

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Shepherd's dial													
2	For latitude $\phi =$		53.96	degrees =		0.94178	rads		Net chart height, H =		240	mm		
3	Length of gnomon, L =		141.4	mm		Change the figures in red to suit your needs								
4														
5	$\delta$ (declination) = $-23.45 \times \cos(360 \times (N+10)/365)$ degs													
6	date	15 Jan	15 Feb	15 Mar	15 April	15 May	15 June	15 July	15 Aug	15 Sep	15 Oct	15 Nov	15 Dec	
7	day no, N	15	46	74	105	135	166	196	227	258	288	319	349	
8	$\delta$ (deg)	-21.3118	-13.37218	-2.91904	9.322379	18.73138	23.30336	21.55726	13.86508	2.317332	-9.50723	-19.0894	-23.325	
9	$\delta$ (rads)	-0.37196	-0.233389	-0.05095	0.162706	0.326924	0.40672	0.376245	0.241991	0.040445	-0.16593	-0.33317	-0.4071	
10														
11	$\sin A = \sin \phi \sin \delta + \cos \phi \cos \delta \cos h$													
12	time, T	hour angle,	solar altitude A, deg	(-ve = below horizon)										
13		15 Jan	15 Feb	15 Mar	15 April	15 May	15 June	15 July	15 Aug	15 Sep	15 Oct	15 Nov	15 Dec	
14	4	-2.094395	-34.6067	-28.24289	-19.5708	-9.16651	-1.08437	2.849179	1.347105	-5.26901	-15.1436	-25.068	-32.8504	-36.1782
15	5	-1.832596	-25.8327	-19.58218	-11.1429	-1.1047	6.630062	10.37152	8.944772	2.632652	-6.86073	-16.4838	-24.1013	-27.3869
16	6	-1.570796	-17.0905	-10.7784	-2.36	7.526548	15.05043	18.65592	17.28392	11.17297	1.873633	-7.67532	-15.3342	-18.6729
17	7	-1.308997	-8.74395	-2.22726	6.367226	16.33485	23.82096	27.37021	26.02297	19.97504	10.6522	0.952608	-6.92364	-10.3892
18	8	-1.047198	-1.1359	5.69244	14.63232	24.91512	32.56547	36.16136	34.79937	28.64459	19.06433	9.008161	0.776339	-2.86782
19	9	-0.785398	5.376203	12.5761	21.98157	32.78698	40.81815	44.58546	43.15956	36.70362	26.63987	16.06649	7.394468	3.546626
20	10	-0.523599	10.4164	17.98096	27.88424	39.3297	47.91983	51.98454	50.44305	43.50764	32.80656	21.652	12.53629	8.49477
21	11	-0.261799	13.62451	21.46198	31.76165	43.77134	52.92729	57.33347	55.65516	48.20336	36.90807	25.27335	15.81918	11.63592
22	12	0	14.72823	22.66782	33.12096	45.36238	54.77138	59.34336	57.59726	49.90508	38.35733	26.53277	16.95062	12.71497
23	13	0.2617994	13.62451	21.46198	31.76165	43.77134	52.92729	57.33347	55.65516	48.20336	36.90807	25.27335	15.81918	11.63592
24	14	0.5235988	10.4164	17.98096	27.88424	39.3297	47.91983	51.98454	50.44305	43.50764	32.80656	21.652	12.53629	8.49477
25	15	0.7853982	5.376203	12.5761	21.98157	32.78698	40.81815	44.58546	43.15956	36.70362	26.63987	16.06649	7.394468	3.546626
26	16	1.0471976	-1.1359	5.69244	14.63232	24.91512	32.56547	36.16136	34.79937	28.64459	19.06433	9.008161	0.776339	-2.86782
27	17	1.3089969	-8.74395	-2.22726	6.367226	16.33485	23.82096	27.37021	26.02297	19.97504	10.6522	0.952608	-6.92364	-10.3892
28	18	1.5707963	-17.0905	-10.7784	-2.36	7.526548	15.05043	18.65592	17.28392	11.17297	1.873633	-7.67532	-15.3342	-18.6729
29	19	1.8325957	-25.8327	-19.58218	-11.1429	-1.1047	6.630062	10.37152	8.944772	2.632652	-6.86073	-16.4838	-24.1013	-27.3869
30	20	2.0943951	-34.6067	-28.24289	-19.5708	-9.16651	-1.08437	2.849179	1.347105	-5.26901	-15.1436	-25.068	-32.8504	-36.1782
31														
32	Distance from bottom of chart, $y = H - (L \times \tan A)$													
33	month	15 Jan	15 Feb	15 Mar	15 April	15 May	15 June	15 July	15 Aug	15 Sep	15 Oct	15 Nov	15 Dec	
34	time, T	J	F	M	A	M	J	J	A	S	O	N	D	
35	dummy	0	0	0	0	0	0	0	0	0	0	0	0	
36	5 & 19	308.4682	290.3104	267.8569	242.7271	223.5611	214.1159	217.7398	233.4971	257.0162	281.8491	303.2673	313.2678	
37	6 & 18	283.4831	266.9234	245.8287	221.3141	201.9712	192.2508	195.9939	212.066	235.3735	259.0597	278.7809	287.796	
38	7 & 17	261.7525	245.5005	224.2183	198.5504	177.5614	166.7844	170.9511	188.5945	213.3992	237.6484	257.1738	265.9292	
39	8 & 16	242.8042	225.9025	203.0758	174.3063	149.6736	136.6373	141.7078	162.7485	191.125	217.5795	238.0836	247.0848	
40	9 & 15	226.6905	208.4492	182.9126	148.9019	117.8451	100.6046	107.3787	134.5695	169.0554	199.2687	221.6457	231.2344	
41	10 & 14	214.0014	194.0995	165.1679	124.1207	83.37044	59.08202	68.78206	105.7547	148.8334	183.8565	208.5523	218.8768	
42	11 & 13	205.7211	184.3987	152.4424	104.5119	52.81445	19.4211	33.02356	81.80357	133.7823	173.2281	199.929	210.8768	
43	noon	202.8228	180.933	147.731	96.77239	39.72661	1.398281	17.16993	72.01953	128.0775	169.386	196.8946	208.0892	
44	(Row 35 is needed to label the x-axis with the month letters)													
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