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ROYAL AIRCRAFT ESTABLISHMENT

Farnborough, Hants.

TABLES FOR USE IN THE INVESTIGATION OF SUPERSONIC FIELDS OF FLOW BY THE METHOD OF CHARACTERISTICS

by

P. J. HERBERT, B.Sc.

and

S. J. OLDER

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Technical Note No. C.W.1

November, 1946

ROYAL AIRCRAFT ESTABLISHMENT, FARNBOROUGH

Tables for Use in the Investigation of Supersonic Fields of Flow by the Method of Characteristics

by

P.J. Herbert, B.Sc.,
and
S.J. Older

R.A.E. Ref: C.W./125/P.J.H./171
M.O.S. Ref: Nil.
R

SUMMARY

Tables are given of Mach angle as a function of pressure number for use in the method of characteristics. The range covered by the tables corresponds to Mach numbers from unity to infinity. The intervals used in the tabulation are as follows:-

1000.000 (0.001) 999.700 (0.01) 995.00 (0.1) 940.0 (1.0) 870

Introduction

The investigation of supersonic fields of flow by the method of characteristics demands a knowledge of the relation between the Mach angle at a point and "the pressure number". In this note tables are given of the Mach angle to 0.001 degrees over the full supersonic range of values of the pressure number at tabular intervals given by 1000.000 (0.001) 999.700 (0.01) 995.00 (0.1) 940.0 (1.0) 870.

In the notation usually employed, the pressure number, P, is defined by the relation in degrees,

$$P = 1000 - \nu$$

where ν is the Prandtl-Meyer angle, which is related to the Mach angle μ by the equation[1] in radians,

$$\nu = \mu + \sqrt{\frac{\gamma+1}{\gamma-1}} \text{ arc cot} \left(\sqrt{\frac{\gamma+1}{\gamma-1}} \tan \mu \right) - \frac{1}{2} \Pi$$

γ is the ratio of the specific heats for air and has been taken as 1.400. With this value of γ the relation between P and μ in degrees becomes

$$P = 1090 - \mu - \sqrt{6} \text{ arc cot } (\sqrt{6} \tan \mu)$$

The tabular values of μ will in some cases be in error by unity in the third decimal place. The intervals in the argument P have been so chosen that the overall error in the value of μ obtained by linear interpolation will not

exceed two units in the third decimal place in the range of P from 999.980 - 870.

In the preparation of the table use was made over part of the range of some unpublished tables prepared by R. Harrop of Aero Department, R.A.E.

REFERENCE

No.	Author	Title, etc.
1	G. Temple	The Method of Characteristics in Supersonic Flow. R.A.E. Report No. S.M.E.3282. Jan, 1944.

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P	μ	$\Delta\mu$	P	μ	$\Delta\mu$
1000·000	90·000	2278	999·950	81·626	55
999·999	87·722	588	949	81·571	54
998	87·134	418	948	81·517	54
997	86·716	330	947	81·463	53
996	86·386	279	946	81·410	53
999·995	86·107	244	999·945	81·357	52
994	85·863	218	944	81·305	51
993	85·645	198	943	81·254	50
992	85·447	182	942	81·204	50
991	85·265	169	941	81·154	50
999·990	85·096	158	999·940	81·104	49
989	84·938	148	939	81·055	48
988	84·790	141	938	81·007	48
987	84·649	134	937	80·959	47
986	84·515	127	936	80·912	47
999·985	84·388	122	999·935	80·865	47
984	84·266	117	934	80·818	46
983	84·149	112	933	80·772	45
982	84·037	108	932	80·727	45
981	83·929	105	931	80·682	44
999·980	83·824	101	999·930	80·638	44
979	83·723	98	929	80·594	44
978	83·625	95	928	80·550	44
977	83·530	92	927	80·506	43
976	83·438	90	926	80·463	42
999·975	83·348	87	999·925	80·421	42
974	83·261	85	924	80·379	42
973	83·176	83	923	80·337	41
972	83·093	81	922	80·296	41
971	83·012	79	921	80·255	41
999·970	82·933	77	999·920	80·214	40
969	82·856	76	919	80·174	40
968	82·780	74	918	80·134	40
967	82·706	73	917	80·094	40
966	82·633	71	916	80·054	39
999·965	82·562	70	999·915	80·015	38
964	82·492	69	914	79·977	39
963	82·423	68	913	79·938	38
962	82·355	66	912	79·900	38
961	82·289	65	911	79·862	37
999·960	82·224	64	999·910	79·825	38
959	82·160	63	909	79·787	37
958	82·097	62	908	79·750	36
957	82·035	61	907	79·714	37
956	81·974	60	906	79·677	36
999·955	81·914	59	999·905	79·641	36
954	81·855	58	904	79·605	36
953	81·797	58	903	79·569	35
952	81·739	57	902	79·534	36
951	81·682	56	901	79·498	35
999·950	81·626		999·900	79·463	

