Bergvesenet
Postboks 3021, N-7441 Trondheim

Rapportarkivet

Bergvesenet rapport nr	Intern Journal nr	Internt arkiv nr	Rapport lokalisering	Gradering
5777				
Kommer fra arkiv	**Ekstern rapport nr**	**Oversendt fra**	**Fortrolig pga**	**Fortrolig fra dato:**

Tittel

Beregninger for det polygonale drag i Litland Gruber, samt dragets tilknytning i dagen.

Forfatter	Dato År	Bedrift (oppdragsgiver og/eller oppdragstaker)
Ing. K. Hollan Hagen	1934	Raffineringsverket A/S

Kommune	Fylke	Bergdistrikt	1: 50 000 kartblad	1: 250 000 kartblad
Osterøy	Hordaland		1216 3	

Fagområde	Dokument type	Forekomster (forekomst, gruvefelt, undersøkelsesfelt)
Oppmåling		Litland Gruber

Råstoffgruppe	Råstofftype
Malm/metall	Ni Cu

Sammendrag, innholdsfortegnelse eller innholdsbeskrivelse

Håndskrevne beregninger (nr 210, Ref 6462) Interessant også som historisk dokumentasjon.

Beregninger

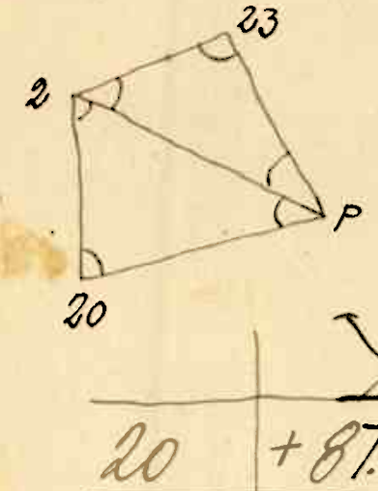
for det polygonale drag i Litland
i Gruber, samt dragets tilknytning
i dagen.

Ref. 6462

INGENIØR K. HOLLAN HAGEN M. N. I. F.
BOGSTADVEIEN 50
OSLO

Utført i Nov. 1934.
Ing. K. Hollan Hagen (M.N.I.F.
nr. 210

Til beregning av P's koordinater er brukt følgende 2 trekanter hvor alle vinkler er målt. Som koordinater er brukt de som er opført i protokol nr. 1464



Se forøvrig:
A/S Kv. sands Nikkelraf. verk
Oversiktskart
målestokk 1:2000
ekvidistanse 5 m.

	Y	X
20	+87.720	÷486,390
2	÷152,166	+148.884
23	+74,302	+624,858

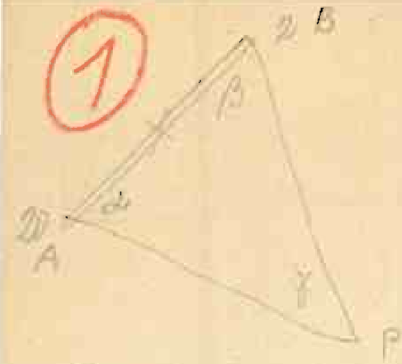
Disse to beregnede koordinatsett stemmer ikke overens $\sqrt{fx^2+fy^2}$ = 82 m/m Som endelige koordinater for P er tatt midtet av disse to. Deretter er alle vinkler pragt i overensstemmelse herved.

Som utgangs azimuth er brugt retningen fra P til 23 med azim. = 380,06,06): 380.06,1

Bysheim 4/12-34

O. Pedersen.

(1)



Δ AMy = 239,186 ✓
Δ AMx = 635,274 ✓

635.274 : 239,886 = 2,648 2329 ✓

479772
1555020
1439316
1157040
959544
1974960
1919088
558720
479772
789480
719658
698220
479772

log = 0.422975.3 ✓

770143.4

(AM) 377.01.43.4 ✓ ✓
α 44.40 68 ✓ ✓
(AP) 21.42 11.4 ✓

(MA) 177.01 43.4 ✓ ✓
β 59 15 86.0 ✓ ✓
(MP) 117.85.57,4 ✓

2.831906.3 ✓
9.903728.9 ✓
2.735635.2 ✓
÷ 9.999318.6 ✓
AP = 2,736316.6 ✓
544,899.6 ✓

$\frac{AB}{AP} = \frac{\gamma}{\beta}$

$AP = \frac{AB \cdot \beta}{\gamma}$

$AP = \frac{A \cdot B \cdot \beta}{(\alpha + \beta)}$

444068
591586
1035654
949346
444068
1408414
591586

BP · $\frac{BP}{\sin\alpha} = \frac{AB}{\sin\gamma}$

$BP = \frac{AB \cdot \sin\alpha}{\sin\gamma}$

2.831906.3 ✓
9.807761.1 ✓
2.639667.4 ✓
÷ 9.999318.6 ✓
2.640348.8 ✓

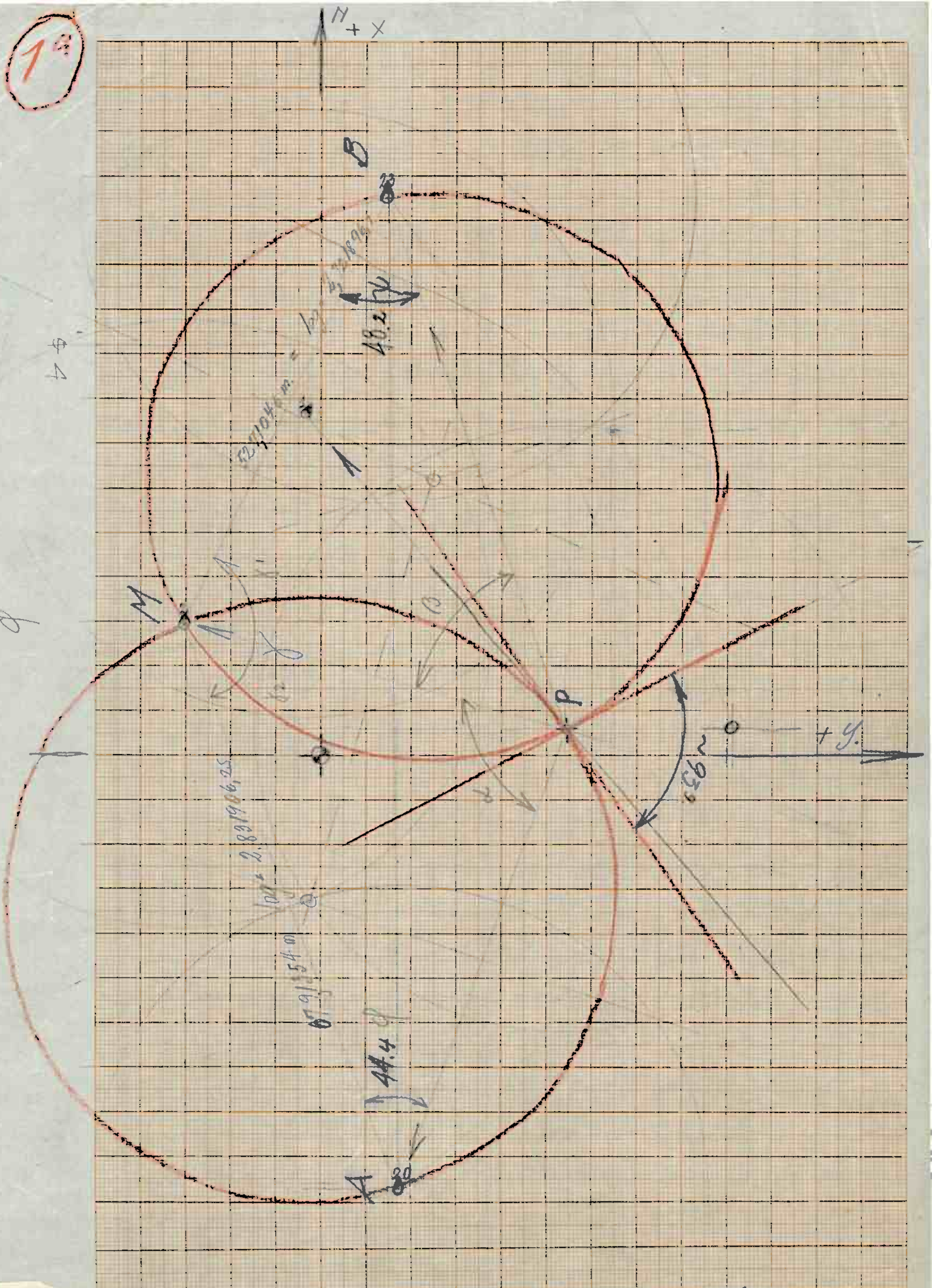
BP 436,866.8 ✓ = MP

206

663872.5
831906.25
112.50

100.00.07

1a



A 4 2 0 297 mm

Litland Grube Bysheim 13-II-34.

