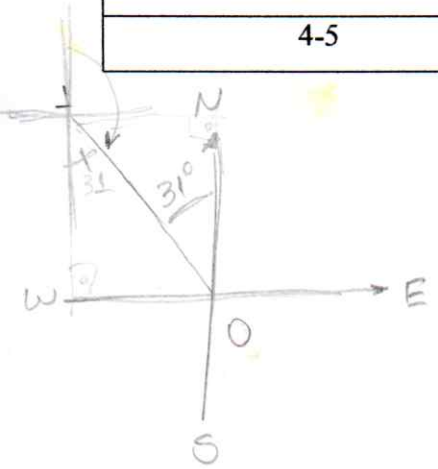
Lista 1 - Topologia

EXERCÍCIOS:

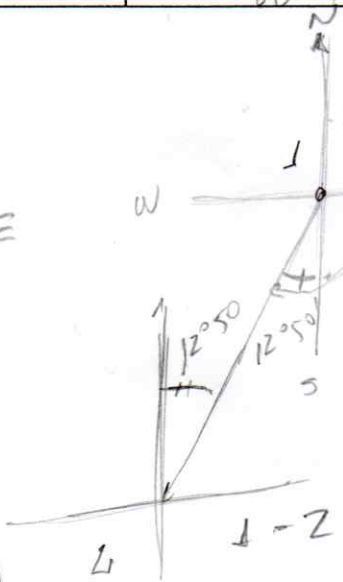
1. **Dados os rumos de vante dos alinhamentos, determinar os azimutes de vante e de ré:**

Alinhamento	Rumo
0-1	31°00'NW
1-2	12°50'SW
2-3	00°15'SE
3-4	88°50'NE
4-5	00°10'NE

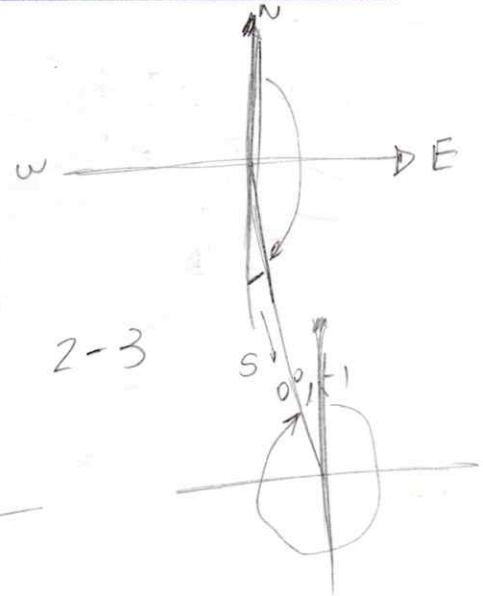
Alinhamento	Azimute de Vante	Azimute de Ré
0-1	329°00'00''	149°00'00''
1-2	192°50'00''	12°50'00''
2-3	179°45'00''	359°45'00''
3-4	88°50'	268°50'00''
4-5	00°10'00''	180°10'00''



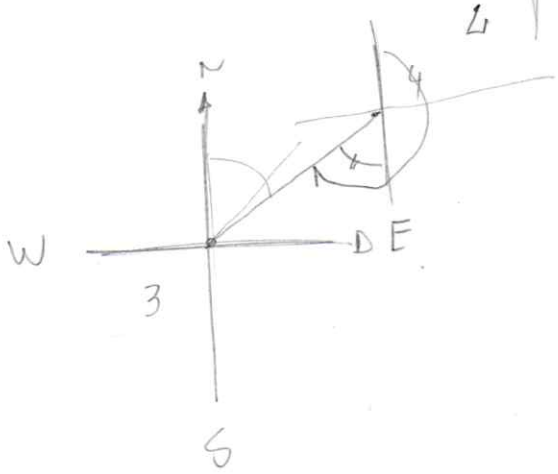
0-1

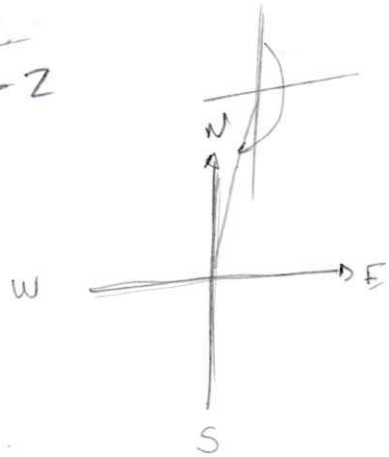


1-2

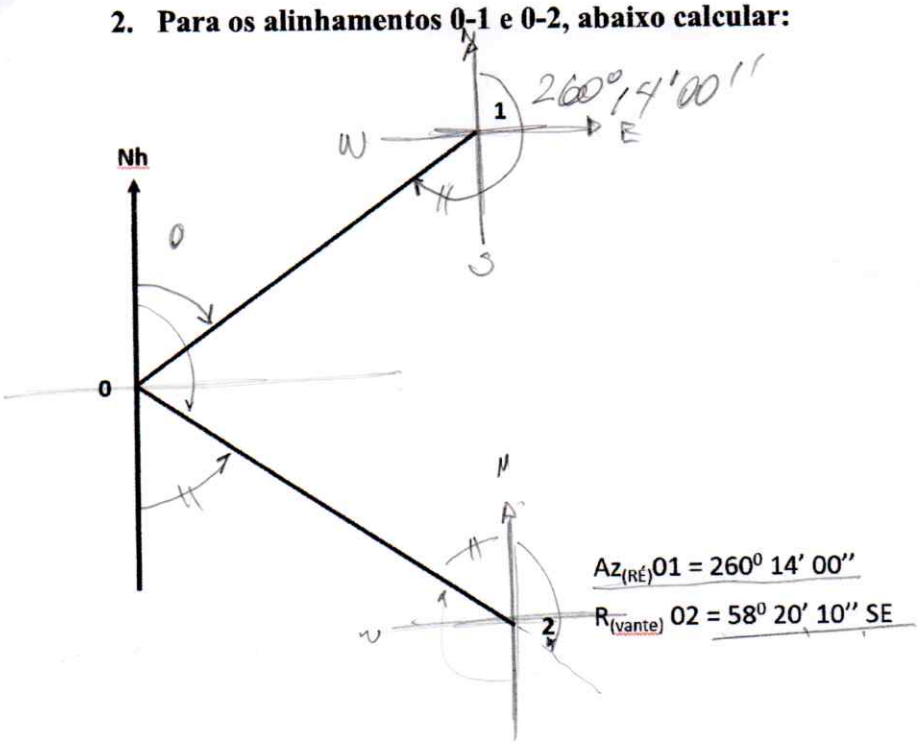


2-3





2. Para os alinhamentos 0-1 e 0-2, abaixo calcular:



Calcular:	Resultado
$A_{z(vante)}$ 0-1	80° 14' 00''
$R_{(vante)}$ 0-1	80° 14' 00'' NE
$R_{(ré)}$ 0-1	80° 14' 00'' SW
$A_{z(vante)}$ 0-2	121° 39' 50''
$A_{z(ré)}$ 0-2	301° 39' 50''
$R_{(ré)}$ 0-2	58° 20' 10'' NW

