

z Tables Output Formatting preface

This Cosmology Calculator was originally designed to produce a limited number of answers and to be used on a desktop, laptop, or similarly large-screened device. While it is possible to read some of the answers on a handheld phone, it is far from ideal. Often times, individual lines will wrap around to the next line (or even multiple additional lines). As time went on and more output answers were added, it became difficult to even fit the one-line answers on a single printable page.

The model is written in the JavaScript language which is designed for interactive user applications. This language is difficult to use for highly-formatted applications that are intended to look/act the same on a number of different browsers (Chrome, Firefox, Safari, Edge, I.E., etc.) which operate on a number of different operating systems (Windows, Mac OS, IOS, and so on).

When the decision was made to add the “z Tables” output to the simple line-by-line answers described in the “**Default Output Documentation**” chapter, the output had to be made readable on as many browser/operating system combinations as possible. Additionally, the design needed to allow users not only to view the answers on the screen but additionally to easily copy the z Tables output to a text file (with a simple Ctrl-C/Ctrl-V) and then to import the text file into a spreadsheet where the user could control spacing, headings, column choices, etc.

In order to accomplish this, the decision was made to use a Monotype font (Courier NEW) and to limit the number of “spaces” in the headings and descriptions. Spaces were intended to be the delimiters for fields for importing into spreadsheets.

As a result of these decisions, the underscore character “_” was chosen to use as a separator within a field (or heading). Also, a single “dot” was chosen as the character for use in spacing of the headings.

z Tables Output Formatting Preface (continued-1)

The two examples below show the stark difference between the interactive z Tables output on a browser and that which can be created by a spreadsheet after importing the data using the above-mentioned text file process.

Browser Example:

```

Table-1 Main_Answers_Table__ (using_pts/integral=1,000)
Input: CMBz=1091.000 H0=69.600 Ωm=0.28600000 Ωvac=0.71400000 ΩK=-0.00008598 ΩR=0.00008598
General .....Light.....Comoving... .....Angular... .....
.....Age_at.....Travel.....Radial.....Comoving .....Size....Luminosity
Redshift ..Redshift... ..Time.....Distance...Volume.. ..Distance.. ..Distance.
... (z).. ..(years)... ..(years)... ..(ly).....(Gpc^3). .....(ly).....(Gyr)...

0.00 13,720,645,822 0 0 0.00 0 0.000
0.01 13,581,155,522 139,490,300 140,185,273 0.00 138,797,300 0.142
0.02 13,443,637,589 277,008,232 279,763,539 0.00 274,277,977 0.285
0.03 13,308,057,470 412,588,351 418,730,765 0.01 406,534,718 0.431
    
```

The headings use underscores (such as “Age_at”) and single dots in order to keep the fields intact for browser spacing and for spreadsheet import.

Spreadsheet Example:

<u>Table 1</u> Main Answers Table						
H ₀ = 69.6000		Geometry= [General]		CMBz= 1091.0000		
Omega(m)= 0.2860		Omega(R)= 0.00008598		Pts/Integral = 1,000		
Omega(vac)= 0.7140		Omega(K)= 0.00008598				
		Light	Comoving		Angular	
z Scale	Age at	Travel	Radial	Comoving	Size	Luminosity
Redshift	Redshift	Time	Distance	Volume	Distance	Distance
(z)	(years)	(years)	(ly)	(Gpc^3)	(ly)	(Gyr)
0.000	13,720,645,822	0	0	0.000	0	0.000
0.010	13,581,155,522	139,490,300	140,185,273	0.000	138,797,300	0.142
0.020	13,443,637,589	277,008,232	279,763,539	0.000	274,277,977	0.285
0.030	13,308,057,470	412,588,351	418,730,765	0.010	406,534,718	0.431

The ability to properly space, center, set decimals, and appropriately label the values and columns in the spreadsheet is much easier.

The user will have the ability to change columns, make new tables, create newly-calculated columns, and create many different graphs from the imported z Tables.

z Tables Output Formatting Preface (continued-2)

Once a set of headings or custom tables has been created, the user can then import different data sets to a separate sheet and then just copy and paste "numbers" to the heading template that has been created.

