α_1:-**

$DC^2=DB^2+BC^2-2DB*BC\cos(\alpha_1)$

$7.865^2=7.86^2+8.11^2-2*7.86*8.11\cos(\alpha_1)$

α_1=58.983

***α_2:-**

$AD^2=AB^2+BD^2-2AB*BD\cos(\alpha_2)$

$7.525^2=7.515^2+7.86^2-2*7.515*7.86\cos(\alpha_2)$

α_2=58.555°

***BD:-**

$BD^2=BC^2+CD^2 -2BC*CD \cos(\beta_1+\beta_2)$

$=8.11^2+7.865^2 -2*8.11*7.865 \cos(27.566+26.462)$

=7.255m

***AC:-**

$AC^2=AB^2+BC^2 -2AB*BC\cos(\alpha_1+\alpha_2)$

$=7.515^2+8.11^2 -2*7.515*8.11 \cos(58.983+58.555)$

=13.364m

***Error and Accuracy in BD:-**

#Error= BD(measure)- BD(calculated)

Error: $|7.86 - 7.255| = 0.605$

#Accuracy= 1/X =Error/true value(BD.cal)

Accuracy: 0.605/7.255=1/11.99

***Error and Accuracy in AC:-**

Error: $|13.7 - 13.364| = 0.336$

#Accuracy= 1/X=Error/true value(AC.cal)

Accuracy: 0.336/13.364 =1/39.77

*Measured horizontal angle:

ANGLE	TARGET	FACE LEFT (I)	FACE RIGHT (II)	Mean
DBC(α_1)	D	**120°37' 0''**	**300°36'50''**	**300°36.5' 25''**
	C	**176°10'0''**	**356°05'50''**	**356°7.5'25''**
DBA(α_2)	D	**120°37'0''**	**300°36'50''**	**300°36.5'25''**
	A	**359°54'20''**	**242° 18'20''**	**242°36'20''**
BCA(β_1)	B	**300°32'40''**	**120°23'10''**	**120° 27.5'25''**
	A	**331°56'30''**	**151°50'10''**	**151°53' 20''**
ACD(β_2)	A	**331°56'30''**	**151°50'10''**	**151°53'20''**
	D	**1°40'50''**	**181°38'0''**	**181°39'25''**

#Mean Method:

- The value of mean:

For(D)= 300 + ((36+37)/2) + ((50+0)/2)=300°36.5' 25''

For(C)= 356 + ((10+05)/2) + ((50+0)/2)=356°7.5'25''

-The value of angle:mean(b)-mean(a)

*α_1=356°7.5'25''- 300°36.5'25''= 55°13'0''

*α_2= 242°36'20'' + (360) - 300°36.5'25'' = 301°59'25''

*β_1=151°53'20''- 120°27.5'25''=31°25' 25"

*β_2 = 181°39'25''- 151°53'20' = 29°46'5''

Difference method:

*sample of calculation:

*Mean=((Difference position1)+(Difference position2))/2

*Angle:

*α_1=176°10’0’’- 120°37’0’’ = 55°33’ 0” FL

α_1=356°05’50’’ - 300°36’50’’ =55° 29’ 0’’ FR

AVG α_1=**55°31’0’’**

*α_2=359°54’20’’- 120°37’0’’ = 239° 17’ 20 ‘’ FL

α_2=**300°36’50’’-** 242°18’20**’’= 58°18’ 30 ‘’ FR**

AVG α_2**= 148°47’55 ‘’**

$*\beta_1$=331°56’30’’- 300°32’40’’ = 31°23’50’’ FL

β_1=151°50’10’’ - 120°23’10’’= 31°27’0’’ FR

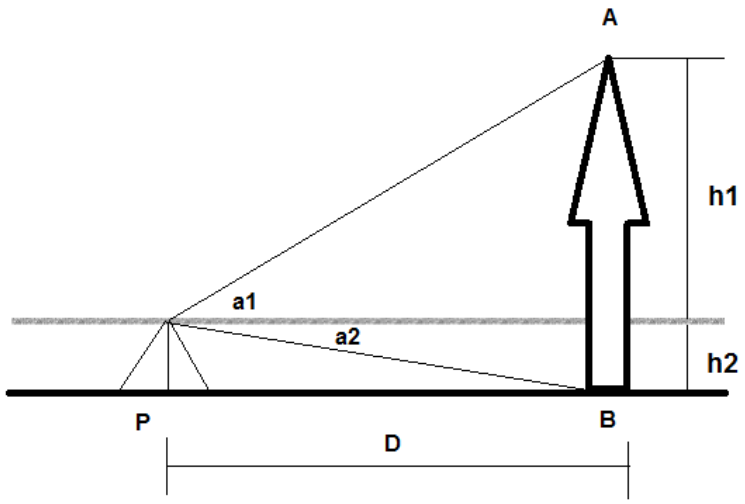
AVG β_1=31°25’25’’

$*\beta_2$=331°56’30’’- 1°40’50’= 330°15’40’’ FL

β_2=181°39’25’’- 151°53’20’’= 29°46’5’’ FR

AVGβ_2=180°0’52.5’’

EX2:MEASURING AN OBJECT HEIGHT BY MEASURING VERTICAL ANGLE:



	FL	FR	SUM
α_1	48° 41' 30''	315° 58' 10''	364° 39' 40''
α_2	100° 10' 50''	259° 49' 30''	360° 0' 20''

D=7.78m **Hi**=1.42m

***Index Error:**

$-\alpha_1$= (360°-364°39'40'')/2=-2°19'50''

$-\alpha_2$=(360°- 360° 0' 20'')/2=-0°0'10''

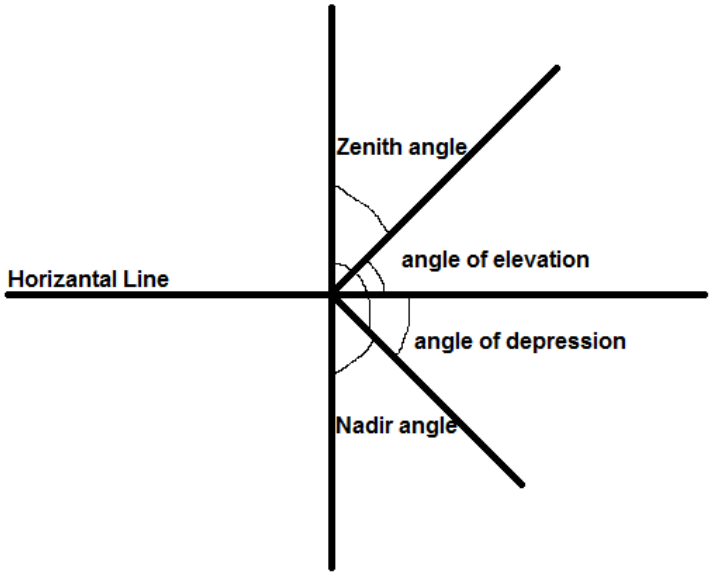
*Coorection= angle +index error

$-\alpha_1$:FL=48° 41' 30''- 2°19'50''= 46°21' 40''

FR=315° 58' 10''- 2°19'50''=313°38' 20''

-α_2:FL=100° *10' 50"*-0°0'10"= 100° *10' 40"*

FR= 259° *49' 30"*-0°0'10"= 259° *49' 20"*



-angle of elevation = 46° *21'40"*

-zenith angle = 90 - 46°*21' 40"*

= 43° 38' 20"