3- Calcular os Azimutes para a poligonal abaixo:

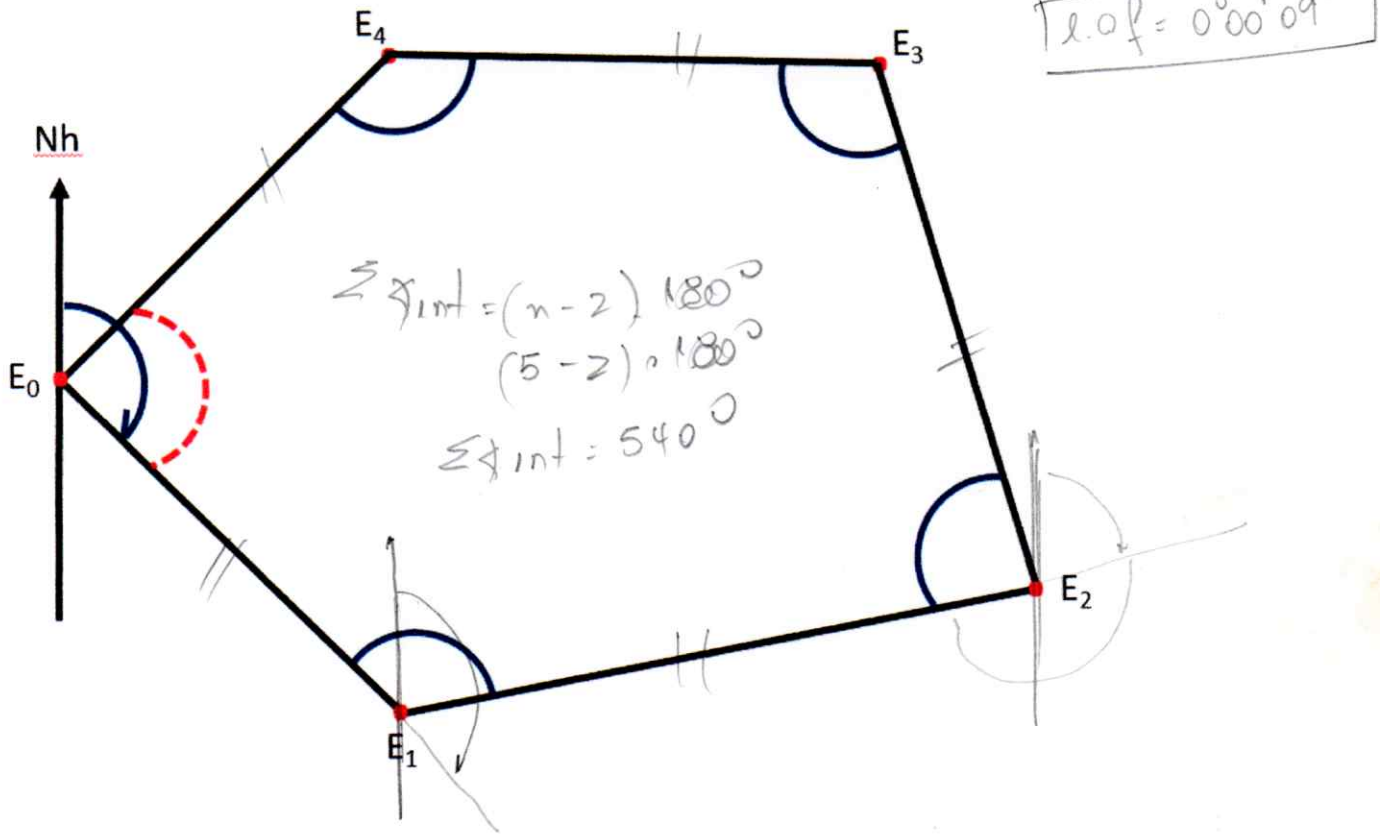
RÉ	PE	PV	ANG. HORIZ	DH (m)	Azimute Calc.
Nh	E_0	E_1	$134^0 45'10"$	66,790	$134^0 45'10"$
E_0	E_1	E_2	$125^0 33'20"$	89,902	$80°18'30"$
E_1	E_2	E_3	$84^0 54'50"$	76,798	$345°13'20"$
E_2	E_3	E_4	$108^0 01'20"$	68,900	$273°14'40"$
E_3	E_4	E_0	$131^0 30'40"$	63,520	$224°45'20"$
E_4	E_0	E_1	$89^0 59'59"$		$134°45'19"$

$\Sigma \measuredangle_{int} = 540°00'09"$

erro $\measuredangle$ de

$l.o.f = 0°00'09"$

Croqui:



4- Com os resultados acima, calcular as Coordenadas Parciais para cada alinhamento.

					Coordenadas Parciais			
					Longitudes (X)		Latitudes (Y)	
RÉ	PE	PV	DH (m)	Az. Calc.	E (x +)	W (x -)	N (y +)	S (y -)
Nh	E_0	E_1	66,790	$134^0 45'10"$	47,431			- 47,023
E_0	E_1	E_2	89,902	$80°18'30"$	88,619		15,135	
E_1	E_2	E_3	76,798	$345°13'20"$	1,453	- 19,588	74,257	
E_2	E_3	E_4	68,900	$273°14'40"$		- 68,789	3,899	
E_3	E_4	E_0	63,520	$224°45'20"$		- 44,723		- 45,107

5) Converta os Azimutes em Rumos.

a) 85°12'23" = 85°12'23" NE

b) 165°58'47" = 14°01'13" SE

c) 254°34'51" = 74°34'51" SW

d) 329°49'06" = 30°10'54" NW

e) 12°58'37" = 12°58'37" NE

f) 147°39'28" = 32°20'32" SE

g) 199°01'03" = 19°01'03" SW

h) 359°59'59" = 0°00'01" NW

i) 90°00'00" = 90°00'00" E

j) 180°00'00" = 0°00'00" S

k) 270°00'00" = 90°00'00" W

6) Converta os rumos em azimute

a) 16°13'43" NE = 16°13'43"

b) 26°48'46" SE = 153°11'14"

c) 34°45'42" SW = 214°45'42"

d) 48°53'17" NW = 311°06'43"

e) 59°47'47" NE = 59°47'47"

f) 62°40'19" SE = 117°19'41"

g) 71°03'58" SW = 251°03'58"