Additional Spreadsheet Examples:

CMB Evolution by z from Observer Location						
Geometry Option = [General]		Points/Integral = 1,000		Observer at z = 0.000		
Hubble Constant (Ho) = 69.600		Omega(m) = 0.2860		Omega(r) = 0.00008598		
Current CMB = 1091.000		Omega(vac) = 0.7140		Omega(k) = 0.00008598		
z Scale	Age when Light from z point first reached Earth (years)	Distance from Earth to z point at that Age (ly)	Age when CMB* light first reached z point (years)	Proper Distance Earth to z point when CMB* Hit z (ly)	Distance from Earth to z point Now (Comoving) (ly)	Pct of Distance from Earth to CMB* for z location (%)
Redshift (z)						
0.000	374,666	0	13,720,645,822	0	0	0.000
0.020	690,808	375,136	13,443,637,589	274,277,979	279,763,539	0.614
0.040	1,123,210	1,002,612	13,174,381,441	535,656,826	557,083,099	1.222
0.060	1,683,763	1,920,564	12,912,610,708	784,838,281	831,928,578	1.825
0.080	2,383,629	3,165,035	12,658,070,999	1,022,474,755	1,104,272,735	2.423

Relative Earth, Future z, and CMBz Locations								
Geometry Option = [General]			Points/Integral = 1,000		Observer at z = 0.000 (Earth)			
Hubble Constant (Ho) = 69.600			Omega(m) = 0.2860		Omega(r) = 0.00008598			
Current CMBz = 1091.000			Omega(vac) = 0.7140		Omega(k) = 0.00008598			
Fut(z) Location	Fut(z) Viewed from Earth (%)	Pct of Earth to CMBz Distance Viewed from CMBz (%)	Distance from Earth to Fut(z) at Last Scatter (ly)	Distance from CMBz to Fut(z) at Last Scatter (ly)	Distance from z location to CMBz Today (ly)	CMBz Photon to Earth Distance at z (ly)	Expansion Rate from Earth to Fut(z) at z Age (ly/y)	Age at z (years)
z Scale								
0.000	0.000%	100.000%	0	41,674,426	45,508,473,670	0	0.000	13,720,645,822
0.010	0.308%	99.692%	128,168	41,546,259	45,368,288,397	138,797,300	0.010	13,581,155,522
0.020	0.614%	99.386%	255,785	41,418,641	45,228,710,131	274,277,979	0.020	13,443,637,589

It is recommended that serious users use Model V2 (10,000 steps per integral) even though it is much slower than V1 (1,000 steps per integral). The accuracy of the answers is better and crosscheck values are much easier to confirm.

Note: HyperSnap – a Windows screen capture/edit program I have used for more than 20 years made this documentation possible. You may obtain the software at:

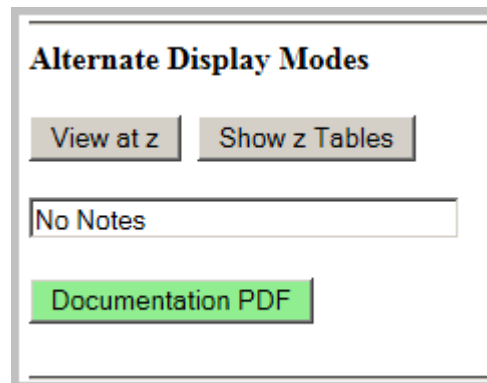
<http://www.hyperionics.com/>

z Table Output Explanation

The best manner in which to read this document is to open two windows (or tabs) in your browser – both with the preloaded default input data – but click “Show z Tables” on the second window. There are many references to the z Tables in this document.

How to Create the z Tables

The z Tables are created by clicking the “**Show z Tables**” button on the left panel of the main output page.



If you have not had the chance to do so, it would be a good idea to review the documentation for the entire Input Data Form.

See: http://davidcook.com/Input_documentation.pdf for additional information regarding the **Input Data Form**.

After clicking the “**Show z Tables**” button, the bottom portion of the Default Output Page will no longer be displayed as it is irrelevant to the z Tables. It is likely that the value for z entered into the Input Data Form will be one of the z values listed in the z Tables anyway.

iPad users should set the reading mode to 50% font size for z Tables to fit.

A **sample of z Table 1** is shown on the following page and discussion will follow on the next page.

Sample of z Table 1

Table-1 Main_Answers_Table__ (using_pts/integral=1,000)

Input: CMBz=1091.000 H_c=69.600 Ω_m=0.28600000 Ω_{vac}=0.71400000 Ω_k=-0.00008598 Ω_Λ=0.00008598