P	μ	$\Delta\mu$	P	μ	$\Delta\mu$
999·900	79·463	35	999·850	77·951	27
899	79·428	34	849	77·924	26
898	79·394	34	848	77·898	26
897	79·360	34	847	77·872	26
896	79·326	34	846	77·846	26
999·895	79·292	34	999·845	77·820	26
894	79·258	34	844	77·794	26
893	79·224	33	843	77·768	26
892	79·191	33	842	77·742	25
891	79·158	33	841	77·717	26
999·890	79·125	32	999·840	77·691	25
889	79·093	33	839	77·666	25
888	79·060	32	838	77·641	26
887	79·028	32	837	77·615	25
886	78·996	32	836	77·590	24
999·885	78·964	31	999·835	77·566	25
884	78·933	32	834	77·541	25
883	78·901	31	833	77·516	25
882	78·870	31	832	77·491	24
881	78·839	31	831	77·467	24
999·880	78·808	31	999·830	77·443	25
879	78·777	31	829	77·418	24
878	78·746	30	828	77·394	24
877	78·716	30	827	77·370	24
876	78·686	30	826	77·346	24
999·875	78·656	30	999·825	77·322	24
874	78·626	30	824	77·298	24
873	78·596	30	823	77·274	23
872	78·566	29	822	77·251	24
871	78·537	29	821	77·227	24
999·870	78·508	29	999·820	77·203	23
869	78·479	29	819	77·180	23
868	78·450	29	818	77·157	24
867	78·421	29	817	77·133	23
866	78·392	29	816	77·110	23
999·865	78·363	28	999·815	77·087	23
864	78·335	28	814	77·064	23
863	78·307	28	813	77·041	23
862	78·279	28	812	77·018	22
861	78·251	28	811	76·996	23
999·860	78·223	28	999·810	76·973	23
859	78·195	28	809	76·950	22
858	78·167	27	808	76·928	23
857	78·140	28	807	76·905	22
856	78·112	27	806	76·883	22
999·855	78·085	27	999·805	76·861	22
854	78·058	27	804	76·839	22
853	78·031	27	803	76·817	22
852	78·004	26	802	76·795	22
851	77·978	27	801	76·773	22
999·850	77·951		999·800	76·751	

P	μ	Δμ	P	μ	Δμ
999·800	76·751	22	999·750	75·740	19
799	76·729	22	749	75·721	19
798	76·707	21	748	75·702	18
797	76·686	22	747	75·684	19
796	76·664	22	746	75·665	18
999·795	76·642	21	999·745	75·647	19
794	76·621	21	744	75·628	18
793	76·600	22	743	75·610	19
792	76·578	21	742	75·591	18
791	76·557	21	741	75·573	18
999·790	76·536	21	999·740	75·555	18
789	76·515	21	739	75·537	19
788	76·494	21	738	75·518	18
787	76·473	21	737	75·500	18
786	76·452	21	736	75·482	18
999·785	76·431	21	999·735	75·464	18
784	76·410	20	734	75·446	18
783	76·390	21	733	75·428	18
782	76·369	21	732	75·410	18
781	76·348	20	731	75·392	18
999·780	76·328	20	999·730	75·374	17
779	76·308	21	729	75·357	18
778	76·287	20	728	75·339	18
777	76·267	20	727	75·321	18
776	76·247	21	726	75·303	17
999·775	76·226	20	999·725	75·286	18
774	76·206	20	724	75·268	17
773	76·186	20	723	75·251	18
772	76·166	20	722	75·233	17
771	76·146	20	721	75·216	18
999·770	76·126	19	999·720	75·198	17
769	76·107	20	719	75·181	17
768	76·087	20	718	75·164	18
767	76·067	20	717	75·146	17
766	76·047	19	716	75·129	17
999·765	76·028	20	999·715	75·112	17
764	76·008	19	714	75·095	17
763	75·989	20	713	75·078	17
762	75·969	19	712	75·061	17
761	75·950	20	711	75·044	17
999·760	75·930	19	999·710	75·027	17
759	75·911	19	709	75·010	17
758	75·892	19	708	74·993	17
757	75·873	19	707	74·976	17
756	75·854	20	706	74·959	17
999·755	75·834	19	999·705	74·942	17
754	75·815	19	704	74·925	17
753	75·796	18	703	74·908	16
752	75·778	19	702	74·892	17
751	75·759	19	701	74·875	16
999·750	75·740		999·700	74·859	