-angle of depression = 100° *10' 40"* – 90 = 10° *10' 40"*

-nadir angle= 90 - 10° *10' 40"* = 79° *49' 20"*

tan(48° *41'30"*) = H2 / 7.78

H2 = 8.853 m

-height of civil college building(AB)=**Hi + H2**

= 1.42+8.853

= 10.273 m

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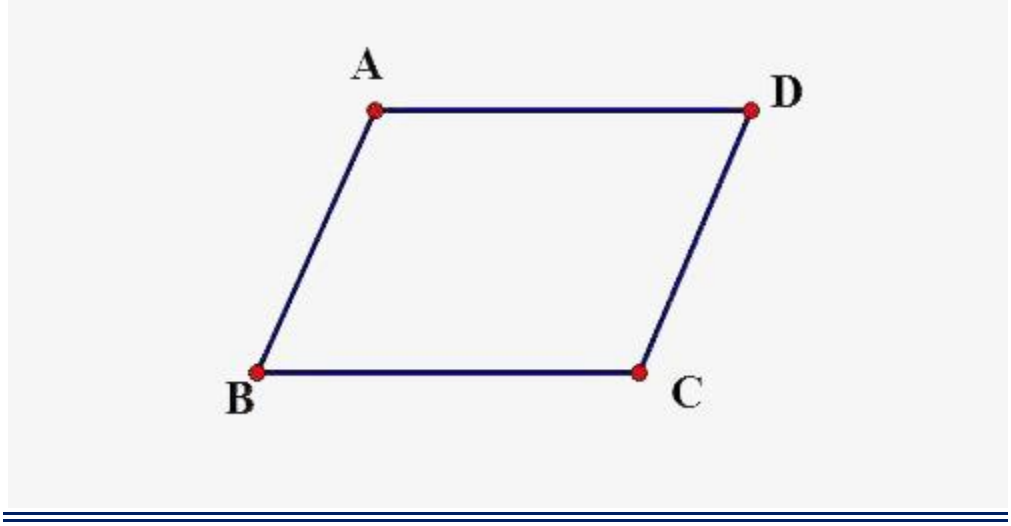
Horizontal control for mapping by linear measurements:-



Track Name	FWD	BWD	AVG
AB	5.76	5.78	5.77
BC	6	6.02	6.01
CD	6	6.01	6.005
DA	6	6.01	6.005

	<DAB	<ABC	<BCD	<CDA
L_0	0°0`0``	286°27`30``	0°0`0``	258°25`0``
L_1	53°25`30``	55°30`10``	52°45`0``	23°42`0``
L_2	107°12`40``	185°5`10``	105°10`20``	148°26`50``
L_3	160°33`40``	-	-	-
L_4	212°48`40``	-	-	-
Mean	53°12`10``	129°18`50``	52°35`10``	125°0`55``

CAL. THE ANGLES:-

For point A:-

Mean= (Lf– L0)/N+(M*360°/N)

= (212°48`40`` - 0°0`0``) / 4 + Zero

= 53°12`10``

For point B:-

Mean= (Lf– L0)/N+(M*360°/N)

= (185°5`10``- 286°27`30``)/2+ (1*360°/2)

= 129°18`50``

For point C:-

Mean= (Lf– L0)/N+(M*360°/N)

= (105°10`20`` - 0°0`0``) / 2 + Zero

= 52°35`10``

For point D:-

Mean= (Lf– L0)/N+(M*360°/N)

= (148°26`50``- 258°25`0``)/2+ (1*360°/2)

= 125°0`55``

∑angles

= (53°12`10``+ 129°18`50``+ 52°35`10``+125°0`55``)

=360°7`5``

Angular closing error:-

➡ 360 - ∑angles

= 360 – 360°7`5``

=– 0°7`5``

Correction Equally :-

Equally= error/N = – 0°7`5`` / 4 = – 0°1`46.25``

Mean$_{<DAB}$ = 53°12`10``– 0°1`46.25``

= 53°10`23.75``

Mean$_{<ABC}$ = 129°18`50`` – 0°1`46.25``

= 129°17`3.75``

Mean$_{<BCD}$ = 52°35`10`` – 0°1`46.25``

= 52°33`23.75``

Mean$_{<CDA}$= 125°0`55`` – 0°1`46.25``

= 124°59`8.75``

CAL. Data to the required scale (1:100):-

AB=5.77*100*(1/100)= **5.77cm**

BC=6.01*100*(1/100)= **6.01cm**

CD=6.005*100*(1/100)=**6.005cm**

DA=6.005*100*(1/100)= **6.005cm**

CAL. Data to the required scale (1:200):-

AB=5.77*100*(1/200)= **2.885cm**

BC=6.01*100*(1/200)=**3.005cm**

CD=6.005*100*(1/200)=**3.0025cm**

DA`6.005*100*(1/200)=**3.0025cm**

CAL. Data to the required scale (1:30):-

In Traverse ABCDA` AND Error`s triangle

#The linear closing error is 0.2 m

Relative error:-

➡ AÀ/AB+BC+CD+DA

=0.2 /(5.77+6.01+6.005+6.005)