General	Light	Comoving	Angular	Age at	Travel	Radial	Comoving	Size	Luminosity
Redshift	Redshift	Time	Distance	Volume	Distance	Distance	Distance	Distance	Distance
... (z) ..	... (years) ...	... (years) ...	... (ly) ...	... (Gpc^3) ...	... (ly) ...	... (Gyr) ...			
0.00	13,720,645,822	0	0	0.00	0	0.000			
0.01	13,581,155,522	139,490,300	140,185,273	0.00	138,797,300	0.142			
0.02	13,443,637,589	277,008,232	279,763,539	0.00	274,277,977	0.285			
0.03	13,308,057,470	412,588,351	418,730,765	0.01	406,534,718	0.431			
0.04	13,174,381,441	546,264,380	557,083,099	0.02	535,656,814	0.579			
0.05	13,042,576,574	678,069,247	694,816,868	0.04	661,730,328	0.730			
0.06	12,912,610,708	808,035,113	831,928,578	0.07	784,838,242	0.882			
0.07	12,784,452,421	936,193,401	968,414,913	0.11	905,060,605	1.036			
0.08	12,658,070,999	1,062,574,822	1,104,272,735	0.16	1,022,474,664	1.193			
0.09	12,533,436,419	1,187,209,403	1,239,499,084	0.23	1,137,154,996	1.351			
0.10	12,410,519,315	1,310,126,506	1,374,091,177	0.31	1,249,173,626	1.512			
0.20	11,269,779,619	2,450,866,203	2,684,639,156	2.34	2,237,198,126	3.222			
0.30	10,272,644,759	3,448,001,063	3,929,949,502	7.33	3,023,034,689	5.109			
0.40	9,397,938,307	4,322,707,515	5,109,856,148	16.11	3,649,890,329	7.154			
0.50	8,628,005,556	5,092,640,265	6,225,446,665	29.13	4,150,286,098	9.338			
0.60	7,947,998,454	5,772,647,368	7,278,759,667	46.56	4,549,207,292	11.646			
0.70	7,345,368,704	6,375,277,117	8,272,497,219	68.35	4,866,150,656	14.063			
0.7092	7,293,427,507	6,427,218,315	8,361,035,433	70.56	4,891,758,130	14.291			
0.80	6,809,483,432	6,911,162,390	9,209,776,742	94.31	5,116,511,124	16.577			
0.90	6,331,318,358	7,389,327,464	10,093,931,925	124.16	5,312,556,450	19.178			
1.00	5,903,204,810	7,817,441,012	10,928,362,247	157.57	5,464,133,742	21.857			
1.50	4,315,769,067	9,404,876,755	14,467,320,880	365.57	5,786,840,411	36.168			
1.622403	4,029,861,333	9,690,784,489	15,199,264,598	423.91	5,795,832,928	39.858			
2.00	3,316,314,141	10,404,331,681	17,198,099,800	614.10	5,732,576,825	51.593			
2.50	2,645,394,197	11,075,251,625	19,368,264,714	877.14	5,533,639,198	67.787			
3.00	2,171,463,679	11,549,182,143	21,139,092,261	1140.39	5,284,601,604	84.554			
3.50	1,822,853,182	11,897,792,640	22,616,489,232	1396.58	5,025,699,846	101.770			
4.00	1,557,943,456	12,162,702,366	23,871,940,478	1642.30	4,774,190,554	119.355			
4.50	1,351,220,287	12,369,425,535	24,955,203,112	1876.16	4,537,104,500	137.247			
5.00	1,186,313,437	12,534,332,385	25,901,931,937	2097.89	4,316,778,371	155.404			
5.50	1,052,308,236	12,668,337,585	26,738,351,480	2307.74	4,113,379,008	173.790			
6.00	941,686,072	12,778,959,750	27,484,198,918	2506.29	3,926,098,796	192.379			
6.50	849,120,853	12,871,524,968	28,154,631,869	2694.20	3,753,734,867	211.148			
7.00	770,747,318	12,949,898,504	28,761,499,417	2872.20	3,594,971,500	230.078			
7.50	703,700,603	13,016,945,219	29,314,210,464	3040.98	3,448,515,475	249.155			
8.00	645,817,619	13,074,828,202	29,820,340,695	3201.22	3,313,157,265	268.366			
8.50	595,438,146	13,125,207,676	30,286,065,662	3353.55	3,187,794,604	287.698			
9.00	551,269,172	13,169,376,649	30,716,475,626	3498.56	3,071,437,148	307.144			
9.50	512,290,402	13,208,355,419	31,115,808,309	3636.78	2,963,202,003	326.693			
10.00	477,687,180	13,242,958,641	31,487,623,613	3768.71	2,862,305,180	346.339			
25.00	130,722,230	13,589,923,592	37,008,993,915	6119.01	1,423,281,294	962.138			
53.60	42,509,109	13,678,136,713	40,184,347,394	7832.86	735,890,774	2,193.808			
67.25	30,272,558	13,690,373,264	40,928,122,513	8275.86	599,606,519	2,793.005			
90.00	19,512,272	13,701,133,549	41,770,081,461	8797.13	458,953,740	3,800.596			
135.50	10,467,615	13,710,178,206	42,763,873,637	9440.02	313,246,856	5,836.494			
181.00	6,706,249	13,713,939,573	43,352,153,361	9834.94	238,166,143	7,889.015			
272.00	3,558,393	13,717,087,429	44,043,072,555	10312.65	161,307,215	12,022.065			
363.00	2,257,445	13,718,388,377	44,449,204,082	10600.54	122,095,682	16,177.189			
545.00	1,177,433	13,719,468,389	44,921,554,150	10942.06	82,261,855	24,523.575			
1091.00	374,666	13,720,271,156	45,508,473,670	11376.52	41,668,160	49,687.781			