P	μ	Δμ	P	μ	Δμ
			999·50	72·099	117
			49	71·982	114
			48	71·868	114
			47	71·754	111
			46	71·643	110
			999·45	71·533	109
			44	71·424	108
			43	71·316	106
			42	71·210	105
			41	71·105	104
			999·40	71·001	103
			39	70·898	101
			38	70·797	101
			37	70·696	99
			36	70·597	98
			999·35	70·499	97
			34	70·402	96
			33	70·306	95
			32	70·211	95
			31	70·116	93
			999·30	70·023	92
			29	69·931	92
			28	69·839	90
			27	69·749	90
			26	69·659	89
			999·25	69·570	88
			24	69·482	87
			23	69·395	87
			22	69·308	86
			21	69·222	85
999·70	74·859	164	999·20	69·137	84
69	74·695	161	19	69·053	83
68	74·534	157	18	68·970	83
67	74·377	154	17	68·887	82
66	74·223	151	16	68·805	82
999·65	74·072	148	999·15	68·723	81
64	73·924	145	14	68·642	80
63	73·779	142	13	68·562	79
62	73·637	140	12	68·483	79
61	73·497	138	11	68·404	78
999·60	73·359	135	999·10	68·326	78
59	73·224	133	09	68·248	77
58	73·091	131	08	68·171	77
57	72·960	128	07	68·094	76
56	72·832	127	06	68·018	75
999·55	72·705	125	999·05	67·943	75
54	72·580	123	04	67·868	74
53	72·457	121	03	67·794	74
52	72·336	119	02	67·720	73
51	72·217	118	01	67·647	73
999·50	72·099		999·00	67·574	

P	μ	$\Delta\mu$	P	μ	$\Delta\mu$
999·00	67·574	72	998·50	64·450	54
998·99	67·502	72	49	64·396	54
98	67·430	71	48	64·342	54
97	67·359	71	47	64·288	54
96	67·288	70	46	64·234	53
998·95	67·218	70	998·45	64·181	53
94	67·148	69	44	64·128	53
93	67·079	69	43	64·075	53
92	67·010	68	42	64·022	52
91	66·942	68	41	63·970	52
998·90	66·874	68	998·40	63·918	52
89	66·806	67	39	63·866	52
88	66·739	67	38	63·814	51
87	66·672	66	37	63·763	52
86	66·606	66	36	63·711	51
998·85	66·540	66	998·35	63·660	51
84	66·474	65	34	63·609	50
83	66·409	64	33	63·559	51
82	66·345	65	32	63·508	50
81	66·280	64	31	63·458	50
998·80	66·216	63	998·30	63·408	50
79	66·153	63	29	63·358	49
78	66·090	63	28	63·309	50
77	66·027	63	27	63·259	49
76	65·964	62	26	63·210	49
998·75	65·902	62	998·25	63·161	49
74	65·840	61	24	63·112	48
73	65·779	61	23	63·064	49
72	65·718	61	22	63·015	48
71	65·657	61	21	62·967	48
998·70	65·596	60	998·20	62·919	48
69	65·536	60	19	62·871	47
68	65·476	59	18	62·824	48
67	65·417	59	17	62·776	47
66	65·358	59	16	62·729	47
998·65	65·299	59	998·15	62·682	47
64	65·240	58	14	62·635	47
63	65·182	58	13	62·588	46
62	65·124	58	12	62·542	46
61	65·066	57	11	62·496	47
998·60	65·009	57	998·10	62·449	46
59	64·952	57	09	62·403	45
58	64·895	57	08	62·358	46
57	64·838	56	07	62·312	46
56	64·782	56	06	62·266	45
998·55	64·726	55	998·05	62·221	45
54	64·671	56	04	62·176	45
53	64·615	55	03	62·131	45
52	64·560	55	02	62·086	45
51	64·505	55	01	62·041	44
998·50	64·450		998·00	61·997	

P	μ	$\Delta\mu$	P	μ	$\Delta\mu$
998·00	61·997	44	997·50	59·950	38
997·99	61·953	45	49	59·912	38
98	61·908	44	48	59·874	37
97	61·864	44	47	59·837	38
96	61·820	43	46	59·799	37
997·95	61·777	44	997·45	59·762	37
94	61·733	43	44	59·725	37
93	61·690	44	43	59·688	37
92	61·646	43	42	59·651	37
91	61·603	43	41	59·614	37
997·90	61·560	43	997·40	59·577	37
89	61·517	42	39	59·540	37
88	61·475	43	38	59·503	36
87	61·432	42	37	59·467	37
86	61·390	42	36	59·430	36
997·85	61·348	43	997·35	59·394	36
84	61·305	42	34	59·358	36
83	61·263	41	33	59·322	36
82	61·222	42	32	59·286	36
81	61·180	42	31	59·250	36
997·80	61·138	41	997·30	59·214	36
79	61·097	41	29	59·178	36
78	61·056	42	28	59·142	35
77	61·014	41	27	59·107	36
76	60·973	41	26	59·071	35
997·75	60·932	40	997·25	59·036	35
74	60·892	41	24	59·001	36
73	60·851	41	23	58·965	35
72	60·810	40	22	58·930	35
71	60·770	40	21	58·895	35
997·70	60·730	40	997·20	58·860	34
69	60·690	40	19	58·826	35
68	60·650	40	18	58·791	35
67	60·610	40	17	58·756	34
66	60·570	40	16	58·722	35
997·65	60·530	39	997·15	58·687	34
64	60·491	40	14	58·653	35
63	60·451	39	13	58·618	34
62	60·412	39	12	58·584	34
61	60·373	39	11	58·550	34
997·60	60·334	39	997·10	58·516	34
59	60·295	39	09	58·482	34
58	60·256	38	08	58·448	34
57	60·218	39	07	58·414	33
56	60·179	38	06	58·381	34
997·55	60·141	39	997·05	58·347	33
54	60·102	38	04	58·314	34
53	60·064	38	03	58·280	33
52	60·026	38	02	58·247	33
51	59·988	38	01	58·214	34
997·50	59·950		997·00	58·180	