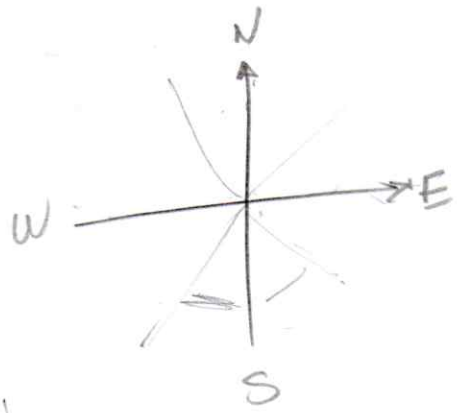
h) 89°59'59" NE = 89°59'59"

i) 0° N = 0°00'00"

j) 90° E = 90°00'00"

k) 0° S = 180°00'00"

l) 90° W= 270°00'00"



Formulas

$DH = 100.(RS-RI).(\text{sen } Z)^2$

$\Delta = \cotg Z . DH$

$DN = \Delta + A.I + RM$

Universidade de São Paulo

Escola Superior de Agricultura "Luiz de Queiroz"

Departamento de Engenharia de Biossistemas

Disciplina: LEB0340 – Topografia

Prof. Dr. Peterson Ricardo Fiorio

Exercícios sobre Taqueometria

Nome: Gabarito **nº. USP:** _____ **Turma:** _____ **Data:** __ / __ / ___

1) Dadas as informações obtidas no campo, referentes ao ângulo horizontal, altura do instrumento e leituras dos retículos superior, médio e inferior, determine a Distância Horizontal (DH) e a Diferença de Nível (DN) do ponto estacionado ao ponto visado.

	a)	b)	c)	d)	e)
Ângulo vertical	90°00'00"	90°00'00"	85°32'17"	41°32'16"	16°32'14"
RS	1,953	0,987	2,394	3,995	4,193
RM	1,897	0,932	2,078	3,391	3,725
RI	1,841	0,876	1,761	2,782	3,257
Ai	1,432	1,458	1,623	1,391	1,005
DH	11,200	11,100	62,917	53,338	7,583
DN	-0,465	0,526	4,454	58,207	22,819

0,112 0,111 0,633 1,213 0,936

Lista Taqueometria

1) $DH = 100 . H . (\text{sen } z)^2$

$DN = \Delta + Ai - RM$

$\Delta = DH \cdot \text{cotg } z$

a) $DH = 100 \times (1,953 - 1,841) . (\text{sen } 90°0'00')^2$

$DH = 11,20m //$

$\Delta = 11,20 \times \text{cotg } 90°0'0''$

$\Delta = 0$

$DN = 0 + 1,432 - 1,897$

$DN = -0,465m //$

b) $DH = 100 \times (0,987 - 0,876) \times (\text{sen } 90°0'00'')^2$

$DH = 11,100m //$

$\Delta = 11,100 \times \text{cotg } 90°00'00''$

$\Delta = 0$

$DN = 0 + 1,458 - 0,932$

$DN = 0,526m //$

c) $DH = 100 \times (2{,}394 - 1{,}761) \times (\text{sen } 85°32'17")^2$

$DH = 62{,}917\,m$ //

$\Delta = 62{,}917 \times \text{cotg } 85°32'17"$

$\Delta = 4{,}910\,m$ //

$DN = 4{,}910 + 1{,}623 - 2{,}078$

$DN = 4{,}455$ //

d) $DH = 100 \times (3{,}995 - 2{,}782) \times (\text{sen } 41°32'16")^2$

$DH = 53{,}338\,m$ //

$\Delta = 53{,}338 \times \text{cotg } 41°32'16"$

$\Delta = 60{,}208\,m$

$DN = 60{,}208 + 1{,}391 - 3{,}391$

$DN = 58{,}208\,m$ //

a) $DH = 100 \times (4{,}193 - 3{,}257) \times (\text{sen } 16°32'14")^2$

$DH = 7{,}583\,m$ //

$\Delta = 7{,}583 \times \text{cotg } 16°32'14"$

$\Delta = 25{,}539\,m$

$DN = 25{,}539 + 1{,}005 - 3{,}725$

$DN = 22{,}819\,m$ //

2) Dada a caderneta de campo de um levantamento taqueométrico, determine:

a) Distâncias Horizontais (DHs) e Diferenças de Nível (DNs) entre o ponto estacionado e os pontos visados.

RÉ	PE	PV	Ai	Ang. Hz.	RS	RM	RI	Ang. Vert.	Obs.	DH	DN	Δ
Nh	A	B	1,746	35°13'13"	1,912	1,000	0,088	90°28'57" 1,824	Ponto B	182,387	-0,790	-1,536
Nh	A	C	1,746	78°21'01"	1,973	1,000	0,027	89°37'48" 1,946	Ponto C	194,582	2,003	1,257
Nh	A	D	1,746	98°42'37"	1,724	1,000	0,276	88°46'39" 1,448	Ponto D	144,734	3,835	3,089
Nh	A	E	1,746	159°57'46"	1,667	1,000	0,333	87°55'20" 1,334	Ponto E	133,225	5,579	4,833
Nh	A	F	1,746	185°21'05"	1,885	1,000	0,115	88°44'11" 1,770	Ponto F	176,914	4,648	3,902
Nh	A	G	1,746	215°36'47"	1,936	1,000	0,064	89°33'22" 1,872	Ponto G	187,189	2,196	1,450
Nh	A	H	1,746	298°10'35"	1,898	1,000	0,251	90°22'33" 1,647	Ponto H	164,693	0,344	-1,080
Nh	A	I	1,746	348°05'32"	1,747	1,000	0,400	91°11'45" 1,347	Ponto I	134,641	-2,064	-2,810

$DH = 100 \cdot (Rs - Ri) \cdot (\tan Z)^2$

$\Delta = \operatorname{cotg} Z \cdot DH$

$DN = \Delta + A.I - RM$

2)

$DH = 100 \times H \times (\text{sen } z)^2$ (2)

$\Delta = DH \times \text{cotg } z$

$DN = \Delta + Ai - RM$

a) Ponto B

$DH = 100 \times (1,912 - 0,088) \times (\text{sen } 90°28'57")^2$

$DH = 182,387\,m$ //

$\Delta = 182,387 \times \text{cotg } 90°28'57"$

$\Delta = -1,536\,m$ //

$DN = -1,536 + 1,746 - 1,000$

$DN = -0,790\,m$ //

Ponto C

$DH = 100 \times (1,973 - 0,027) (\text{sen } 89°37'48")^2$

$DH = 194,592\,m$ //

$\Delta = 194,592 \times \text{cotg } 89°37'48"$

$\Delta = 1,257\,m$

$DN = 1,257 + 1,746 - 1,000$

$DN = 2,003\,m$

(2)