(2)

$MP = \frac{MB \cdot \sin \gamma_1}{\sin \beta}$

2.7218967
+ 9.8369665
2.5588632
− 9.9184444
MP = 2.6404188

436,9368

228 27 22.9
89 59 01
3 11 78 62 39
62 19 40.0
3 80 05 63 9

$BP = \frac{MB \cdot \sin \gamma_2}{\sin \beta}$

2.7218967
− 9.9184444
2.8034523
+ 9.9941681
BP 2.7976204

BP = 627,508

226,468
475.974 = 2,1017274
452936 lg. 0.3222576.6
230380
226468
391200 28.27.22,90
226468
1647320
1585276
620440
452936

(AP) = 21 42 11.4
(MP) = 117 85 57.4
(MP) = 117 86 23,9
(BP) 180 05 63.9

AP 544,8996
MP = 436,9368
MP = 436,9368
BP 627,508.0

2.7363166.6
9.5187362
2.2550528
179,9091

2.7976204
9.4887968
2.2864172
193,3824

2.7363166.6
9.9749363
2.7112529
514.3432

2.7976204
9.9783308
2.7759512
596,9677

2.6403488
9.9826885
2.6230373
419,7973

2.6404188
9.9826775.6
2.6230944
419.8504

2.6403488
9.4421888
2.0825376
120.9310

2.6404188
9.4423460
2.0827648
120,9944

(3)

A

+87, 720 ✓ ÷486, 390 ✓
179, 909 ✓ 514.343 ✓
267 629 ✓ 27,953 ✓

M2

152.166 ✓ 148, 884 ✓
419, 797 ✓ 120,931 ✓
267, 631 ✓ 7 m/m 27.953 ✓

M1

152.166 148, 884
419.850 120, 994
267,684 27.890

$\sqrt{(57 m/m)^2 + (32)^2}$

B

$\sqrt{292}$
384
676

74,302 624, 858
193,382 596, 968
267,684 Y 27,890 X

267.684 } 267,657 27,890 } 27,922 31 m/m
630 27,953
114 27 m/m 243
54 m/m 6.3 m/m

i retning P-B ~ ~~16 m/m~~): 16 m/m · 636620 / 627,508 = ~16 cc

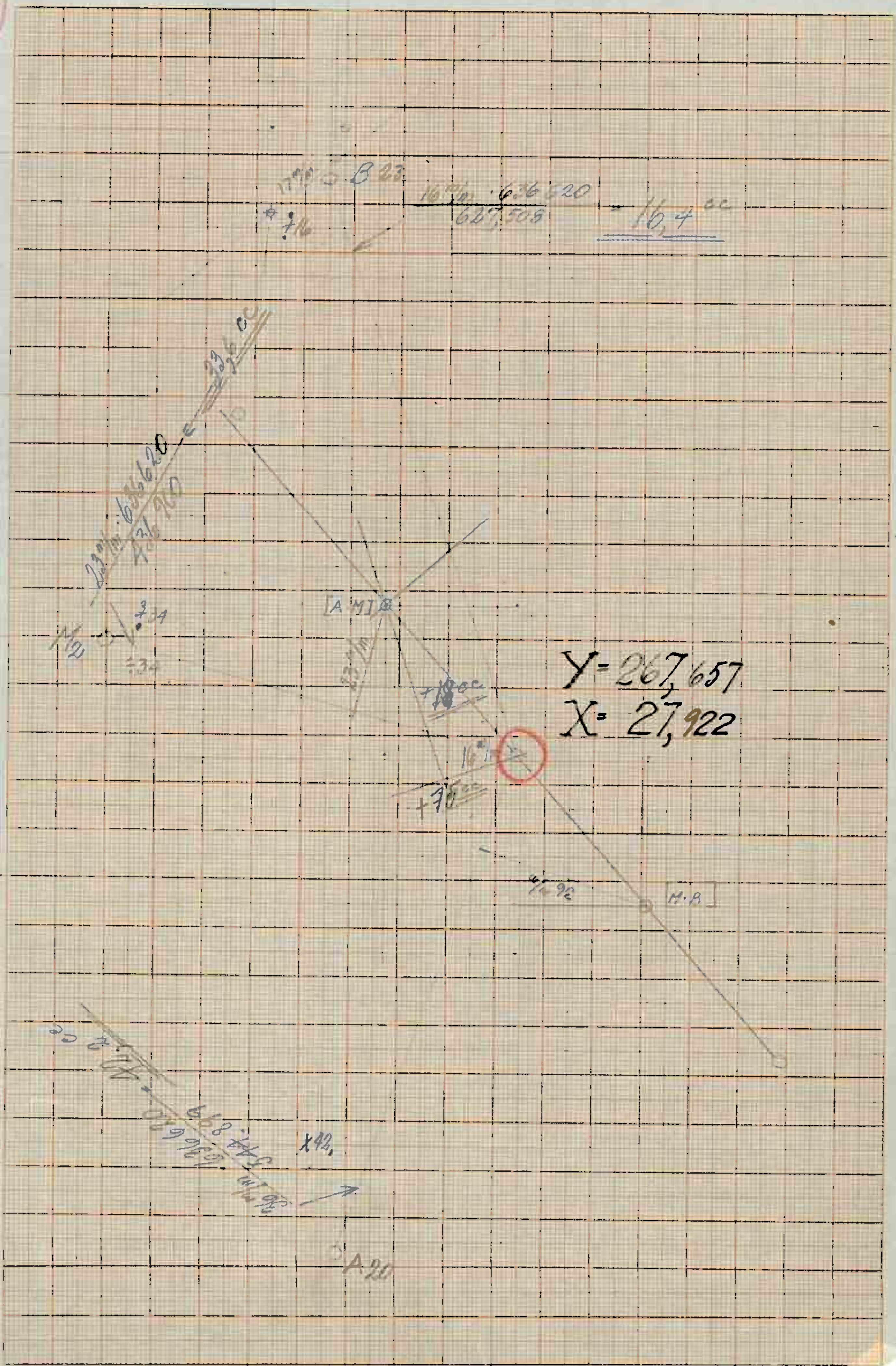
i — " — P-M ~ ~~23 m/m~~): 23 m/m · 636620 / 436, 900 = ~~33⅓~~ cc.

(4) Retning P B velges som utg. retning for orientering av draget ned i Grida.

P.gr.a. overensstemmelsen får alle 4 og sider korreksjoner.
se grafiske utgjørning (4a)

Beregnede azim. p. gr. a. oppgitte koordinater og målte ∠	rettelse pgr. av at 2, 820, 823 ikke har rikt. koordinater.	Utlignede azim.
(P-A_{82}) = 221.42.11.4	16cc	221.42.27
(P-H_2) 317.85.57.4	34cc	317,85.91
(P-H_1) 317.86 23.9	34cc	
(P-B_{82}) 380.05 63.9	42cc	380.06 06

Målte ∠	Rettet til Σ sum. 200.00 gc	rettelse	Beregnet av utlignede azim	
α 96.43.46	96.43.46		96.43.64	+18
β 62.19.44	62.19.40	4	62.20.15	+75
χ_1 89.59.05	89.59.01	4	89.58.68	+33
χ_2 59.15.86	59.15.86		59.15.52	+34
γ 48.21.63	48.21.59	4	48.21.59	0
Φ	44.40.68		44.40.84	+16



A4 210×297 mm

fra-til	α	log D / tg α	D tg α	s	D tgα ÷ s	v+J÷R	H.forskjell	m.o.h
P-23	+5.73.79	2.797620 8.956059 1.753679	+56,712 m.	0	+56.712	× 0.026		
23-P	÷5.98.63	2.797620 8.974561 1.772181	÷59.181	0	÷59.181	0.895 0.026 0.921	÷58,260	144.81 ÷58.26 86.55 (P)
P-2	÷08500	2.640419 6.125565 0.765984	÷5.834	0	÷5.834	× 0.014		
2-P	+43.94	2.640419 7.838989 0.479408	+3,016	0	+3.016	1.265 0.014 1.279	82.260 +4.295 86.555	86.56 (P)
2-23	+7.36.76	2.721897 9.065395 1.787292	+61,276	0	+61.276	1.265 0.018 1.283	+62,559	144.81 (23) 62.56 82,25
23-2	÷7.62.64	2.721897 9.080524 1.802421	÷63448	0	÷63,448	0.895 0.018 0.913	+62,535	144.81 (23) 62.54 82.27

86.555 P

82.26 (2)

P = 86,555 m.o.h

P→1 faller 11.808

1 = 74.747 m.o.h. ~~ved~~ ? skjaktåpning 74.747

101 - 201 - 301 pkt i skakt.