P	μ	Δμ	P	μ	Δμ
997·00	58·180	33	996·50	56·614	29
996·99	58·147	33	49	56·585	30
98	58·114	33	48	56·555	29
97	58·081	33	47	56·526	30
96	58·048	33	46	56·496	29
996·95	58·015	32	996·45	56·467	29
94	57·983	33	44	56·438	30
93	57·950	32	43	56·408	29
92	57·918	33	42	56·379	29
91	57·885	32	41	56·350	29
996·90	57·853	33	996·40	56·321	29
89	57·820	32	39	56·292	29
88	57·788	32	38	56·263	29
87	57·756	32	37	56·234	29
86	57·724	32	36	56·205	28
996·85	57·692	32	996·35	56·177	29
84	57·660	32	34	56·148	29
83	57·628	32	33	56·119	28
82	57·596	32	32	56·091	29
81	57·564	31	31	56·062	28
996·80	57·533	32	996·30	56·034	29
79	57·501	32	29	56·005	28
78	57·469	31	28	55·977	28
77	57·438	32	27	55·949	29
76	57·406	31	26	55·920	28
996·75	57·375	31	996·25	55·892	28
74	57·344	31	24	55·864	28
73	57·313	31	23	55·836	28
72	57·282	31	22	55·808	28
71	57·251	31	21	55·780	28
996·70	57·220	31	996·20	55·752	28
69	57·189	31	19	55·724	28
68	57·158	31	18	55·696	27
67	57·127	31	17	55·669	28
66	57·096	30	16	55·641	28
996·65	57·066	31	996·15	55·613	27
64	57·035	30	14	55·586	28
63	57·005	31	13	55·558	27
62	56·974	30	12	55·531	28
61	56·944	30	11	55·503	27
996·60	56·914	31	996·10	55·476	28
59	56·883	30	09	55·448	27
58	56·853	30	08	55·421	27
57	56·823	30	07	55·394	27
56	56·793	30	06	55·367	27
996·55	56·763	30	996·05	55·340	27
54	56·733	30	04	55·313	27
53	56·703	29	03	55·286	27
52	56·674	30	02	55·259	27
51	56·644	30	01	55·232	27
996·50	56·614		996·00	55·205	

P	μ	$\Delta\mu$	P	μ	$\Delta\mu$
996·00	55·205	27	995·50	53·920	24
995·99	55·178	27	49	53·896	25
98	55·151	27	48	53·871	24
97	55·124	26	47	53·847	25
96	55·098	27	46	53·822	24
995·95	55·071	26	995·45	53·798	25
94	55·045	27	44	53·773	24
93	55·018	26	43	53·749	24
92	54·992	27	42	53·725	24
91	54·965	26	41	53·701	25
995·90	54·939	27	995·40	53·676	24
89	54·912	26	39	53·652	24
88	54·886	26	38	53·628	24
87	54·860	26	37	53·604	24
86	54·834	27	36	53·580	24
995·85	54·807	26	995·35	53·556	24
84	54·781	26	34	53·532	24
83	54·755	26	33	53·508	24
82	54·729	26	32	53·484	24
81	54·703	26	31	53·460	24
995·80	54·677	25	995·30	53·436	24
79	54·652	26	29	53·412	23
78	54·626	26	28	53·389	24
77	54·600	26	27	53·365	23
76	54·574	26	26	53·342	24
995·75	54·548	25	995·25	53·318	24
74	54·523	26	24	53·294	23
73	54·497	25	23	53·271	24
72	54·472	26	22	53·247	23
71	54·446	25	21	53·224	24
995·70	54·421	26	995·20	53·200	23
69	54·395	25	19	53·177	24
68	54·370	25	18	53·153	23
67	54·345	26	17	53·130	23
66	54·319	25	16	53·107	23
995·65	54·294	25	995·15	53·084	24
64	54·269	25	14	53·060	23
63	54·244	25	13	53·037	23
62	54·219	26	12	53·014	24
61	54·193	25	11	52·990	23
995·60	54·168	25	995·10	52·967	23
59	54·143	25	09	52·944	23
58	54·118	24	08	52·921	23
57	54·094	25	07	52·898	23
56	54·069	25	06	52·875	22
995·55	54·044	25	995·05	52·853	23
54	54·019	25	04	52·830	23
53	53·994	24	03	52·807	23
52	53·970	25	02	52·784	23
51	53·945	25	01	52·761	23
995·50	53·920		995·00	52·738	