Ponto D

$DH = 100 \times (1{,}724 - 0{,}276) (\text{sen } 88° 46' 39")^2$

$DH = 144{,}734 m //$

$\Delta = 144{,}734 \times \text{cotg } 88° 46' 39"$

$\Delta = 3{,}089 m$

$DN = 3{,}089 + 1{,}746 - 1{,}000$

$DN = 3{,}835 m //$

Ponto E

$DH = 100 \times (1{,}667 - 0{,}333) (\text{sen } 87° 55' 20")^2$

$DH = 133{,}225 m //$

$\Delta = 133{,}225 \times \text{cotg } 87° 55' 20"$

$\Delta = 4{,}833 m //$

$DN = 4{,}833 + 1{,}746 - 1{,}000$

$DN = 5{,}579 m //$

Ponto F

$DH = 100 \times (1{,}885 - 0{,}115) (\text{sen } 88° 44' 11")^2$

$DH = 176{,}914 m //$

$\Delta = 176{,}914 \times \text{cotg } 88° 44' 11"$

$\Delta = 3{,}902 m$

$DN = 3{,}902 + 1{,}746 - 1{,}000 \qquad DN = 4{,}648 m //$

Ponto G)

$DH = 100 \times (1,936 - 0,064) \times (\text{sen } 89°33'22")^2$

$DH = 187,189\,m$ //

$\Delta = 187,189 \times \text{cotg } 89°33'22"$

$\Delta = 1,450\,m$

$DN = 1,450 + 1,746 - 1,000 = 2,196\,m$ //

Ponto H)

$DH = 100 \times (1,898 - 0,251) \times (\text{sen } 90°22'33")^2$

$DH = 164,693\,m$ //

$\Delta = 164,693 \times \text{cotg } 90°22'33"$

$\Delta = -1,080\,m$

$DN = -1,080 + 1,746 - 1,000 = -0,334\,m$ //

Ponto I)

$DH = 100 \times (1,747 - 0,400) (\text{sen } 91°11'45")^2$

$DH = 134,641\,m$ //

$\Delta = 134,641 \times \text{cotg } 91°11'45"$

$\Delta = -2,810\,m$ //

$DN = -2,810 + 1,746 - 1,000$

$DN = -2,064\,m$ //

b) As coordenadas retangulares dos pontos visados, considerando que as coordenadas do ponto A são (0,000;0,000).

Ponto	Coordenada		cota
	X	Y	
A	0,000	0,000	100
B	105,186	148,999	99,210
C	190,583	39,293	102,003
D	143,065	-21,918	103,835
E	45,647	-125,161	105,979
F	-16,500	-176,143	104,648
G	-109,002	-152,179	102,196
H	-145,176	77,766	99,666
I	-27,781	131,744	97,936

Cota = 100

b,

	X	Y	
Ponto A	0,000	0,000	100
Ponto B	105,186//	148,999//	99,210m
Rec (182,387 , 35°13'13")			
Ponto C	190,583//	39,293//	102,003m
Rec (194,592 , 78°21'01")			
Ponto D	143,065//	-21,918//	103,835
Rec (144,734, 98°42'37")			
Ponto E	45,647//	-125,161//	105,579
Rec (133,225, 159°57'46")			
Ponto F	-16,500//	-176,143//	104,648
Rec (176,914, 185°21'05")			
Ponto G	-109,002//	-152,179//	102,196
Rec (187,189, 215°36'47")			
Ponto H	-145,176//	77,766//	99,666
Rec (164,693, 298°10'35")			
Ponto I	-27,781//	131,744//	97,936
Rec (134,641, 348°05'32")			

c) Distâncias Horizontais (DHs), Diferenças de Nível (DNs) e Azimutes (Az) dos alinhamentos informados na tabela.

Alinhamento	DH	DN	Az
AB	182,387	- 0,790	35°13'13"
BC	139,025	2,793	142°06'08"
CD	77,490	1,832	217°49'20"
DE	141,948	1,744	223°20'14"
EF	80,383	-0,931	230°38'11"
FG	95,556	- 2,452	284°31'26"
GH	232,773	- 2,530	351°63'35"
HI	129,210	- 1,730	65°18'26"
IA	134,641	- 2,064	168°05'33"

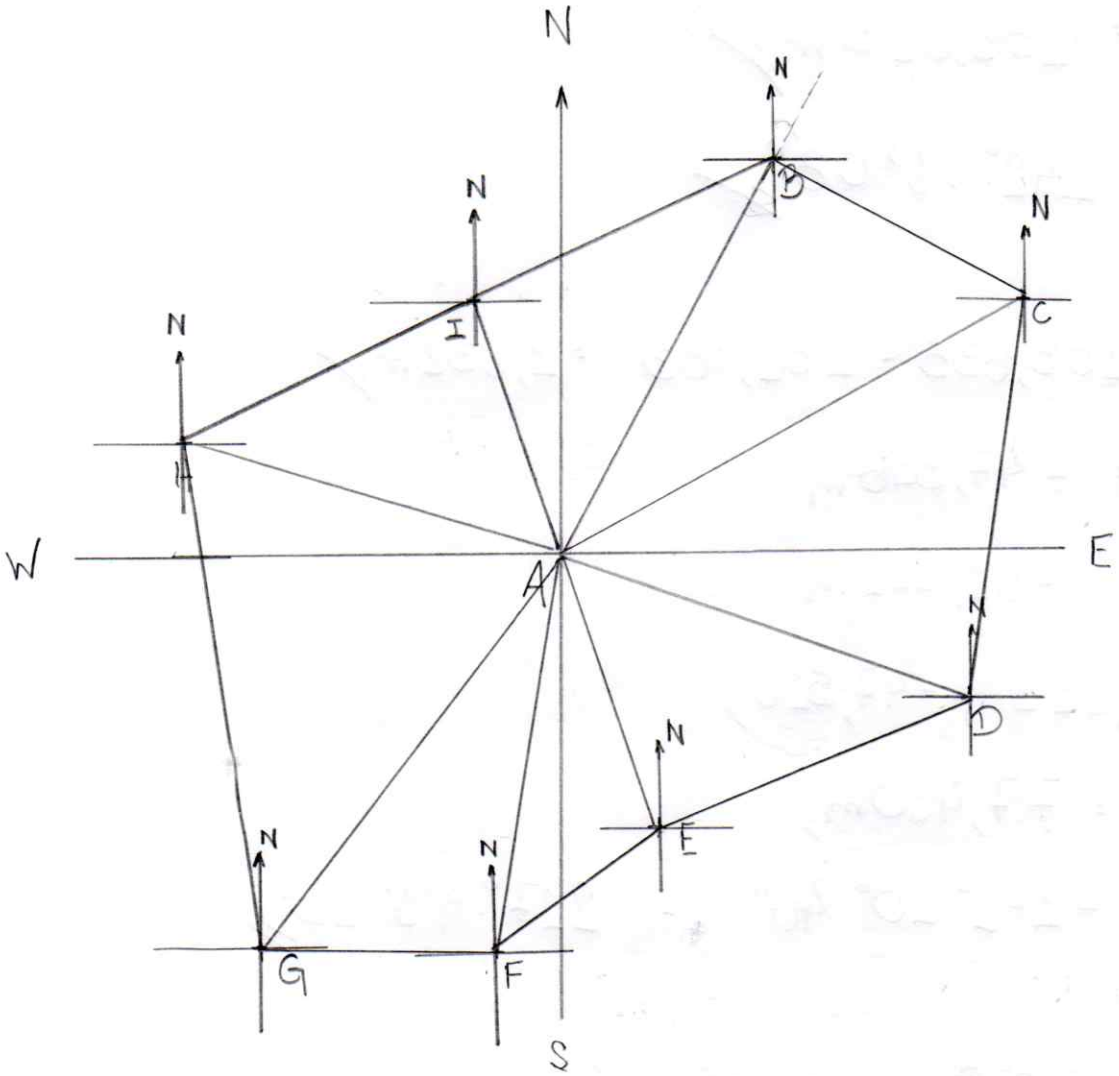
d) A área da poligonal pelo método de Gauss.