19/11 ⊙1-P

8627 } 862.4
8621 }

1.085090
9.134497
1.019587

10.464
1.344
11,808

(6)

17/11 861.8 } 861.6
861.4 }

1.085090
9.134089
1.019179

10.452
1.354
11.806

11.808

17/11 9.90.4 } 990.1
989.9 }

1.08.50.90
9.19 53 20
1.08 04 14

12034
1.354
13388
1.578
11810

6) Utgangs azimuth for Grubemålingen
fra △P til △23 er 380.06.06 ✓

△23 ligger 114,81 m.o.h. iflg oversiktskartet

△P " 86,555 —"—

⊙1 " 74,955 m.o.h.

∠ mellem △23 △P ⊙1

I " II
① 242.41.75 242.41.87 Bruker
el ② 242.41.70 242.42.05

242.41.84.25 242,41.84 ± 3cc

målt 23/11-34

Azimuth △P-1

380 06.06
242.41.84
222.47.90

222,47.9

Azimuth 1-301

222.47.9
243.075
265.554

Azimuth 201-301

265.554
3.073
262.481

(7)

log 28.82.2 — 1.459724
cos 27.71.0 / 27.70.4 — 9.957494
1.417218 — 26,1347

1.844
1.354
3.198 — 3.198

log 28.82.2 — 1.459724
sin 27.70.9 — 9.624940
1.084664

~~12.152~~
~~3.198~~
~~8.954~~

12.152
3.198
8954

1-2 (101) 17/11

---

log 28.84.4 — 1.460055
cos 28.07.2 — 9.956341
sin 28.06.8 — 1.416396 — 26.085 ✓

2.036 ✓
~~1.344~~
~~0.692~~

3380

log 28.84.4 — 1.460055
sin 28.07.0 — 9.630198
1.096253

12.310
3.380
8.930 ✓

1-101 19/11

28.444 — 1.453991
cos 26.070 / 26.061 — 9.962535
1.416526 — 26.093

1.332
1.060
~~0.272~~

2372

28.444 — 1.453991
sin 26.065 — 9.599977
1.053968

11.323
2.392
8.931 — 8.931 ✓

2-1 (101) 17/11

27.953 — 1.446428
cos 23.392 / 23.392 — 9.969.995
1.416423 — 26.087 ✓

1.109
0.00
1.109

1214

27.953 — 1.446428
sin 23.39.3 — 9.555386
1.001814

10.042
1.109
8.933 ✓

101-1 19/11

1-P 8627 / 8621 } 8624 1.885090 / 9.134497 / 1.019587 1.885129

19/11 10.464 / 1.344 / 11.808 ✓

8.61.8 / 8.61.4 } 8.61.6 1.885090 / 9.134089 / 1.019179 10452 / 1149 / 11.601 / 005 / 12038 / 1149 ✓ / 13187 / 1578 ✓ / 11.609 11.806 11.809

17/11

17/11 9.90.4 188.50.90 / 9.195454 / 1.080544

10.08.1 1885090 / 9203275 / 1.088365 11.814

7/11 12256 / 1.193 / 13449 / 1576 / 11.873

17/11 8.56.4 1.885090 / 9.131427 / 1.016517 10388 / 1354 / 11.742 2

86.555 / 11.807 / 74748

log 33.341 (8) 1.522979
cos 27.57.0 9.957943
27.56.4 1.480922

30.264

2956
1332 ✓
1.624

log 33.341 1.522979
sin 27.56.7 9.622852
1.145831

13990
1.624
12366

2956
1107
3063
1332
1731

3990
1731
2259

101-201 17/11

log 32.752 1.515238
9.965627
1.480865

30.260

cos 24.998
24.990

2230
1.844
0.386

2230
1.951
279

575
66
741

log 32.752 1.515238
sin 24.994 9.582741
1.097979

12531
0.386
12145

12531
0.279
12252

201-101 17/11

log. 56.346 1.750863
9.654601
tg 26.99.9
26.994 1.405464

25437
4.245
21.192

1344 ✓
2.901
4.245

1-101 = 26.086
101-201 = 30.260
56.346 m

109
492
601

55
326
381

1-201 19/11 —

17/11 1.750863
tg. 27.054 9.655601
27.048 1.406464

25496
4.310
21.186 1-201

1354 ✓
2.956
4.310

583
18
601

1-101 =
101-201

1.750863
9.638095
26.099
26.107 1.388958

24488
3.290
21.198

2230
1.060
3.290

56
695
751

17/11 —

201-1

log 33.360 (9) 1.523226
9.957.624
cos 27.667 1.480850 30,259.
27.665

log 33.360 1.523226
sin 27.666 9.624295
1.147521

101-201 1/11

log
cos.

2080
2086 V
0044

13279.
1044

201-101 1/11

log. 15.439 1.188619
997904
cos. 6 25.1 2.186523 15,364.
6 248

2080
0.657
1423

log 15.439 1.188619
sin 6.249 8991233
0179852 +1513
=1423
+0.090

201-202

201 - 301 (10)

19.805 | 1.296775 | | 2086
27.657 | 9.957660 | 17.965 | 2080
27.656 | 1.254435 | | 0.006

19805 | 1.296775
27.6565 | 9.624.169 | 8.3357
| 0.920944 | 6
| | 8.330

301 - 201 | | | 2321
19.306 | 1.285692 | | 1063
23.857 | 9.968802 | 17.968 | 1.258
23858 | 1.254494

19.306 | 1.285692
23.8575 | 9.563531 | 70668 | 8.325
| 0.849223 | 1258
| | 8.3248

201 - 301 | | | 2230
19.72.2 | 1.294951 | | 2047
27.10.5 | 9.959398 | | 0.183
27098 | 1.254349 | 17.962

19.72.2 | 1.294951
27.10.15 | 9.615915 | 81445 | 8.328
| 0.910866 | 183
| | 8.3275

201 74.310 | 1.871047 | | 1344
+9 26.58.8 | 9.647100 | | 2086
1% 26.584 | 1.518147 | 32.972 | 3430
| | 3430
| | 29542

74.31.0 | 1.871047 | | 2047
26.48.7 | 9.645202 | | 1354
26.48.9 | 1.516249 | 32.828 | 3401
| | 3401 |
| | 29427 |

55
147
202

(11)

Sammenstilling av horisontale lengder og høydeforskjell.

	l		h	
⊙1 - P	76.759 76.744	76.752	11.808 11.806 11.810	+11.808

⊙1 - ⊙101	15.5°		8.930	
	26.085		8.931	
	26.093	26,086	8.933	÷8.931
	26.087	1 temp.		
4½°	26.085'			

⊙101 - ⊙201	10.3°		12.253	
	30.259		12.259	
	30.264	30.260	12.252	÷12.255
9.7°	30.260	÷ 3 temp		
		30.257		

⊙201 - ⊙202 15.364 + 0.090

⊙201 - ⊙301	t = 7°C.		8.330	
	17.965		8.325	
	17.968	17.964	8.328	8.327
	17.962	÷ 3 temp		
		17.961		

⊙301 - 302

$\frac{13°}{75} = 0.173°$ pr. m.

+20° N75 m.

+7°

26.086 [15.5 - 20] - 0.015°

26. 4.5 · 0.0115 = 1,35 m/m

30 · 9.7 · 0.0115 = 3.35 m/m.