P	μ	$\Delta\mu$	P	μ	$\Delta\mu$
996·00	55·205	27	995·50	53·920	24
995·99	55·178	27	49	53·896	25
98	55·151	27	48	53·871	24
97	55·124	26	47	53·847	25
96	55·098	27	46	53·822	24
995·95	55·071	26	995·45	53·798	25
94	55·045	27	44	53·773	24
93	55·018	26	43	53·749	24
92	54·992	27	42	53·725	24
91	54·965	26	41	53·701	25
995·90	54·939	27	995·40	53·676	24
89	54·912	26	39	53·652	24
88	54·886	26	38	53·628	24
87	54·860	26	37	53·604	24
86	54·834	27	36	53·580	24
995·85	54·807	26	995·35	53·556	24
84	54·781	26	34	53·532	24
83	54·755	26	33	53·508	24
82	54·729	26	32	53·484	24
81	54·703	26	31	53·460	24
995·80	54·677	25	995·30	53·436	24
79	54·652	26	29	53·412	23
78	54·626	26	28	53·389	24
77	54·600	26	27	53·365	23
76	54·574	26	26	53·342	24
995·75	54·548	25	995·25	53·318	24
74	54·523	26	24	53·294	23
73	54·497	25	23	53·271	24
72	54·472	26	22	53·247	23
71	54·446	25	21	53·224	24
995·70	54·421	26	995·20	53·200	23
69	54·395	25	19	53·177	24
68	54·370	25	18	53·153	23
67	54·345	26	17	53·130	23
66	54·319	25	16	53·107	23
995·65	54·294	25	995·15	53·084	24
64	54·269	25	14	53·060	23
63	54·244	25	13	53·037	23
62	54·219	26	12	53·014	24
61	54·193	25	11	52·990	23
995·60	54·168	25	995·10	52·967	23
59	54·143	25	09	52·944	23
58	54·118	24	08	52·921	23
57	54·094	25	07	52·898	23
56	54·069	25	06	52·875	22
995·55	54·044	25	995·05	52·853	23
54	54·019	25	04	52·830	23
53	53·994	24	03	52·807	23
52	53·970	25	02	52·784	23
51	53·945	25	01	52·761	23
995·50	53·920		995·00	52·738	

P	μ	$\Delta\mu$	P	μ	$\Delta\mu$
			995·0	52·738	225
			4·9	52·513	223
			4·8	52·290	219
			4·7	52·071	216
			4·6	51·855	213
			994·5	51·642	210
			4·4	51·432	207
			4·3	51·225	205
			4·2	51·020	202
			4·1	50·818	199
			994·0	50·619	197
			3·9	50·422	195
			3·8	50·227	192
			3·7	50·035	189
			3·6	49·846	188
			993·5	49·658	185
			3·4	49·473	183
			3·3	49·290	181
			3·2	49·109	179
			3·1	48·930	177
			993·0	48·753	175
			2·9	48·578	174
			2·8	48·404	171
			2·7	48·233	170
			2·6	48·063	167
			992·5	47·896	166
			2·4	47·730	165
			2·3	47·565	163
			2·2	47·402	161
			2·1	47·241	159
			992·0	47·082	158
			1·9	46·924	157
			1·8	46·767	155
			1·7	46·612	154
			1·6	46·458	152
			991·5	46·306	150
			1·4	46·156	150
			1·3	46·006	148
			1·2	45·858	147
			1·1	45·711	145
			991·0	45·566	144
			0·9	45·422	143
			0·8	45·279	142
			0·7	45·137	141
			0·6	44·996	139
			990·5	44·857	138
			0·4	44·719	137
			0·3	44·582	136
			0·2	44·446	135
			0·1	44·311	134
			990·0	44·177	