62.648,751 m² → 6,265 ha

C)

$\overline{AB}$ DH:

(4)



$DN_{\vec{AB}}$ = -99,210 -100 = -0,790 m //

$DH_{\vec{AB}}$ = 182,387 m //

$Az_{\vec{AB}}$ = 35°13'13"

(4)

$DN_{\vec{BC}}$: 102,003 - 99,210 = 2,793m //

$Long P_{\vec{BC}}$: 190,583 - 105,186 : 85,397m //

$Lat P_{\vec{BC}}$: 39,293 - 148,999 : -109,706m //

Pol (-109,706 , 85, 397)

$DH_{\vec{BC}}$: 139,025 m //

$Az_{\vec{BC}}$ = 142° 06' 08" //

$DN_{\vec{CD}}$ = 103,835 - 102,003 = 1,832m //

$Long P_{\vec{CD}}$: -47,518 m

$Lat P_{\vec{CD}}$: -61,211 m

Pol(-61,211 , -47,518)

$DH_{\vec{CD}}$: 77,490m //

$Az_{\vec{CD}}$ = -142° 10° 40" = 217° 49' 20" //

$DN_{\vec{DE}}$: 105,579 - 103,835 : 1,744m //

$Long P_{\vec{DE}}$: -97,418 m

$Lat P_{\vec{DE}}$ = -103,243m

Pol (-103,243, -97,418)

$DH_{\vec{DE}}$: 141,948 m //

$Az_{\vec{DE}}$: -136° 39' 46" = 223° 20' 14" //

$DN_{\vec{EF}}$: 104,648 - 105,579 = - 0,931 m //

$Long P_{\vec{EF}}$ = -62,147 m

$Lat P_{\vec{EF}}$: -50,982 m

Pol (-50,982, -62,147)

$DH_{\vec{EF}}$: 80,383 m //

$Az_{\vec{EF}}$ = -129°21'49" = 230°38'11" //

$DN_{\vec{FG}}$: 102,196 - 104,648 = -2,452 m //

$Long P_{\vec{FG}}$: -92,502 m

$Lat P_{\vec{FG}}$: 23,964 m

Pol (23,964, -92,502)

$DH_{\vec{FG}}$: 95,556 m //

$Az_{\vec{FG}}$: -75°28'34" = 284°31'26" //

$DN_{\vec{GH}}$: 99,666 - 102,196 = -2,530 m //

$Long P_{\vec{GH}}$: -36,174 m

$Lat P_{\vec{GH}}$: 229,945 m

Pol (229,945, -36,174)

$DH_{\vec{GH}}$: 232,773 m //

$Az_{\vec{GH}}$ = -8°56°25" = 351°03'35" //

$DN_{\overrightarrow{HI}}$: 97,936 - 99,666 = -1,730 m //

$Long P_{\overrightarrow{HI}}$ = 117,395 m

$Lat P_{\overrightarrow{HI}}$ = 53,978 m

Pol (53,978 m , 117,395)

$DH_{\overrightarrow{HI}}$ = 129,210 m //

$Az_{\overrightarrow{HI}}$ = 65° 18' 26" //

$DN_{\overrightarrow{IA}}$: 97,936 - 100 = -2,064 m //

$Long P_{\overrightarrow{IA}}$ = +27,781 m

$Lat P_{\overrightarrow{IA}}$ = -131,744 m

Pol (-131,744 , 27,781)

$DH_{\overrightarrow{IA}}$ = 134,641 m

$Az_{\overrightarrow{IA}}$ = 168° 05' 33" //

d,

	Y.X	X	Y	Y.X
A		0	0	
B		105,186	148,999	
C		190,583	39,293	
D		143,065	-21,918	
E		45,647	-125,161	
F		-16,500	-176,143	
G		-109,002	-152,179	
H		-145,176	-77,766	
I		-27,781	131,744	
A		0	0	

Area = 162648,751 = 6,265 ha

a) Distâncias Horizontais (DHs) e Diferenças de Nível (DNs) entre o ponto estacionado e os pontos visados.

RÉ	PE	PV	Ai	Âng. Hz.	RS	RM	RI	Âng. Vert.	Obs.	DH	DN	Δ
Nh	A	B	1,453	14°12'31"	0,912	0,873	0,834	90°50'25"	Ponto B	7,798	0,466	-0,114
Nh	A	C	1,453	21°10'15"	1,950	1,458	0,965	84°09'54"	Ponto C	97,482	9,957	9,962
Nh	A	D	1,453	52°21'36"	1,194	1,076	0,958	98°38'13"	Ponto D	23,068	-3,127	-3,504
Nh	A	E	1,453	93°36'57"	0,328	0,293	0,258	71°17'46"	Ponto E	6,280	3,286	2,126
Nh	A	F	1,453	115°43'49"	1,723	1,680	1,637	64°46'22"	Ponto F	7,038	3,089	3,316
Nh	A	G	1,453	193°57'32"	0,846	0,822	0,798	85°25'37"	Ponto G	4,769	1,012	0,3814
Nh	A	H	1,453	232°49'29"	1,546	1,518	1,489	73°22'09"	Ponto H	5,233	1,498	1,563
Nh	A	I	1,453	299°34'28"	1,365	1,262	1,158	96°44'18"	Ponto I	20,415	-2,221	-2,412
Nh	A	J	1,453	308°22'09"	1,623	1,548	1,473	87°31'42"	Ponto J	14,972	0,551	0,646
Nh	A	K	1,453	312°17'01"	1,871	1,834	1,796	72°01'01"	Ponto K	6,785	1,821	2,202

b) As coordenadas retangulares dos pontos visados, considerando que as coordenadas do ponto A são (0,000;0,000).