18 · 13 · 0.0115 = 2.7 m/m

(12)

12.924

248.62.4
2.50.9
246.115

~~230.36.3~~
~~473.44.1~~
~~243.077~~

476.49.4
230.36.3
246.13.1

203.35.6
357.23.9
246.117

403.35.9
157.22.7
246.132

246.1234
246.1245 } 246.12.4 ∡ i P o1 101

∡ i P o1 201

17/11

246.55.2
2.50.9
244.043

474.42.2
230.36.3
244.05.9

244.05.1

19/11

201.286
357.239
244.047

401.28.9
157.227
244.062

244.054

244.053

∡ i P o1 301

17/11

245.58.4
2.50.9
243.07.5

473.44.1
230.36.3
243.07.8

243.0765

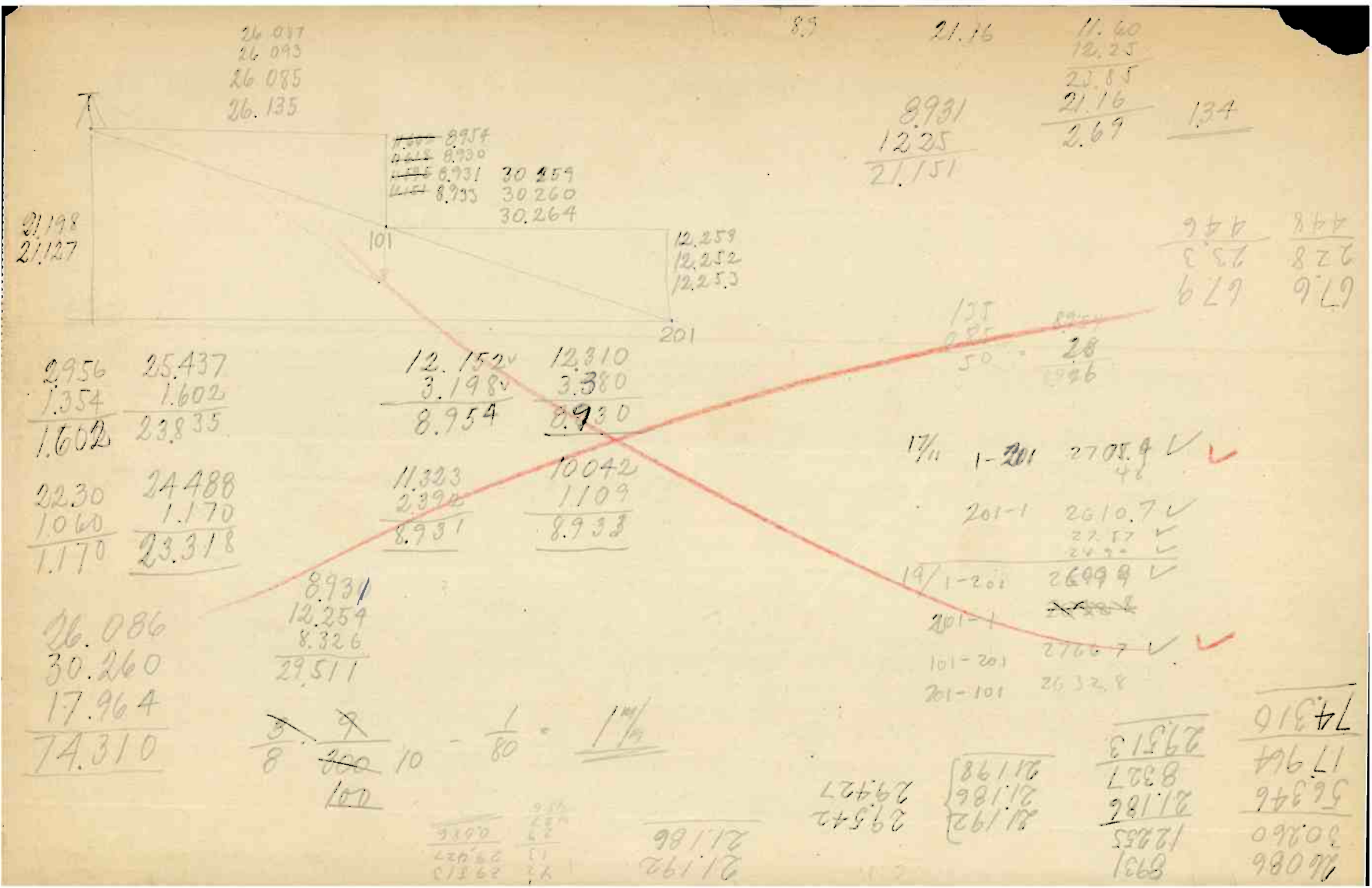
19/11

200.30.4
357.22.9
243.07.5

400.30.1
157.227
243.074

243.0745

243.075


101
201

(13)

⊙1 ⊙201
i ⊙101

319.09.0
122.96.9
196.121

119.104
322.94.6
196.158

196.140

19/11

392.36.4
188.50.4
196.140

192.36.1
388.50.7
196.146

196.143

196.141

17/11 ⊙1 ⊙301
⊙101

318.24.9
122.96.9
195.280

118.25.8
322.94.6
195.312

195.296

19/11

187.65.8
392.36.4
195.294

387 66 2
192.36.1
195 301

195.297.5

195.297

17/11 ⊙1 ⊙202
⊙201

117.67.6
11.02 1
106.655

117.67.9
11.025
106.654

106.65.45

19/11 ⊙101 ⊙202
⊙201

117.67.6
9.23.3
108443

117.67.9
9.22.8 ← 18 I og II by Hes
108451

108.447

373 189
89 292
462481

108.44.6
264.743
373.190

(14)

17/11 ⊙1 ⊙301
⊙201

321. 57.8 | 121. 58.7
125. 63.1 | 325 63.8
195.947 | 195.949

195.948

19/11
206.96.7 | 206.97.2
11.02.1 | 11.02.5
195.946 | 195.947

195.9465
48

195.947

195.9470
106.6545
89.2925

17/11 ⊙101 ⊙301
⊙201

321.57.8 | 121.58.7
123.83.5 | 23.85.4
197.743 | 197.733

197.737

19/11
II 206.96.7 | I 206.97.2
9.22.80 | 9.23.3
197.739 | 197.739

No 5 of II by ttes

197.739

197.738

19/11 ⊙1 ⊙302
⊙301

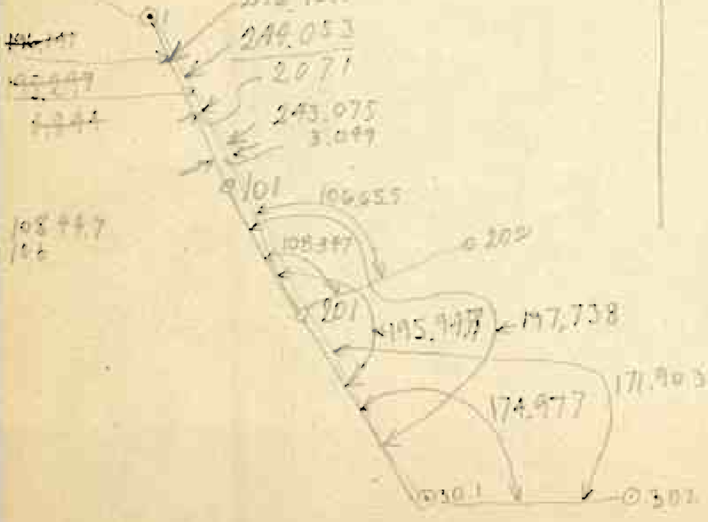
184 87.6 | 384.88.0
12 978 | 212 97.2
171.898 | 171.908