P	μ	$\Delta\mu$	P	μ	$\Delta\mu$
990·0	44·177	133	985·0	38·547	96
989·9	44·044	132	4·9	38·451	95
9·8	43·912	130	4·8	38·356	95
9·7	43·782	130	4·7	38·261	94
9·6	43·652	129	4·6	38·167	94
989·5	43·523	127	984·5	38·073	93
9·4	43·396	127	4·4	37·980	93
9·3	43·269	126	4·3	37·887	93
9·2	43·143	125	4·2	37·794	92
9·1	43·018	124	4·1	37·702	91
989·0	42·894	123	984·0	37·611	91
8·9	42·771	122	3·9	37·520	90
8·8	42·649	122	3·8	37·430	90
8·7	42·527	120	3·7	37·340	90
8·6	42·407	120	3·6	37·250	89
988·5	42·287	119	983·5	37·161	89
8·4	42·168	118	3·4	37·072	88
8·3	42·050	117	3·3	36·984	88
8·2	41·933	117	3·2	36·896	88
8·1	41·816	115	3·1	36·808	87
988·0	41·701	115	983·0	36·721	86
7·9	41·586	114	2·9	36·635	86
7·8	41·472	114	2·8	36·549	86
7·7	41·358	112	2·7	36·463	86
7·6	41·246	112	2·6	36·377	85
987·5	41·134	111	982·5	36·292	84
7·4	41·023	111	2·4	36·208	84
7·3	40·912	110	2·3	36·124	84
7·2	40·802	109	2·2	36·040	83
7·1	40·693	108	2·1	35·957	83
987·0	40·585	108	982·0	35·874	83
6·9	40·477	107	1·9	35·791	82
6·8	40·370	106	1·8	35·709	82
6·7	40·264	106	1·7	35·627	81
6·6	40·158	105	1·6	35·546	81
986·5	40·053	105	981·5	35·465	81
6·4	39·948	104	1·4	35·384	80
6·3	39·844	103	1·3	35·304	80
6·2	39·741	102	1·2	35·224	80
6·1	39·639	102	1·1	35·144	79
986·0	39·537	102	981·0	35·065	79
5·9	39·435	101	0·9	34·986	79
5·8	39·334	100	0·8	34·907	78
5·7	39·234	100	0·7	34·829	78
5·6	39·134	99	0·6	34·751	77
985·5	39·035	99	980·5	34·674	78
5·4	38·936	98	0·4	34·596	77
5·3	38·838	97	0·3	34·519	76
5·2	38·741	97	0·2	34·443	77
5·1	38·644	97	0·1	34·366	76
985·0	38·547		980·0	34·290	

P	μ	$\Delta\mu$	P	μ	$\Delta\mu$
980·0	34·290	75	975·0	30·847	63
979·9	34·215	75	4·9	30·784	62
9·8	34·140	76	4·8	30·722	63
9·7	34·064	74	4·7	30·659	62
9·6	33·990	75	4·6	30·597	61
979·5	33·915	74	974·5	30·536	62
9·4	33·841	74	4·4	30·474	62
9·3	33·767	73	4·3	30·412	61
9·2	33·694	73	4·2	30·351	61
9·1	33·621	73	4·1	30·290	61
979·0	33·548	73	974·0	30·229	60
8·9	33·475	72	3·9	30·169	61
8·8	33·403	72	3·8	30·108	60
8·7	33·331	72	3·7	30·048	60
8·6	33·259	71	3·6	29·988	60
978·5	33·188	72	973·5	29·928	60
8·4	33·116	70	3·4	29·868	59
8·3	33·046	71	3·3	29·809	59
8·2	32·975	70	3·2	29·750	59
8·1	32·905	71	3·1	29·691	59
978·0	32·834	69	973·0	29·632	59
7·9	32·765	70	2·9	29·573	59
7·8	32·695	69	2·8	29·514	58
7·7	32·626	69	2·7	29·456	58
7·6	32·557	69	2·6	29·398	58
977·5	32·488	69	972·5	29·340	58
7·4	32·419	68	2·4	29·282	58
7·3	32·351	68	2·3	29·224	57
7·2	32·283	68	2·2	29·167	57
7·1	32·215	67	2·1	29·110	58
977·0	32·148	68	972·0	29·052	57
6·9	32·080	67	1·9	28·995	56
6·8	32·013	66	1·8	28·939	57
6·7	31·947	67	1·7	28·882	56
6·6	31·880	66	1·6	28·826	57
976·5	31·814	66	971·5	28·769	56
6·4	31·748	66	1·4	28·713	56
6·3	31·682	66	1·3	28·657	55
6·2	31·616	65	1·2	28·602	56
6·1	31·551	65	1·1	28·546	55
976·0	31·486	65	971·0	28·491	56
5·9	31·421	65	0·9	28·435	55
5·8	31·356	64	0·8	28·380	55
5·7	31·292	64	0·7	28·325	55
5·6	31·228	64	0·6	28·270	54
975·5	31·164	64	970·5	28·216	55
5·4	31·100	64	0·4	28·161	54
5·3	31·036	63	0·3	28·107	54
5·2	30·973	63	0·2	28·053	54
5·1	30·910	63	0·1	27·999	54
975·0	30·847		970·0	27·945	