Ponto	Coordenada	
	X	Y
A	0,000	0,000
B	1,914	7,559
C	35,206	90,903 (*)
D	18,267	14,088
E	6,267	-0,396
F	6,340	-3,055
G	-1,150	-4,628
H	-4,170	-3,162
I	-17,755	10,076
J	-11,738	9,293
K	-5,020	4,565

c) Distâncias Horizontais (DHs), Diferenças de Nível (DNs) e Azimutes (Az) dos alinhamentos informados na tabela.

Alinhamento	DH	DN	Az
AB	7,797	0,466	14°12'33"
BC	89,747	9,491	21°46'28"
CD	78,660	-13,084	192°26'08"
DE	18,809	6,431	219°38'30"

EF	2,660	-0,197	178°25'39"
FG	7,653	-2,077	258°08'22"
GH	3,357	0,486	295°53'36"
HI	18,968	-3,719	314°15'32"
IJ	6,068	2,772	97°24'51"
JK	8,215	1,270	125°08'14"
KA	6,785	-1,821	132°16'56"

d) A área da poligonal pelo método de Gauss.

Área 784,584m²

3) a)

Ponto B DH = +7,798 m
Δ = -0,114 m
DN = +0,466 m

Ponto C DH = 97,482 m
Δ = 9,962 m
DN = 9,957 m

Ponto D DH = 23,068 m
Δ = -3,504 m
DN = -3,127 m

Ponto E DH = 6,280 m
Δ = 2,126 m
DN = 3,286 m

Ponto F DH = 7,038 m
Δ = 3,316 m
DN = 3,089 m

Ponto G DH = 4,769 m
Δ = 0,381 m
DN = 1,012 m

Ponto H DH = 5,233 m
Δ = 1,563 m
DN = 1,498 m

Ponto I DH = 20,415 m
Δ = -2,412 m
DN = -2,221 m

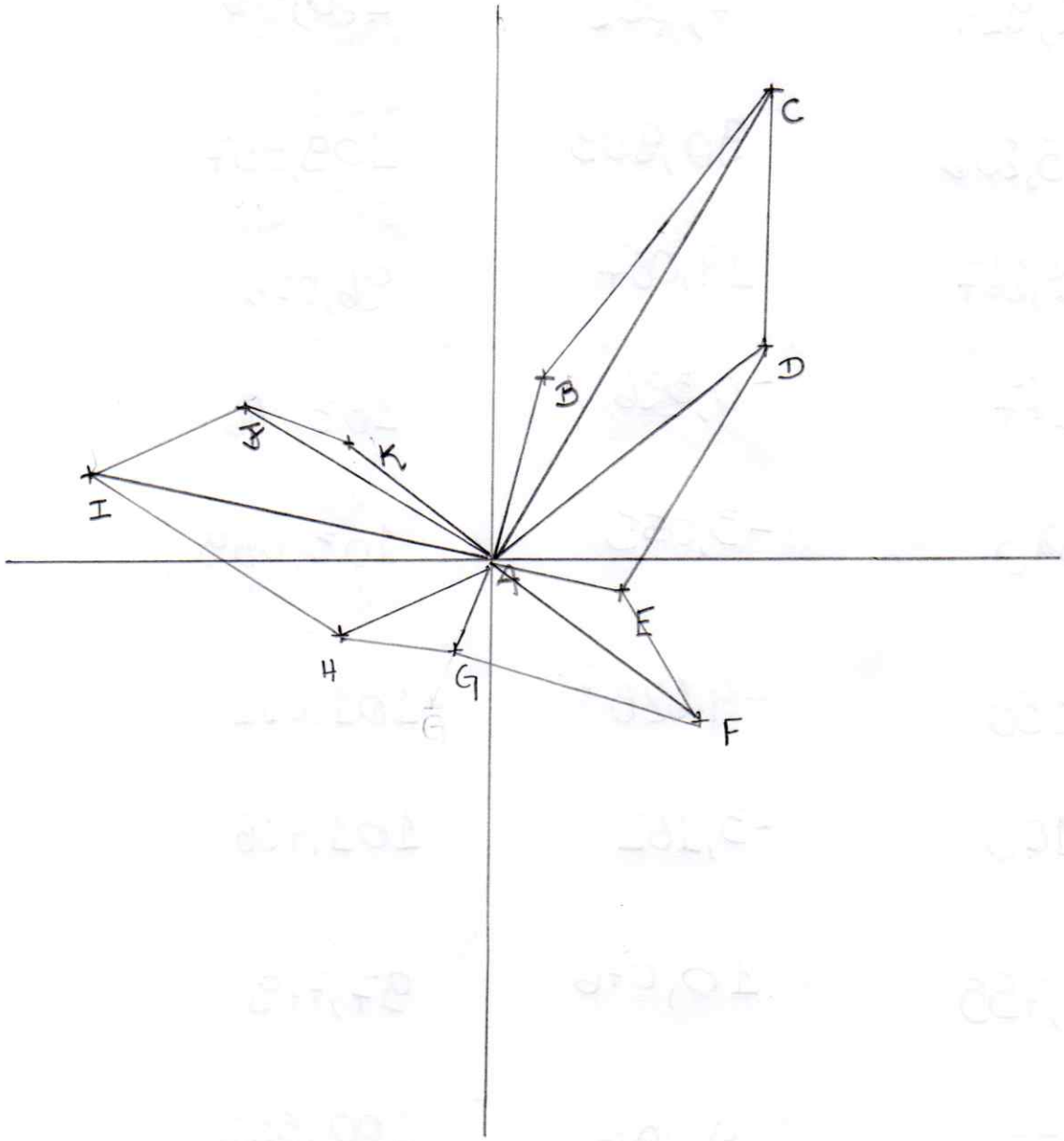
Ponto J DH = 14,972 m
Δ = 0,646 m
DN = 0,551 m

Ponto K DH = 6,785 m
Δ = 2,202 m
DN = 1,821 m

b,

	X	y	Gta
A	0	0	100
B	1,914	7,559	100,466
C	35,206	90,903	109,957
D	18,267	14,087	96,873
E	6,267	-0,396	103,286
F	6,340	-3,055	103,089
G	-1,150	-4,628	101.012
H	-4,170	-3,162	101,498
I	-17,755	10,076	97,779
J	-11,738	9,293	100,551
K	-5,020	4,565	101,821

c)