171.903

⊙201 ⊙302 19/11
⊙301

184. 87.6 | 384.880
9. 90.2 | 209.900
174.974 | 174.980

174.977



~~0.84.4~~ Δ ⊙101 ⊙1 ⊙201

196.141
2.071
1.792
200.004

195.947
3.049

244.053
243.075
0.978

246.124
244.053
2.071

108.447
106.655
1.792

246.124
243.075
3.049

174.977
171.903
03.074

174

195.948
1.791
197.739
262.481
264.742 ✓

265. 55.4 ✓
3.049 ✓
268 603
196 140
264.743

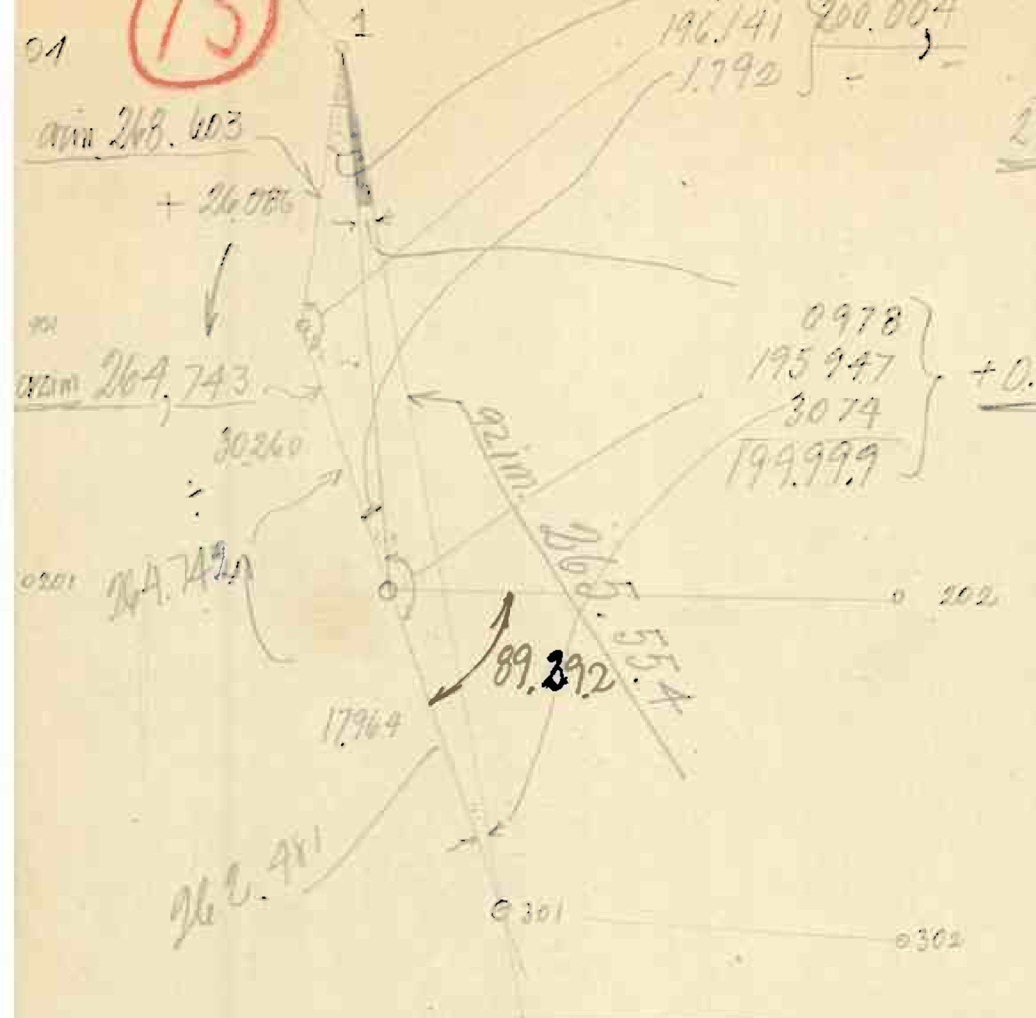
2070 ✓
0.979 ✓
3.049

268, 603.
196. 140
264.743 ✓
1

265. 55.4 ✓
3.073 ✓
363.481 ✓
195.948
257.429
1.791
259 220
258.645
575

265. 55.4
3 049
262.505
196. 140
258, 645
1

1150



2071 / 196.141 / 1.792 } 200.004 − 2070 / 196.140 / 1.791 / 200.001

0.978 / 195.947 / 3.074 / 199.999 } + 0.001 → 0.979 / 195.948 / 3.073 / 200.000

195.948 / 1.791 / 197.739 / 89.292 / 108.447

70 m/m — x — 30260 m/m

$\frac{\sin 2.070}{30.260} \cdot \frac{\sin 196.140}{x} = \frac{\sin 1.791}{26.086}$

$x = \frac{70 \cdot 6.386}{30.260} = 14.6^c$

70 m/m tg 14.6c

$x = \frac{\sin 196.140 \cdot 30.260}{\sin 2.070}$ = 8.782441 / 1.480869 / 10.263310 / 8.512014 / 1.751296 — 56.402

1.8401 / 7.3605 / 9.2006 — 0.1587 m/m ~ 1/6 m/m

$x = \frac{\sin 196.140 \cdot 26.086}{\sin 1.791}$ = 8.782441 / 1.416407 / 10.198848 / 8.449158 / 1.749690 — 56.194

1 m/m · 636620cc / 12000 m/m = 53cc

$\frac{\sin 195.948 \cdot 17.964}{\sin 0.979}$ = 8.803496 / 1.254403 / 10.057899 / 8.186885 / 1.871014 — 74.3095

9.999975

$\frac{\sin 3.074 \cdot 17.964}{\sin 0.979}$ = 8.683655 / 1.254403 / 9.938058 / 8.186885 / 1.751173 — 56.386

Usikker bestemmelse ved å regne med så spisse vinkler.

K. Hollan

⊙1 ⊙302

⊙301 4 171.903 (16)

⊙301 ⊙303

⊙302

235.106	35.105
87.633	287.634
147.473	147.471

147.472

⊙302 ⊙304

⊙303

177.599	377.598
73.807	273.808
103.792	103.790

103.791

⊙302 ⊙305

⊙303

268.260	68.261
73.807	273.808
194.453	194.453

194.453.

⊙303 ⊙306

⊙305

198.789	398.789
40.953	240.954
157.836	157835

157835.5

⊙305 ⊙308

⊙306

112.148	312.149
269.079	69078
243.069	243,071

243.067
243.069

243.068

(17)

°306 °310

° 308

355. 24.4	55 24.4
122. 21.9	322. 21.9
233 025	233. 025

233.025 233. 02.6

233 02.8

°308 °311

°310

276 61 8	76.61.9
200.49.7	049.5
76.121	76.124

76.1225 76. 12.3

76 12 30

°308 °312

°310

393.324	193. 32.6
200 49.7	049.5
192827	192.831

192.829 · 192.83.05

192. 83.2

310 313

° 312

379. 62.2	179 62.2
295.67 9.	95.68.2
83.943	83.940

83.941.5 } 83 94.15

83 9415

310 312 314

78 32. 2	278 32.6
295.67.9	95.68.2
182643	182.644

182,6435
182.6415 · 182.64.25

203 - 205

204 | 10.057 | 310.068 | 10.060
204.449 | 4450 | 4.450
205608 | 205618 | 205610

205.611
194.389

204 206
205

130.270 | 330.270 | 130.270 | 330.270
340.535 | 140.551 | 340.538 | 140.549
189735 | 189719 | 189739 | 189721

189.728
210.272

205 207
206

84.083 | 384.086
255.677 | 55.680
228406 | 238406

228.406
171.594

206 208
207

127.088 | 327.089
325.054 | 125.057
202034 | 203032

202.033

207 209
208

76.405 | 7639.6 | 276.396 | 76.405
337.864 | 137.867 | 337.866 | 137.866
338541 | 338529 | 338530 | 338539

338.535): 161.465

208 311
209

144.604 | 344618
381.034 | 181044
163570 | 163574

163.572

209 310
311

157.828 | 357.832 | 157.833 | 357.837
371.983 | 171.972 | 371.984 | 171.973
185845 | 185860 | 185849 | 185864

185.855

2 315

314

443.409
258.627
184.782

243.41.4
058.62.9
184.785

184.7835 · 184.78.3
184.7825

314 316

315

189.276
29.63.2
159.644

389.282
229.63.8
159.644

159.644 · } 159.63.8
159.632

314 317

315

236.408
29.63.2
206.776

36.41.2
229.63.2
206.780

206.778
159.644
47.134

206.767
159.632
47.135

206.778 · 206.77.25
~~206.76.7~~

77.3
63.8
13.5

II etg.