=**0.0084 m**

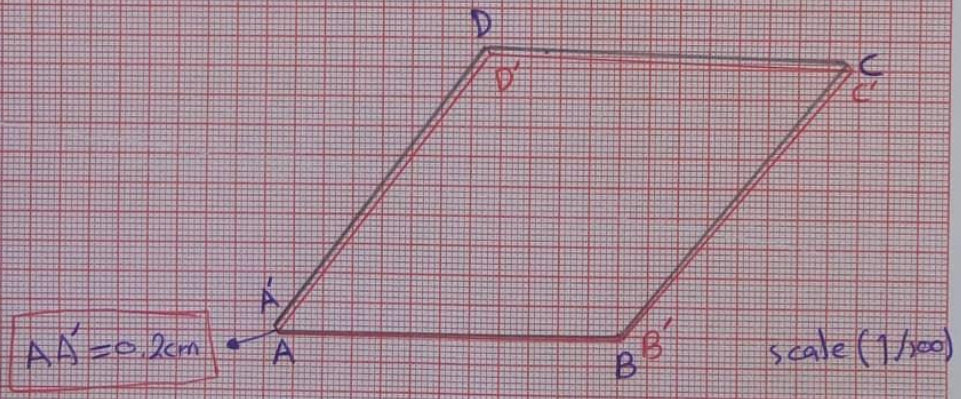
➡ **AÀ=0.2 m**

➡ **BB’=0.06 m**

➡ **CC’=0.105 m**

➡ **DD’=0.165 m**

Traverse ABCDA'



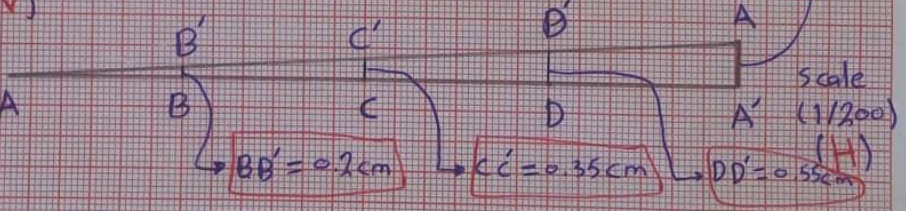
The linear closing error is AA':-

$$AA' = \frac{0.2}{100} \times 100 = 0.2 \text{ m}$$

Error's Triangle

scale (1/30) (V)

$AA' = \frac{0.2}{100} \times 100 \times \frac{1}{30} = 0.67\,cm$



$BB' = \frac{0.2}{100} \times 30 = 0.06\,m$

$CC' = \frac{0.35}{100} \times 30 = 0.105\,m$

$DD' = \frac{0.55}{100} \times 30 = 0.165\,m$

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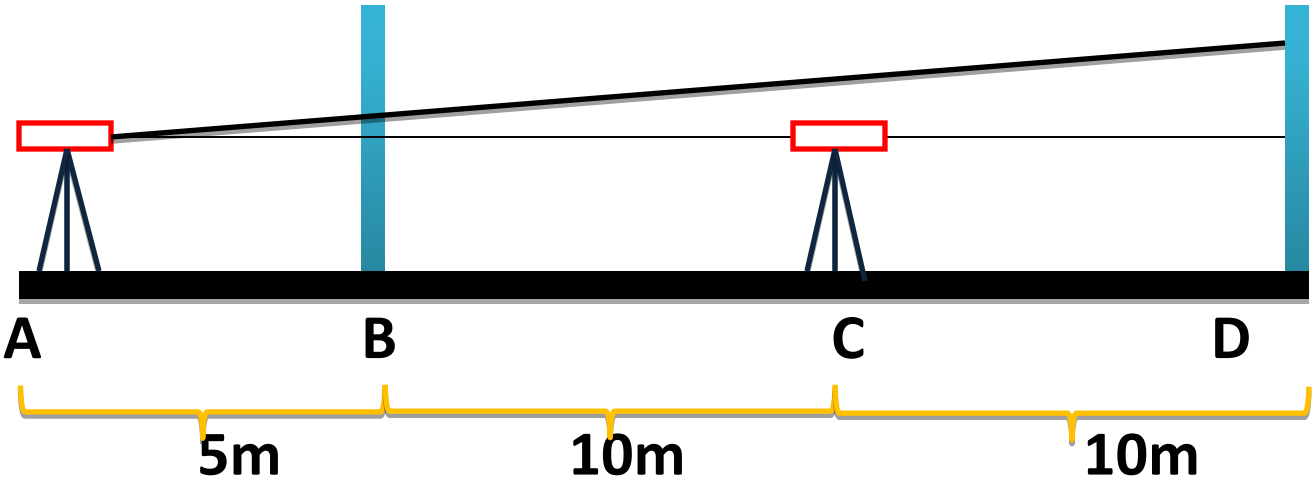
EX:TEXT THE LEVELING:



	Rod reading
R_{cb}	1.323
R_{cd}	1.433
R_{ab}	1.423
R_{ad}	1.533

-True difference in elevation:-

$R_{CD} - R_{CB} = 1.433 - 1.323 = 0.11m$

-Collimation error (e):-

$e = ((R_{ad} - R_{ab}) - (R_{cd} - R_{cb})) / (d_{cb} + d_{cd})$

$e = ((1.533 – 1.423) – (1.433 -1.323)) / (10+10)$

$e = 0$ m/m

-Correction value:-

$R`_{CB} = R_{CB} - 10e = 1.323 - (10 * 0) = 1.323$ m

$R`_{CD} = R_{CD} - 10e = 1.433 - (10 * 0) = 1.433$ m

$R`_{AB} = R_{AB} - 5e = 1.423 - (5 * 0) = 1.423$ m

$R`_{AD} = R_{AD} - 25e = 1.533 - (25 * 0) = 1.533$ m

-Check:-

$R_{CD} - R_{CB} = R`_{CD} - R`_{CB}$

$R`_{CD} - R`_{CB} = 1.433 - 1.323 = 0.11$ m

Check is ok

	Rod reading	Corrected rod readings
R_{cb}	1.323	1.323
R_{cd}	1.433	1.433
R_{ab}	1.423	1.423
R_{ad}	1.533	1.533

بسم الله الرحمن الرحيم

Hashemite University
Faculty of Engineering
Civil Engineering Department

Surveying Laboratory

Experiment No. 5

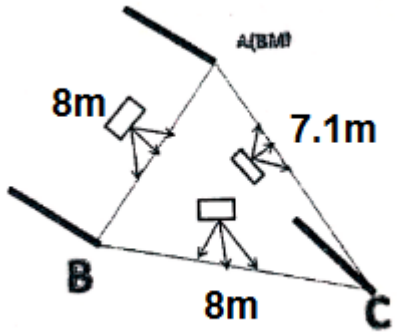
Differential leveling

Name : Abdullah Khaled ALmassri
No. : 1639799

Sunday

Group 5

-



- Data (In Meter) ...

BS	FS	Hi	Cumulative distnace	elevation	point
1.332	-	601.332	-	600	A(B.M)
1.368	1.369	601.331	8	599.963	B
1.347	1.334	601.344	16	599.997	C
	1.343		23.1	600.001	A

AB = BC = 8m ,, CA = 7.1 m

HI_1= elev. @A + RR@B.S_A = 600 + 1.332

= 601.332

Elev. @B = HI_1 - RR@F.S_B = 601.332 – 1.369 = 599.963 m

HI_2= elev. @B + RR@B.S_B =601.331

Elev. @C = HI_2 - RR@F.S_C =599.997 m

HI_3= elev. @C + RR@B.S_C = 601.334

Elev. @A = HI_3 - RR@F.S_A = 599.991 m

- **Check**

  $\sum B.S - \sum F.S$ = Last elev. – First elev.

  4.047 - 4.046 = 600.001 -600 = 0.001

  check is correct

- Error in A = Last elev. – First elev.