$DN_{\vec{AB}} = 0,466\,m$ $\quad DN_{\vec{BC}} = 9,491\,m$

$DH_{\vec{AB}} = 7,798\,m$ $\quad DH_{\vec{BC}} = 89,747\,m$

$Az_{\vec{AB}} = 14°12'31''$ $\quad Az_{\vec{BC}} = 21°46'28''$

$DN_{\vec{CD}} = -13,084\,m$ $\quad DN_{\vec{DE}} = 6,413\,m$

$DH_{\vec{CD}} = 78,661\,m$ $\quad DH_{\vec{DE}} = 18,808\,m$

$Az_{\vec{CD}} = 192°26'08''$ $\quad Az_{\vec{DE}} = 219°38'37''$

$DN_{\vec{EF}} = -0,197m$

$DH_{\vec{EF}} = 2,660m$

$Az_{\vec{EF}} = 178°25'39"$

$DN_{\vec{FG}} = -2,077m$

$DH_{\vec{FG}} = 7,653m$

$Az_{\vec{FG}} = 258°08'22"$

$DN_{\vec{GH}} = 0,486m$

$DH_{\vec{GH}} = 3,357m$

$Az_{\vec{GH}} = 295°53'36"$

$DN_{\vec{HI}} = -3,719m$

$DH_{\vec{HI}} = 18,968m$

$Az_{\vec{HI}} = 314°15'32"$

$DN_{\vec{IJ}} = 2,772m$

$DH_{\vec{IJ}} = 6,068m$

$Az_{\vec{IJ}} = 97°24'52"$

$DN_{\vec{JK}} = 1,270m$

$DH_{\vec{JK}} = 8,215m$

$Az_{\vec{JK}} = 125°08'14"$

$DN_{\vec{KA}} = -1,821m$

$DH_{\vec{KA}} = 6,817m$

$Az_{\vec{KA}} = 132°50'44"$

d)

$Area = 784,599\ m^2 = 0,078\ ha$

4) Dada a caderneta de campo de um levantamento taqueométrico, determine:

a) Distâncias Horizontais (DHs) e Diferenças de Nível (DNs) entre o ponto estacionado e os pontos visados.

$DH = 100 \cdot (RS - Ri) \cdot (\sin Z)^2$

1,487

RÉ	PE	PV	Ai	Ang. Hz.	RS	RM	RI	Ang. Vert.	Obs.	DH	DN	Δ
Nh	A	B	1,487	22°23'19"	1,044	1,000	0,956	89°19'36"	Ponto B 0,088	8,799	0,590	0,103
Nh	A	C	1,487	31°21'28"	1,083	1,000	0,917	88°28'43"	Ponto C 0,166	16,588	0,927	0,440
Nh	A	D	1,487	64°32'37"	1,105	1,000	0,895	87°34'24"	Ponto D 0,210	20,962	1,375	0,888
Nh	A	E	1,487	98°47'46"	1,043	1,000	0,957	90°46'57"	Ponto E 0,086	8,598	0,370	-0,117
Nh	A	F	1,487	145°54'55"	1,124	1,000	0,876	89°55'33"	Ponto F 0,248	24,800	0,519	0,032
Nh	A	G	1,487	186°46'47"	1,101	1,000	0,899	88°41'48"	Ponto G 0,202	20,189	0,946	0,459
Nh	A	H	1,487	259°50'33"	1,216	1,000	0,784	87°32'17"	Ponto H 0,432	43,120	2,341	1,854
Nh	A	I	1,487	268°45'32"	1,247	1,000	0,753	89°23'29"	Ponto I 0,494	49,394	1,012	0,525
Nh	A	J	1,487	305°33'16"	1,238	1,000	0,762	90°14'53"	Ponto J 0,476	47,599	0,281	-0,206
Nh	A	K	1,487	325°28'03"	1,129	1,000	0,871	91°05'48"	Ponto K 0,258	25,790	-0,007	-0,494
Nh	A	L	1,487	333°49'07"	1,150	1,000	0,850	92°16'34"	Ponto L 0,150	29,953	-0,703	-1,190

b) As coordenadas retangulares dos pontos visados, considerando que as coordenadas do ponto A são (0,000;0,000).

Ponto	Coordenada	
	X	Y
A	0,000	0,000
B	3,351	-8,136
C	8,632	14,165
D	18,927	9,010
E	8,497	-1,315
F	13,898	-20,540

G	-2,383	-20,048
H	-42,444	-7,604
I	-49,382	-1,070
J	-38,725	27,679
K	-14,620	21,246
L	-13,216	26,880

c) Distâncias Horizontais (DHs), Diferenças de Nível (DNs) e Azimutes (Az) dos alinhamentos informados na tabela.

Alinhamento	DH	DN	Az
AB	8,799	0,590	22°23'08"
BC	8,015	0,337	41°12'58"
CD	11,513	0,448	116°35'54"
DE	14,676	-1,005	225°17'24"
EF	19,969	0,149	164°18'29"
FG	16,288	0,427	271°43'51"
GH	41,949	1,395	287°15'22"
HI	9,530	-1,329	313°16'56"
IJ	30,660	-0,731	200°20'24"
JK	24,948	-0,283	104°56'25"
KL	5,806	-0,696	13°59'35"
LA	29,953	0,703	153°49'05"

d) A área da poligonal pelo método de Gauss.

Área = 1.949,887 m²

5) Obtenha as coordenadas retangulares dos alinhamentos a seguir, utilizando a função

4) a)

Ponto B DH = 8,799 m //
Δ = 0,103 m
DN = 0,590 m //

Ponto C DH = 16,588 m //
Δ = 0,440 m
DN = 0,927 m //

Ponto D DH = 20,962 m //
Δ = 0,888 m
DN = 1,375 m //

Ponto E DH = 8,598 m //
Δ = -0,117 m //
DN = 0,369 m //

Ponto F DH = 24,800 m //
Δ = 0,032 m
DN = 0,519 m //

Ponto G DH = 20,189 m //
Δ = 0,459 m
DN = 0,946 m //

Ponto H DH = 43,120 m //
Δ = 1,854 m
DN = 2,341 m //

Ponto I DH = 49,394 m //
Δ = 0,525 m
DN = 1,012 m //

Ponto J DH = 47,599 m //
Δ = -0,206 m
DN = 0,281 m //

Ponto K DH = 25,790 m //
Δ = -0,494 m
DN = -0,007 m //

Ponto L DH = 29,953 m // Δ = -1,190 m DN = -0,703 m //

b)