201 203
202

343.85.3
166.070
177.783

143.85.4
366.07.1
177.783

177.783
222.217

202 204
203

36.064
211.359
224.705

236.06.6
11.36.0
224.706

224.7055
175.2945

301 - 302 ~~stinger~~

log. 12.924 1.111397 ÷ 1.063
+ 0.17.7 9.999998 + 0.742
0.17.9 9.111395 12.924 ÷ 0.321

log 12.924 1.111397 + 0.036 135
7.446539 ÷ 0.321
sin + 0.17.8 8.557936 ÷ 0.385

---

302 - 301 + 1.205
÷ 0.731
12.926 1.11.1464 + 0.474
÷ 0.958 9.999.951
0.964 1.111.415 12.9246

12.926 1.111464 ÷ 0.195 ~~11~~
÷ 0.961 8.178827 + 0.474
9.290291 + 0.279

---

302 - 303 26.478 1.422885 + 0.855
+ 0.51.3 9.999986 ÷ 0.731
0.51.1 1.422871 26.477 + 0.124

26.478 1.422885
0.51.2 9.905385 + 0.213
9.328270 + 124
+ 0.337

---

303 - 302
26.485 1.423000 1.023
1.037 9.999942 0.931
cos ÷ 1.037 1.422942 26.481 0.092

26.485 1.423000
sin 1.037 8.211879 ÷ 0.432
9.634879 92
0.340

303 - 304 (19)

+ 21.951 | 1.341454 | 21.909 | + 1.855
3.960 | 9.999160 | | ÷ 0.931
3.958 | 1.340614 | | + 0.924

21.951 | 1.341454 | + 1.363
3.959 | 8.7934.25 | + 0.924
| 0.134879 | + 2.287

303 - 305

17.154 | 1.234365 | 17.1442 | + 1.007 | 1.855
÷ 2.148 | 9.999753 | | ÷ 0.931 | 0.931
2.149 | 1.234118 | | + 0.076 | 0.924

17.154 | 1.234365 | ÷ 0.579 | ÷ 0.579
÷ 2.1485 | 8.528172 | + 0.076 | 0.924
| 9.762537 | ÷ 0.503 | 0.345

305 - 303

17.153 | 1.234340 | | 1.655
2.437 | 9.999681 | 17.1404 | 0.503
2.438 | 1.234021 | | 1.152

17.153 | 1.234340 | 1.152
÷ 2.4375 | 8.582959 | 0.656
| 9.817299 | 0.496

305 - 306

20.399 | 1.309609 | 20.399 | + 0.940
÷ 0.021 | 0.000000 | | ÷ 0.503
0.017 | | | + 0.437

20.399 | 1.309609 | + 0.437 | 305
0.019 | 6.474873 | ÷ 0.006 | 6
| 7.784482 | + 0.431

0.443

125 | 125 | 250 | 106 | 84 | 175 | 200

306 - 305

20.401 1.309651 20.401 0675
÷ 0.21.7 9.999997 0313
0.21.8 1.309648 0.362

20.401 1.309651 0.362
0.2175 7.533576 ÷ 0.0687
8.843227 0.4307

306 - 308

20.222 1.305824 + 1.115
÷ 0.20.9 9.999998 20.222 ÷ 0675
21.0 1.305822 + 0.440 ✓

20.222 1.305824 + 0.440 ✓ 0.440
0.2095 7.517 ÷ 0.0665 0.067
8.822824 + 0.506 0.373

308 - 306

20.224 1.305867 ÷ 0918
+ 0.039 9.999991 20.223 + 0.528
0.042 1.305858 ÷ 0.390 ✓

20.224 1.305867 ÷ 0.390 0.390
0.0405 6.7982 + 0.1272 ✓ 0.013
8.104067 ÷ 0.517 ÷ 0.377

309 - 310

21.073 1.323726 21.073 1.252
+ 0.043 0.00008 0918
0.044 0.334

21.073 1.323726 + 0.334
0.0435 6.834 + 0.014
8.157726 + 0.348

(20)

310 - 308 21.087 1.324015 1494
\+ 2.402 9999691 21.072 1051
2402 1.323706 0.443

21.087 1.324015
2402 8576590 ÷ 0.794
9.900605 + 0.443
÷ 0.351

---

310 - 311 20.998 1.322178 3.341
÷ 040.0 9.999991 20.997 1051
40.0 1.322169 2.290

20.998 1.322178 + 2290
040.0 7.7982 ÷ 0.132
9.120378 + 2.158

---

310 - 312 19.702 1.294510 + 1189
\+ 0013 0000000 ÷ 1051
0,01,3 19.702 + 0.138

19.702 1.294510
0013 6.310063
7.604573 0.0040232 + 0.142

---

312 - 310 19.705
÷ 1.187 1.294576 19.702 + 1153
1189 9999925 ÷ 0943
1.294501 + 0.210

10.705 1.294576 0.142
1,18,8 8.270911 ÷ 0.36738 0157
9.565487 + 0210 0.299
÷ 0.157 0.149

312 - 313

17.848 1.251590 + 1.509
÷ 0.890 9999958 ÷ 0.943
0.887 1.251548 17.846 + 0.566

17.848 1.251590 + 0.566
0.8885 8.1447 ÷ 0.24905
9.396290 + 0.317

312 - 314

12.773 1.106293 + 0.966 + 1.022
÷ 0.146 9.999999 0.943 + 0.914
0.14.6 1.106292 + 0.023 ÷ 0.108
12.773 0.53.7

12.773 1.106293 ÷ 0.129293 1.106392 ÷ 0.108
0.146 7.360472 7.926104 + 0.10274
8.466765 + 0.023 m/m 9.032396 ÷ 0.006
0.006
NB vertikal ÷

314 - 312

12.777 1.106429
÷ 1.87.6 9999812 + 1.135 + 1.144
187.3 1.106241 0.765 0.760
12.771 + 0.370 + 0.384
÷ 1.943

12.777 1.106429
12.87.5 8469058 ÷ 0.3762 6
9.575487 + 0.370
÷ 0.006

12.772

314 315

10.188 1.008089 + 0.787
÷ 0.770 9.999768 0.765
0.769 1.008057 + 0.022
10.188

10.188 1.008089 ÷ 0.12314
0.7695 8.082318 + 0.022
9.090407 ÷ 0.101

(21)

---

315 - 314

10.188 1.008089 + 0.722
+ 0.007 10.188 0.628
0.007 + 0.094

0.101
0.095
0.196
0.098

10.188 1.008089 + 0.001120
0.007 6.041218 + 0.094
7.049307 0.095

---

315 - 316

9.974 0.998869 + 0.887
÷ 0.534 0.998854 .997365 0.628
0.529 + 0.259

9.974 0.9988.69 | + 0259
0.531.5 .99216 | ÷ 0.08326
8.920169 | 0.176

---

315 - 317

12.482 1.096284 + 1.488
÷ 2.830 9.99571 0.628
2.828 1.095855 12.469 + 0.860

12.482 1.096284 + 0860
2.829 8647610 ÷ 0.55449
9.743894 + 0306

202 - 201

15.366
÷ 0.082
0.081

15.366
0.0815

15366

1.1865
7.105
8.2915

0.711
0.637
0.074

÷ 0.074
÷ 0.0196
÷ 0.0936

---

202 - 203

28.195
+ 0530
0528

28.195
0529

1.450172
9.999985
1.450157

1.450172
7.919571
9.369743

28194

1.395
0.711
0.684

0.684
0.234
0.918

0.450

---

203 - 202

28.197
÷ 1.192
1190

28.197
1191

1.450203
9.999924
1.450127

1.450203
8.272006
9.722209

28.192

1.276
0.877
0.399

0.527
÷ 0.399
0.926

0.128

---

311 - 310

21.018
÷ 2.893
2.892

21.018
28925

1.32 2591
9.999 551
1.322142

1.32 2591
9 65 72
9.979791

20.996

2.985
1.777
1.208

÷ 1208
÷ 0954
÷ 2.162

203 - 204

16.843 1.226419 16.843 2.139
0000000 1.276
0.863

+ 0.017
0.019

0863

16.843 1.226419 +0.00476
0.018 6.451392 0.8677
7.677811

---

204 - 203 16.850 1.226600 1.919
÷ 1.038 9.999942 16.847 1.319
1.041 1.226542 0.600

0600
÷ 0.275
16.850 1.226600 ÷ 0.875
1.0395 8.21229
9.439500

---

204 - 205 6.858 0.836197 2.876
+41.478 9.900441 5.453 1.919
41.482 0.736638 0.957

6.858 0.836197 + 4.159
41.480 9.782783 957
0.618980 +5.116

---

205 - 204 6.751 0.829368 2.915
÷40.126 9.907330 5.4538 1.771
40.127 0.736698 1.144

6.751 0.829368 ÷ 3.979
40.1265 9.770404 1.144
0.599772 ÷ 5.123

205-206

26.542 1.423934
− 9.904 9.994725 26.221
9.901 1.418659

2.915
0.882
2.033

23

26.542 1.423934
9.9025 9.190112
0.614046

4112
2.033
6.145

206-205

26.414 1.421834
+ 7.570 9.996924 26.227
756.5 1.418758

3.790
0.777
3.013

26.414 1.421834 + 3.132
7.5675 9.074049 3.013
0.495883 + 6.145

206-207

17.951 1.254089
+ 2.289 9.999720 17.939
2.285 1.253809

0.777
0.515
0.262

17.951 1.254089 + 0.644
2.287 8.555293 ÷ 2.62
9.809382 + 0.382

207-206

17.939 1.253798
÷ 0.360 9.999993 17.939
0.355 1.253791

0.812
0.535
0.277

17.939 1.253798 ÷ 0.1007
0.3575 7.7494 ÷ 2.77
9.003198 ÷ 0.377

207-208

18.042	1.256285	18.035	0.812
+ 1.786	9.999829		0.616
1.784	1.256114		0.196

(24)