P	μ	$\Delta\mu$	P	μ	$\Delta\mu$
970·0	27·945	54	965·0	25·430	47
969·9	27·891	53	4·9	25·383	47
9·8	27·838	54	4·8	25·336	46
9·7	27·784	53	4·7	25·290	47
9·6	27·731	53	4·6	25·243	47
969·5	27·678	53	964·5	25·196	46
9·4	27·625	53	4·4	25·150	47
9·3	27·572	52	4·3	25·103	46
9·2	27·520	53	4·2	25·057	46
9·1	27·467	52	4·1	25·011	46
969·0	27·415	52	964·0	24·965	46
8·9	27·363	52	3·9	24·919	46
8·8	27·311	52	3·8	24·873	46
8·7	27·259	52	3·7	24·827	45
8·6	27·207	52	3·6	24·782	46
968·5	27·155	51	963·5	24·736	45
8·4	27·104	52	3·4	24·691	46
8·3	27·052	51	3·3	24·645	45
8·2	27·001	51	3·2	24·600	45
8·1	26·950	51	3·1	24·555	45
968·0	26·899	51	963·0	24·510	45
7·9	26·848	50	2·9	24·465	45
7·8	26·798	51	2·8	24·420	44
7·7	26·747	50	2·7	24·376	45
7·6	26·697	51	2·6	24·331	44
967·5	26·646	50	962·5	24·287	45
7·4	26·596	50	2·4	24·242	44
7·3	26·546	50	2·3	24·198	44
7·2	26·496	49	2·2	24·154	44
7·1	26·447	50	2·1	24·110	44
967·0	26·397	50	962·0	24·066	44
6·9	26·347	49	1·9	24·022	44
6·8	26·298	49	1·8	23·978	44
6·7	26·249	49	1·7	23·934	43
6·6	26·200	49	1·6	23·891	44
966·5	26·151	49	961·5	23·847	43
6·4	26·102	49	1·4	23·804	43
6·3	26·053	49	1·3	23·761	44
6·2	26·004	48	1·2	23·717	43
6·1	25·956	48	1·1	23·674	43
966·0	25·908	49	961·0	23·631	43
5·9	25·859	48	0·9	23·588	43
5·8	25·811	48	0·8	23·545	42
5·7	25·763	48	0·7	23·503	43
5·6	25·715	47	0·6	23·460	42
965·5	25·668	48	960·5	23·418	43
5·4	25·620	48	0·4	23·375	42
5·3	25·572	47	0·3	23·333	43
5·2	25·525	47	0·2	23·290	42
5·1	25·478	48	0·1	23·248	42
965·0	25·430		960·0	23·206	

P	μ	$\Delta\mu$	P	μ	$\Delta\mu$
960·0	23·206	42	955·0	21·207	38
959·9	23·164	42	4·9	21·169	38
9·8	23·122	42	4·8	21·131	38
9·7	23·080	41	4·7	21·093	38
9·6	23·039	42	4·6	21·055	38
959·5	22·997	42	954·5	21·017	37
9·4	22·955	41	4·4	20·980	38
9·3	22·914	42	4·3	20·942	38
9·2	22·872	41	4·2	20·904	37
9·1	22·831	41	4·1	20·867	37
959·0	22·790	41	954·0	20·830	38
8·9	22·749	41	3·9	20·792	37
8·8	22·708	41	3·8	20·755	37
8·7	22·667	41	3·7	20·718	37
8·6	22·626	41	3·6	20·681	37
958·5	22·585	41	953·5	20·644	37
8·4	22·544	40	3·4	20·607	37
8·3	22·504	41	3·3	20·570	37
8·2	22·463	40	3·2	20·533	37
8·1	22·423	41	3·1	20·496	37
958·0	22·382	40	953·0	20·459	36
7·9	22·342	40	2·9	20·423	37
7·8	22·302	40	2·8	20·386	37
7·7	22·262	40	2·7	20·349	36
7·6	22·222	40	2·6	20·313	36
957·5	22·182	40	952·5	20·277	37
7·4	22·142	40	2·4	20·240	36
7·3	22·102	40	2·3	20·204	36
7·2	22·062	40	2·2	20·168	36
7·1	22·022	39	2·1	20·132	36
957·0	21·983	40	952·0	20·096	37
6·9	21·943	39	1·9	20·059	35
6·8	21·904	40	1·8	20·024	36
6·7	21·864	39	1·7	19·988	36
6·6	21·825	39	1·6	19·952	36
956·5	21·786	39	951·5	19·916	36
6·4	21·747	39	1·4	19·880	35
6·3	21·708	39	1·3	19·845	36
6·2	21·669	39	1·2	19·809	36
6·1	21·630	39	1·1	19·773	35
956·0	21·591	39	951·0	19·738	35
5·9	21·552	38	0·9	19·703	36
5·8	21·514	39	0·8	19·667	35
5·7	21·475	38	0·7	19·632	35
5·6	21·437	39	0·6	19·597	35
955·5	21·398	38	950·5	19·562	36
5·4	21·360	39	0·4	19·526	35
5·3	21·321	38	0·3	19·491	35
5·2	21·283	38	0·2	19·456	35
5·1	21·245	38	0·1	19·421	34
955·0	21·207		950·0	19·387	