  = 600.001 -600 = 0.001

- Allowable error = $12 \times 10^{-3} \times \sqrt{K}$

  = $12 \times 10^{-3} \times \sqrt{0.0231}$

  = 0.00182

*K=23.1/1000=0.0231 Km

- Is the error A within allowable error ?

  ** Yes

- Accuracy = error / total distance

  = 0.001 / 23.1 =0.0000433

Sample of calculations :

- Correction when we use Cumulative distance & corrected elevation …

  Correction for point B = $\frac{Cumulative\ distance}{total\ distance} \times error$

  = $\frac{8}{23.1} \times 0.001$= 0.000346

  Correction elevation for point B = Correction ± elevation

  = **599.963** -0.000346= 599.9626

- Correction when we use # of setup & corrected elevation …

Correction for point B = $\frac{\#of\ setup}{total\ \#\ of\ setup} \times error$

$= \frac{2}{3} \times 0.001$ =0.00066

Correction elevation for point A = Correction ± elevation

= **599.997** - 0.00066 =599.99634

point	**elevation**	correction # of set up	Corrected elevation using #of setup	Correction Cumulative distance	Corrected elevation using cumulative distance
A	**600**	-	-		600
B	**599.963**	$= \frac{1}{3} \times 0.001$ = 0.00033	599.96267	$= \frac{8}{23.1} \times 0.001$= 0.000346	599.9626
C	**599.997**	$= \frac{2}{3} \times 0.001$ = 0.00066	599.99634	$= \frac{16}{23.1} \times 0.001$= 0.00069	599.99631
A	**600.001**	$= \frac{3}{3} \times 0.001$ = 0.001	600	$= \frac{23.1}{23.1} \times 0.001$= 0.001	600

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EX: Contouring from grid (Spot Elevation):-

Point	BS	IS	FS	HI	Elev.
BM	1.328			601.328	600
A1		1.472			599.856
A2		1.464			599.864
A3		1.450			599.878
A4		1.453			599.875
B1		1.267			600.061
B2		1.257			600.071
B3		1.252			600.076
B4		1.241			600.087
C1		1.243			600.085
C2		1.237			600.091
C3		1.230			600.098
C4		1.225			600.103
D1		1.219			600.109
D2		1.218			600.110
D3		1.214			600.114
D4		1.204			600.124
E1		1.289			600.039
E2		1.294			600.034
E3		1.289			600.039
E4		1.279			600.049

F1		1.411			599.917
F2		1.422			599.906
F3		1.417			599.911
F4			1.433		599.895

Elevation

	A	B	C	D	E	F
1	599.856	600.061	600.085	600.109	600.039	599.917
2	599.864	600.071	600.091	600.110	600.034	599.906
3	599.878	600.076	600.098	600.114	600.039	599.911
4	599.875	600.087	600.103	600.124	600.049	599.895
Max.	599.878	600.087	600.103	**600.124**	600.049	599.917
Min.	**599.856**	600.061	600.085	600.109	600.034	599.895

Check:-

BS – FS= Last Elev. – First Elev.

1.328 – 1.433 = 599.895 – 600

- 0.105 = - 0.105 ⟹ It's ok

CI:-

Max. Elev. =600.124

Min. Elev. =599.856

CI = (Max. Elev. – Min. Elev.) / (#of line+1)

= (600.124 – 599.856) / (5+1) = 0.0447

Contour Elev.:-

(Min. Elev. + CI)