18.042	1.256285	+ 0.505
1.785	8.447701	196
	9.703986	+ 0.309

208-207

18.049	1.256453	18.032	0.993
÷ 2.775	9.999587		0.518
2.775	1.256040		0.475

18.049	1.256453	÷ 0.786
2.775	8.639245	475
	9.895698	÷ 0.311

208-209

6.298	0.799203	6.188	0.518
+ 11.918	9.992344		0.363
11.920	0.791547		0.155

6.298	0.799203	+ 1.1723	1.3273
11.919	9.269820	0.155	722
	0.069023	+ 1.0173	0.605

209-208

6.196	0.792111		0.875 ?
÷ 3.028	9.999508	6.189	0.160
3.029	0.791619		0.715

6.196	0.792111		183305
3.0285	8.677183	÷ 0.29464	35
	9.469294	0.715	18.3270
		÷ 1.009	94240
			89030

~~311-209~~
209-311 14.269 1.154394 10.970
÷ 44. 16.7 9.885812
44. 17.1 1.040206

+ 1.995
÷ 0875 7
+ 1120

(25)

14.269 1.154394
44. 16.9 9.805818 ÷ 0.91246
0.960212 + 1.120
8.0046
7.997

9.1246
7.997
1.1276
1.995
0.869 0.875
0.834

311-209 15.351 1.186137 10.971
49.32.4 9.854118
49 32.3 1.040255

2.985
0.243
2.742

15.351 1.186137 10.739
49. 32.35 9.844821 2.742
1.030958 7.997

26

	Frem	tilbake	kontroll	middel	Korrekt for ÷7° Cels	Hor. lengde
301 - 301	17. 965	17. 968	17. 962	17. 964	÷ 3	17. 961
301 302	12 924	12 925		12 924	2	12 922
302 303	26 481	26 477		26 478	4	26 474
303 305	17 144	17 140		17 142	3	17. 139
305 306	20 401	20 399		20 401	3	20 398
306 308	20 222	20 223		20 222	3	20 219
308 310	21 072	21 073		21 072	3	21 069
310 311	20 997	20 996		20 996	3	20 993
311 209	10 970	10 971		10 970	1.	10 969
209 208	6 188	6 189	6.188	6 188	1	6 187
208 207	18 035	18 032		18 033	3	18 030
207 206	17 939	17 939		17 939	3	17 936
206 205	26 221	26 227		26 223	4	26 219
205 204	5 453	5 454		5.453	1	5 452
204 203	16 843	16 847		16.844	2	16 842
203 202	28 194	28 192		28.194	4	28 190
202 201	15 366	15 365		15.365	2	15 363
				302.408	÷45	302 363
				÷ 45		
				302 363		

Målebånd 13 m/m × 0.12 m/m.
Temp i grūva + 7° Celsiūs
Korreksjon for temp.

$302.4 [7 ÷ 20] \cdot 0.0115 = 45,3$ m/m

$\frac{45,3 \text{ m/m}}{302.4} = 0,1495$ m/m pr. m.

av hensyn til pilen er strekket holdt meget over 10 kg. og fra det arithm. middel er konsekvent fratrukket 1 m/m

+ Sum i polygone. Sidelengder.

0.005 · 18 = 0.090
5
140

g	c	cc
17,	497,	7[redacted]
14,	747,	2[redacted]
19,	445,	3[redacted]
15,	783,	5[redacted]
24,	306,	7[redacted]
23,	302,	5[redacted]
7,	612,	2[redacted]
8,	929,	2[redacted]
22,	221,	7[redacted]
17,	529,	4[redacted]
19,	438,	9[redacted]
21,	027,	2[redacted]
17,	159,	4[redacted]
19,	796,	7[redacted]
6,	146,	5[redacted]
23,	642,	8[redacted]
21,	414,	5[redacted]
300,	001,	4[redacted] *

1.40

$m_f = \frac{1.4}{\sqrt{17}} \cdot 0.34^c = 34^{cc}$

$\frac{80\,cc \cdot 17.65}{636\,620} = 0.23$ ≈ 2,5 m.

$\frac{302,363}{17} = \sim 17,75$ m.

$\frac{34\,cc \cdot 17.75}{636\,620} = \sim 1$ m

179,61
129,22
264,74
171,39
203,98
202,19
210,69
209,93
109,69
61,87
180,30
179,36
262,19
54,52
168,42
281,90
153,63

302,363 * m.

Koordinat

Y

62,09
54,54
170,11
61,62
207,03
109,52
50,05
4,15

719,11 *

18 m/m

149,31
71,72
43,72
1,61
115,27
15,79
62,79
196,27
62,81

719,29 *

324
169
$\sqrt{493} = 22.2$ m/m

X

34,69
180,25
179,35
235,49
52,18
156,28
202,35
140,21

1,180,80 *

13 m/m

99,83
107,49
257,36
162,48
112,57
192,57
206,10
6,16
36,37

1,180,93 *

Punkt nr.	g	c	cc	Lengde		X m.
304	157	83	5	20.398		135.071
306	243	06	7	20.219		146.337
308	233	02	5	21.069		165.583
300	76	12	2	20.993		186.1[illegible]
311	214	14	5	10.969		182.7[illegible]
209	236	42	9	6.187		183.239
208	61	46	5	18.030		186.976
207	197	96	7	17.936		118.950
206	171	59	4	26.219		151.014
205	210	27	2	5.452		127.464
204	194	38	9	16.842	224.583	132.245
203	175	29	4	28.190	218.310	106.616
202	232	21	7	15.363	198.684	86.33[illegible]

3000 D 4

tillatt 72 — 302,363

$\sqrt{18^2 + 13^2} = 22$ m/m — tillatt 140 m/m

71,911 — 71,929 — 71,920

118,080 — 118,093 — 118,087

1 Punkt nr.	2 Polygonvinkel β (g c cc)	3 Side (m.)	4 Azimuth α (g c cc)	5 Log sin α / Log side / Log cos α	6 Log sin + log side / Log side + log cos (Eller efter koordinattabeller)	7 Koordinattilvekster Δy + (m.)	8 Δy − (m.)	9 Δx + (m.)	10 Δx − (m.)	11 Koordinater Y (m.)	12 X (m.)	13 Punkt nr.
6 P		76.752	322 47 9	9.536835 1.885090 9.978345	1.423[illegible] 1.857435		·26.542		72.017	+ 267.657	+27.92[illegible]	P
1		26.086	268 60 3	9.94… 1.416391 9.675358	1.321233 1.091147		·22.977		·13.350	241.115	÷44.095	1
101		30.961	264 74 3	9.929687 1.480826 9.780933	1.410513 1.201759		·25.734		·15.913	218.138	÷56.445	101
201		17.961	263 48 1							192.404	72.358	201
6 P		192.72	207 34 6	9.061207 2.282996 9.997102	1.184143 2.120038		÷15.281		÷191.687	267.657	+27.92[illegible]	P
B		16.936	258 25 2	9.899040 1.228811 9.785169	1.127851 1.013980		÷13.423		·10.327	252.376	÷103.915	B
lodd										238.953	÷114.242	lodd
101		5.854 1‰	199 40 2	9.9999… 0.767379 7.972815	8.767360 0.740194	·0.055			5.853	÷218.138	÷56.445	101
102	147 42 6	33.309 5‰	146 82 1	9.770080 1.522496 9.886730	1.292576 1.349226	·24.698			22.347	218.193	62.298	102
103	268 14 4	22.153 3"	214 97 2	9.367389 1.345374 9.987877	0.712763 1.333251		·5.162		·21.541	242.886	84.645	103
104	175 26 3	8.124 1	190 22 5	9.184529 0.90…254 9.994860	0.094780 0.905111	·1.344			·8.038	237.724	106.186	104
lodd						25.990	5.162		57.786	238.968	114.224	lodd
				middel						238.		