P	μ	$\Delta\mu$	P	μ	$\Delta\mu$
950·0	19·387	35	945·0	17·711	32
949·9	19·352	35	4·9	17·679	32
9·8	19·317	35	4·8	17·647	32
9·7	19·282	34	4·7	17·615	32
9·6	19·248	35	4·6	17·583	32
949·5	19·213	35	944·5	17·551	32
9·4	19·178	34	4·4	17·519	32
9·3	19·144	35	4·3	17·487	32
9·2	19·109	34	4·2	17·455	32
9·1	19·075	34	4·1	17·423	32
949·0	19·041	35	944·0	17·391	32
8·9	19·006	34	3·9	17·359	31
8·8	18·972	34	3·8	17·328	32
8·7	18·938	34	3·7	17·296	32
8·6	18·904	34	3·6	17·264	31
948·5	18·870	34	943·5	17·233	32
8·4	18·836	34	3·4	17·201	31
8·3	18·802	34	3·3	17·170	32
8·2	18·768	34	3·2	17·138	31
8·1	18·734	33	3·1	17·107	31
948·0	18·701	34	943·0	17·076	32
7·9	18·667	34	2·9	17·044	31
7·8	18·633	33	2·8	17·013	31
7·7	18·600	34	2·7	16·982	31
7·6	18·566	34	2·6	16·951	31
947·5	18·532	33	942·5	16·920	32
7·4	18·499	33	2·4	16·888	31
7·3	18·466	34	2·3	16·857	31
7·2	18·432	33	2·2	16·826	30
7·1	18·399	33	2·1	16·796	31
947·0	18·366	34	942·0	16·765	31
6·9	18·332	33	1·9	16·734	31
6·8	18·299	33	1·8	16·703	31
6·7	18·266	33	1·7	16·672	31
6·6	18·233	33	1·6	16·641	30
946·5	18·200	33	941·5	16·611	31
6·4	18·167	33	1·4	16·580	31
6·3	18·134	33	1·3	16·549	30
6·2	18·101	32	1·2	16·519	31
6·1	18·069	33	1·1	16·488	30
946·0	18·036	33	941·0	16·458	30
5·9	18·003	32	0·9	16·428	31
5·8	17·971	33	0·8	16·397	30
5·7	17·938	33	0·7	16·367	30
5·6	17·905	32	0·6	16·337	30
945·5	17·873	33	940·5	16·307	31
5·4	17·840	32	0·4	16·276	30
5·3	17·808	32	0·3	16·246	30
5·2	17·776	33	0·2	16·216	31
5·1	17·743	32	0·1	16·185	30
945·0	17·711		940·0	16·155	

P	μ	Δμ	P	μ	Δμ
			900	6·233	214
			899	6·019	213
			8	5·806	212
			7	5·594	211
			6	5·383	210
			895	5·173	209
			4	4·964	209
			3	4·755	208
			2	4·547	207
			1	4·340	207
940	16·155	299	890	4·133	206
939	15·856	295	889	3·927	205
8	15·561	291	8	3·722	205
7	15·270	287	7	3·517	204
6	14·983	285	6	3·313	204
935	14·698	281	885	3·109	203
4	14·417	277	4	2·906	203
3	14·140	275	3	2·703	203
2	13·865	272	2	2·500	202
1	13·593	268	1	2·298	202
930	13·325	266	880	2·096	201
929	13·059	263	879	1·895	201
8	12·796	261	8	1·694	201
7	12·535	258	7	1·493	201
6	12·277	256	6	1·292	200
925	12·021	253	875	1·092	201
4	11·768	251	4	0·891	200
3	11·517	249	3	0·691	200
2	11·268	246	2	0·491	200
1	11·022	245	1	0·291	200
920	10·777	242	870	0·091	
919	10·535	241			
8	10·294	238			
7	10·056	237			
6	9·819	235			
915	9·584	234			
4	9·350	231			
3	9·119	230			
2	8·889	229			
1	8·660	227			
910	8·433	226			
909	8·207	224			
8	7·983	223			
7	7·760	222			
6	7·538	220			
905	7·318	219			
4	7·099	218			
3	6·881	217			
2	6·664	216			
1	6·448	215			
900	6·233				

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ABSTRACT

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