Ponto	X	Y	Cota
A	0	0	100
B	3,351	8,136	100,590
C	8,632	14,165	100,927
D	18,927	9,010	101,375
E	8,497	-1,315	100,369
F	13,898	-20,540	100,519
G	-2,383	-20,048	100,946
H	-42,444	-7,604	102,341
I	-49,382	-1,070	101,012
J	-38,725	27,678	100,281
K	-14,620	21,246	99,993
L	-13,216	26,880	99,297

c) DN_{AB} = 0,590m //

DH_{AB} = 8,799m //

Az_{AB} = 22°23'19" //

DN_{BC} = 0,337m //

DH_{BC} = 8,015m //

Az_{BC} = 41°12'58" //

DN_{CD} = 0,448m //

DH_{CD} = 11,513m //

Az_{CD} = 116°35'54" //

DN_{DE} = -1,006m //

DH_{DE} = 14,676m //

Az_{DE} = 225°17'23" //

$DN_{EF} = 0,150 m$ //

$DH_{EF} = 19,969 m$ //

$A_{zEF} = 164° 18' 29"$ //

$DN_{FG} = 0,427 m$ //

$DH_{FG} = 16,288 m$ //

$A_{zFG} = 271° 43' 51"$ //

$DN_{GH} = 1,395 m$ //

$DH_{GH} = 41,949 m$ //

$A_{zGH} = 287° 15' 22"$ //

$DN_{HI} = -1,329 m$ //

$DH_{HI} = 9,530 m$ //

$A_{zHI} = 313° 16' 56"$

$DN_{IJ} = -0,731 m$ //

$DH_{IJ} = 30,660 m$ //

$A_{zIJ} = 20° 20' 24"$ //

$DN_{JK} = -0,288 m$ //

$DH_{JK} = 24,948 m$ //

$A_{zJK} = 104° 56' 25"$ //

$DN_{KL} = -0,696 m$ //

$DH_{KL} = 5,806 m$ //

$A_{zKL} = 13° 59' 35"$ //

$DN_{LA} = 0,703 m$ //

$DH_{LA} = 29,953 m$ //

$A_{zLA} = 153° 49' 05"$ //

d, Área: $1949,887 m^2 = 0,195 ha$ //

5) Obtenha as coordenadas retangulares dos alinhamentos a seguir, utilizando a função Rec da calculadora.

Alinhamento	DH (m)	Az	Coordenadas	
			X	Y
AB	15,328	0°11'24"	0,051	15,328
AC	26,587	42°29'42"	17,960	19,603
AD	65,981	53°30'13"	53,042	39,244
AE	12,984	88°43'18"	12,981	0,290
AF	65,842	129°52'47"	50,527	-42,216

AG	37,591	181°45'31"	-1, 154	-37, 573
AH	14,965	189°34'26"	-2, 489	-14, 757
AI	159,587	241°27'56"	-140, 202	-76, 233
AJ	123,957	282°15'38"	-121, 130	26, 323
AK	147,369	359°59'89"	-0, 000 414	147, 369

6) Obtenha as coordenadas polares dos alinhamentos a seguir, utilizando a função Pol da calculadora.

Alinhamento	X	Y	DH (m)	Az
AB	0,180	12,387	12,388	0°49'57"
AC	-14,297	57,297	59,054	345°59'22"
AD	32,258	37,149	49,200	40°58'09"
AE	48,367	32,987	58,545	55°42'20"
AF	36,781	49,257	61,474	36°44'57"
AG	49,857	68,329	84,585	36°07'00"
AH	37,149	67,345	76,911	28°52'56"
AI	98,126	102,384	141,814	43°47'00"
AJ	127,381	159,357	204,011	38°38"13"
AK	397,127	431,291	586,278	42°33'18"

Lista Levantamento por irradiação

Exercício do Levantamento por Irradiação

Dada a planilha do levantamento de campo abaixo:

RÉ	PE	PV	AI	Ang. Horiz	RS	RM	RI	Ang. Vert
Nh	E0	1	1,520	22° 45' 20''	1,365	1,000	0,635	89° 25' 49''
Nh	E0	2	1,520	159° 10' 20''	1,375	1,000	0,625	89° 45' 50''
Nh	E0	E1	1,520	78° 59' 40''	1,465	1,000	0,535	89° 55' 50''
E0	E1	3	1,600	244° 15' 20''	1,315	1,000	0,685	92° 10' 15''
E0	E1	4	1,600	193° 20' 20''	1,410	1,000	0,590	92° 40' 59''
E0	E1	5	1,600	139° 50' 50''	1,295	1,000	0,705	90° 10' 20''

1- Calcular as distâncias horizontais (DH) e diferenças de nível (DN) e azimutes

RÉ	PE	PV	Azimutes Calculados	DH (m)	DN (m)
Nh	E0	1	22° 45' 20''	72,992	+ 1,246
Nh	E0	2	159° 10' 20''	74,999	+ 0,829
Nh	E0	E1	78° 59' 40''	93,000	+ 0,633
E0	E1	3	143° 15' 00''	62,910	- 1,785
E0	E1	4	92° 20' 00''	81,820	- 3,234
E0	E1	5	38° 50' 30''	58,999	+ 0,423

cota (100)
101,246 1
100,829 2
100,633
98,848 3
97,399 4
101,056 5

2- Calcular todas as coordenadas para os pontos

	Coordenadas Parciais		Coordenadas Totais	
PV	X	Y	X	Y
PV	—		—	
1			29,233	67,310
2			26,666	-70,093
E1	91,290	17,754	91,290	17,754
3	37,640	-50,407	128,930	-32,653
4	81,752	-3,331	173,042	+14,423
5	37,002	45,953	128,292	+63,707

1° estação (E0)

2° estação (E1)

$Long\ P_{AB} = Long\ T_B - Long\ T_A$

$173,042 - 128,930$

$Lat\ P_{AB} = Lat\ P_B - Lat\ P_A$

3 - Calcular a área por GAUSS da poligonal (1,2,3,4,5)

Área = 13.956,634 m²

4 - Calcular as DH, DN e Azimutes para os alinhamentos (1-2; 2-3; 3-4; 4-5; 5-1)

Alinhamentos	DH (m)	Azim.	DN (m)
1-2	137,436	180° 39' 12''	100,829 - 101,246
2-3	108,904	69° 53' 21''	98,848 - 100,829
3-4	64,514	43° 08' 18''	97,399 - 98,848
4-5	66,569	314° 45' 38''	101,056 - 97,399
5-1	100,124	272° 03' 44''	101,246 - 101,056

ch - P

DN
-0,417
-1,981
-1,449
+3,657
0,190

* cota de E_1 = 100,633

$E_1 - 3 \rightarrow DN = -1,785$
$E_1 - 4 \rightarrow DN = -3,234$
$E_1 - 5 \rightarrow DN = 0,423$ } + 100,633

cota 3	98,848
cota 4	97,399
cota 5	101,056

alinhamento

	Δx	Δy
1 - 2	- 1, 567	- 137, 408
2 - 3	102, 264	37, 445
3 - 4	44, 112	47, 076
4 - 5	- 44, 750	49, 284
5 - 1	- 100, 059	3, 603

GAUSS

X	Y	
128,233	167,310	
126,666	29,902	→ 3.834,423
228,930	67,347	→ 8.530,575
273,042	114,423	→ 26.194,857
228,292	163,707	→ 44.698,887
128,233	167,310	→ 38.195,534

21.192,488 ←
6.845,465 ←
18.388,560 ←
26.121,855 ←
20.992,640 ←

Σ = 93.541,008 m²

Σ = 121.454,277