	+	÷	Middel +	Middel ÷	Endelig verdi +	Endelig verdi ÷	m.o.h.	pkt.
201 – 301	~~0.337~~ ~~0.~~	8.330 8.323 8.328		8.327		8.326	53.561	201
301 – 302	~~0.~~	0.285 0.279		0.282		0.282	45.235	301
302 – 303	0.337 0.340	[illegible]	0.339		0.340		44.954	302
303 – 305		0.503 0.496		0.500		0.499	45.294	303
305 – 306	0.431 0.431		0.431		0.432		44.795	305
306 – 308	0.373 0.377		0.375		0.376		45.227	306
308 – 310	0.348 0.351		0.350		0.351		45.603	308
310 – 311	2.158 2.162		2.160		2.161		45.954	310
311 – 209	8.005 7.997		8.001		8.003		48.115	311
209 – 208		1.009 1.017		1.013		1.012	56.117	209
208 – 207		0.311 0.309		0.310		0.309	55.105	208
207 – 206		0.377 0.382		0.380		0.379	54.796	207
206 – 205	6.145 6.145		6.145		6.146		54.417	206
205 – 204		5.116 5.123		5.120		5.119	60.563	205
204 – 203		0.875 0.869		0.872		0.871	55.444	204
203 – 202		0.926 0.918		0.922		0.921	54.573	203
202 – 201		0.093 0.090		0.092		0.091	53.652	202
			17.801	17.818	17.808	17.808		

17.810

17 m/m som fordeles pr. opstilling

(ikke prop. lengden, da måling av instrument og sikte höide er den störrelse som er mest usikker)

$\sqrt{472} = 21.6$ m/m

Höideforskjeller

265.554
0.979
2.070

268.603
262.479

46.124

195.948
1.791

197.739

245.58.4
248.62.4

24 .960

76.494
73.441

3.053

248.62.4
246.58.4

2.040

268.603
196.140

264.743
197.739

262.482

Beregning av Polygonpt. høider

i m.o.h.

28

$\Delta P = 86{,}555$ m.o.h

$o1 = 74.747$ – " –

$o1 - 101 = 8.931$

$o101 - o201 = 12.255$

21.186

74.747
8.931
65.816
12.255
53.561
21.186

$o101 = 65.816$ m.o.h.

$o201 = 53.561$ – " –

225
325
550
} 232

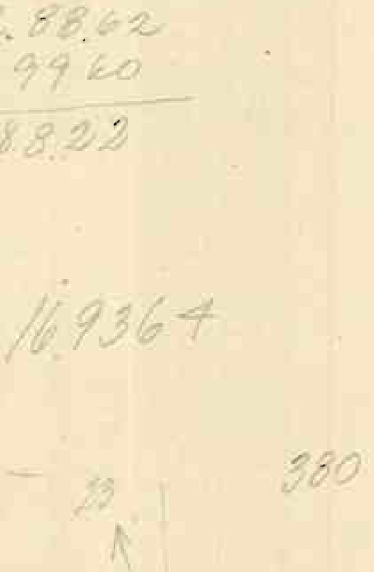
71.7 } 71.45
71.2 }

87.0 } 86.65
86.3 }

1.22.88.62
99 99 60
1 22 88 22

16.9364

224. 92. 67
397. 64 34
227. 28 33



29

△ 23 ○B 227.28.57
△P 227.28.55 } 227.28.56

△P – B.pel = l = 132,72 (målt bare én vei)

△P ○lodd i Nybrottsgak 250.90.5
○B 250.90.7 } 250.90.6

○Bpel – ○lodd = l = 16.936

380.06.06
227.28.56
607.34.62 azimuth △P – Bpel = 207.34.62

250.90.6
58.25.22 azimuth Bpel – lodd = 258.25.2

169.67.9
38.87.3
130.806 ∡ i 101 (1, 102, 101)

azim 1–101 = 268.603
130.806
199.409 azimuth 101–102 (1)

235.01.85
169.67.9
65.33.95 ∡ (102, 201, 101)

azim. 101–201 = 264.742
65.34.0
199.402 azim 101–102 (201)

Bruker 199.402 da retning 201 er sikrere

101-102-101

0.767379
8 915 850
9.683229

÷0.4822
÷0.122
0.604

3316
+3.320 } +3.318

0.767379
8 717 340
9.484719

+0.3053
+0.294
0.599

÷0.602

÷0.962
÷0.122

+1.054
÷0.760
+0.294

102-103-102

+0.680
1.522496
6.028645
9.551141

+0.3557
÷0.024
+0.331

÷0.760
+0.736
÷0.024

+0.336

÷0.577 ÷0.546
54.5

1.522496
7 933 323
9.455819

÷0.2856
÷0.056
÷0.341

÷0.749
+0.693
÷0.056

103-104-103

÷0.014 ÷0.016
0.018

1.345374
6 400 240
7.795614

÷0.0069247
0.201
÷0207

÷0.834 ÷0.833
832 +487

1.345374
8.116790
9462164

÷0.2908
+0.197

÷0.202

÷0.749
+0.548
÷0.201

+0.945
÷0.458
+0487

30

75895
260.1535
147260

380. 41.05
112. 26.70
268.1435

390. 40 55
215. 3515
175.2540

390. 41.00
215. 35.90
175.25.10

175.25.25

0.768934
9998531
0.767465 5.854

0,768120
9999410
0.767530 5.855

199. 402
147. 426
146.828
268.144
214.972
175.253
190.225

0.522588
9999975
0.522563 33.309

0.522601
9999984
0.522585 33.311

33.309

0,345413 = 22.152

0.345550
0.999963
0.345513 22.157

22.154 r
Velger 22.153

~~+2.546~~

+2.947

÷0.658

+2.289

24.288 1.38.53.92

+ 1.32.9 9999905

1.345297 24.2827

1329

24288 1.38.5392

+ 1.329 8319613

9.705005 +150700

+2289

+2.796

Koordinater for. 304, 307, 309,

(31)

24. 93.0	9.993148	1.333711	+21.563 = Y
103 79.1	1.34.05.63	0.586679	3,8608 = X
azim 88.721	9.246166		

l = 21.909	+176.513	÷118.824
÷ tap 3	+ 21.563	+ 3.861
21.906	+198.076	÷114.963
	Y	X

304

303 - 304 + 2.287 bredde 45.294 + 2.287 = 47.581

307

137.21.7			
146.16.3			
azim 83380	9.985029	1.370260	23,456
	1.385231	0.797037	6,2667
	9.411806		

l = 24.283	+198.980	÷146.327
÷ 4	+ 23.456	+ 6.267
24,279	+222436	÷140.060
	Y	X

306 - 307 stiger 45207 + 2,796 = 48023

22.752 ÷ 55.2 ÷ 55.4

1.357020
9999984
1.357004 22.751

+3.546
÷0902
+2.644

22.754 ÷ 553

1.357020
7938840 + 2.641
9.295860 ÷ 0.19863
2.446

22.

309 (32)

180.28.4
109.16 8
azim 89.45 2

9.994011 1.350954
1.356943 0.574244
9.217301

l = 22.751
temp ÷ 3 %
22.748

+ 205.143
+ 22.436
+ 227.579
y

÷ 165.523
+ 3.7528
÷ 161.8315
X

45.603 308
+ 2.446 308-309
48.049 h 309

213.30.8
192.831
206.139
83.941
290.080

206 13.4
182.643
388.782
184.783
173565
159.638
133.203

669
77
746

391
35
426

55
12
93

m.	β	l	α azim.	log tg α / log l / log Δ	Δy +	Δy ÷	Δx +	Δx ÷	Y	X	m.
310	192.8305	19.699	213.308 206,13.9	8.715644 0.277988 1.294444 9.997978 1.292422		.1897		19.608	÷200.772	÷186,192	310
312	83.9415	17.843	90.08.0	9.994706 1.246174 1.251468 9.190878 0.442341	17.627		2.769		198.875	÷205.800	312
313									216.502	÷203.031	313
312	182.793 182.643	12.759	206.13.9 188.78.2	9.243782 0.349942 1.106157 9.993322 1.099379	2.238			12.571	198.875	205.800	312
314	154.783 184.783	10.186	173.565	9.605346 0.613750 1.008004 9.961430 0.969434	4.109			9.320	201.113	218.371	314
315	159.638 159.638	9.972	123.203	9.938043 0.936825 0.998782 9.697426 0.696208	8.646			4.968	205.222	÷227.691	315
316									213.868	232.659	316
315	206.773	12.467	173.565 180,338	9.488821 0.578583 1.095762 9.978949 1.074711	3.790			11.877	205.222	227.691	315
317									209.012	239.568	317

	+	÷	m.o.h.
310	0.149		45.954
312	0.317		46.103
313			46.400
312	0.006		46.103
314		÷0.098	46.109
315	0.176		46.011
316			46.187
315	0.306		46.011
317			46.317