1- 599.856 + 0.0447 = 599.9007

2- 599.9007 + 0.0447 = 599.9454

3- 599.9454 + 0.0477 = 599.9901

4- 599.9901 + 0.0477 = 600.0348

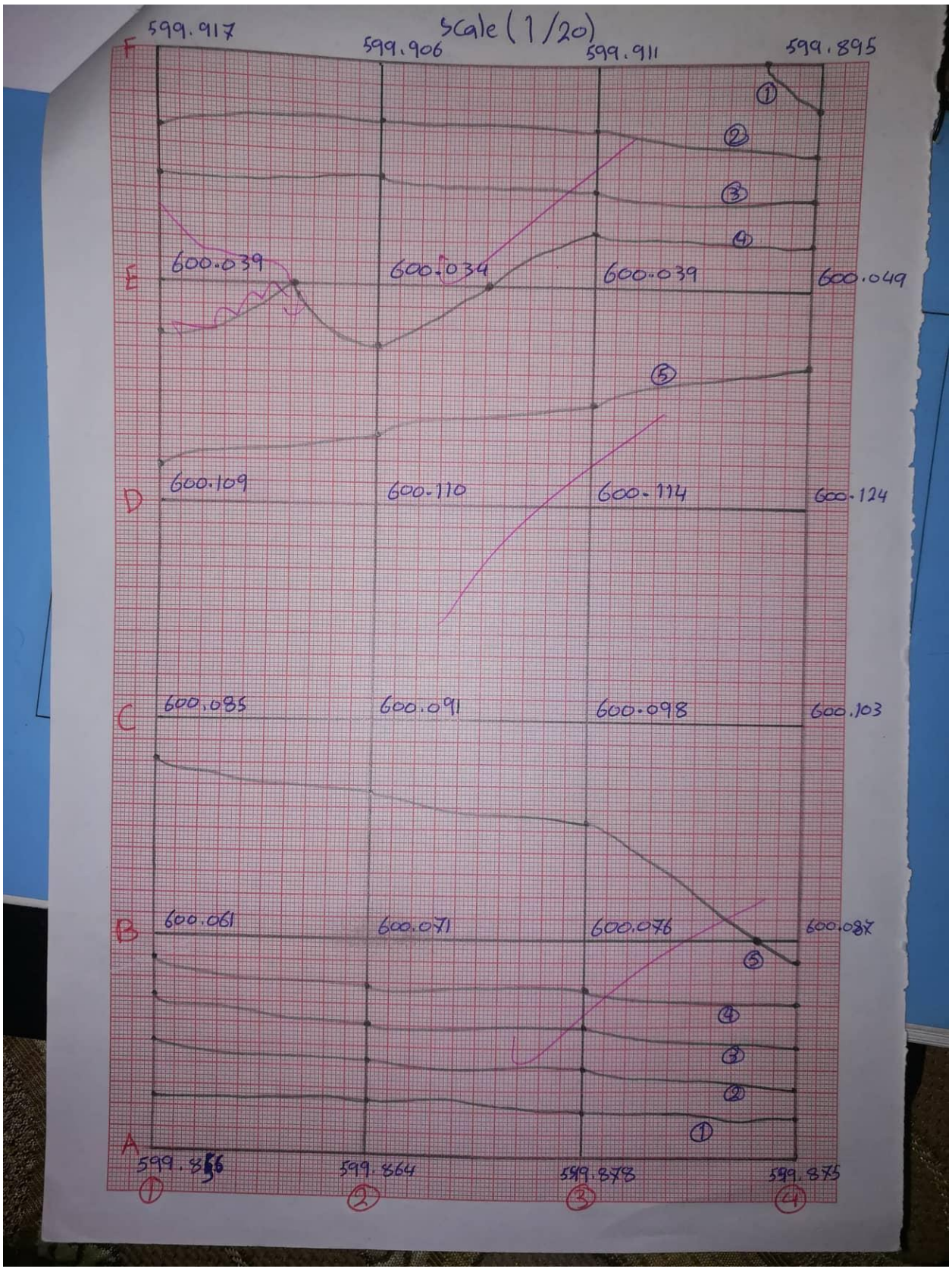
5- 600.0348 + 0.0477 = 600.0795

Definitions:-

Contour Lines: is a curve along which the function has a constant value, so that the curve joins points of equal value.

Contour interval: the difference in elevation represented by each contour line on a topographic map.

Horizontal Equivalent: is the horizontal distance between two points on two consecutive contour lines for a given slope.


scale (1/20)
599.917
599.906
599.911
599.895
F
E
D
C
B
A
600.039
600.034
600.039
600.049
600.109
600.110
600.114
600.124
600.085
600.091
600.098
600.103
600.061
600.071
600.076
600.087
599.856
599.864
599.878
599.875
1
2
3
4
5