All of the z Table pages are structured in a similar fashion. The top of each page shows the name of the Table followed by the basic Input Form Data used for the calculations. **Additionally, the type of geometry selected on the Input Data Form is highlighted in yellow.** In the sample z Table, “General” geometry was selected.

Following the basic Input Form Data heading are the column headings:

Table-1 Main_Answers_Table__ (using_pts/integral=1,000)							
Input: CMBz=1091.000 H ₀ =69.600 Ω _m =0.28600000 Ω _b =0.71400000 Ω _k =-0.00008598 Ω _r =0.00008598							
General	.....	.....	Light.....	.....	Comoving...	.....	Angular...
.....	.....	Age_at.....	.....	Travel.....	.....	Radial.....	Comoving
Redshift	.....	Redshift...	.....	Time.....	.....	Distance...	Volume..
... (z) ..	.....	(years) ...	.....	(years) ...	.....	(ly)	(Gpc^3) .
	.....		.....		.....	(ly)	(Gyr) ...

Every z Table page will have the Redshift (z) as the first column. These z values start at z=0.000 (Observer location today for example) and continue in various increments until the final value is the **Cosmic Microwave Background (CMB) z value.** In the default Input Form Data, that would **1091.000.**

There are **two z values** that are shown **with extended decimals.** One is these two special values is the **z value when the expansion of the universe begins to accelerate (z=0.7092 in the Default data).** That z value is shown with **4 decimal places.** The second special z value is at the z value of the **maximum Proper Distance from the observer location to that of the CMB photons (z=1.622403)** as those photons streamed toward the Observer (Earth in the Default case) and is shown with **6 decimals.**

An example would be to see when the expansion of the universe begins to accelerate (column 6 on Table 5).

A second example is the maximum CMB photon Proper Distance reached (column 1 on Table 4) when those photons crossed to below the speed of light (column 8 on Table 4) relative to the Observer.

In the previous example, it is important to understand that the CMB photon **started** toward Earth's future location **at $z=1091.000$** (the last line of the sample z Table shown above). The CMB photon continued through all of the other z points before finally **reaching Earth now at $z=0.000$** . In order to spot some trends (or changes in trend), it may be that looking from the bottom of the z Table up toward the top of the z Table is necessary for certain columns.

z Table Columns

All of the z Tables created are shown **below** the top half of the **Default Output Page** (below **Default Output Sections 1-3**). Users can scroll up and down as needed to view any Table or to do screen-captures of values.

The individual columns are for values that would be found in the Default Output for any single z value. Showing the same item for many z values in columnar fashion allows for better understanding of trends or trend changes at various points.

Shown below are each of the eight z Table page headings. Below each heading will be two reference numbers:

- (1) The Default **Output Section Number (1-7)**
- (2) The **Item Number within that Section** (Item shown with bullet points).

These numbers enable the user to quickly cross reference and, if necessary, to review the documentation for that item in the **Default Output Documentation**.

Z Table 1 - Main Answers

[General]	.....Light.....	.....Comoving.....	.....Angular.....	.....	.....	.....
.....	.....Age_at.....	.....Travel.....	.....Radial.....	.....Comoving.....	.....Size.....	.....Luminosity.....
.....	.....Redshift.....	.....Time.....	.....Distance.....	.....Volume.....	.....Distance.....	.....Distance.....
.....(z).....	.....(years).....	.....(years).....	.....(ly).....	.....(Gpc^3).....	.....(ly).....	.....(Gyr).....

Section #	4	4	4	4	4	4
Item #	1	2	3	4	5	7

Z Table 2 - Hubble Parameter Components

[General]	.....Hubble.....	.....	.....	.....	.....	.....
.....	.....Parameter.....	.....E(Ω_s).....	.....Ω_m^3.....	.....Ω_v^1.....	.....Ω_k^2.....	.....Ω_r^4
.....	.....at z.....	.....OmegaSum.....	.....Value.....	.....Value.....	.....Value.....	.....Value.....
.....(z).....	.....(k/s/Mpc).....	.....(at_z).....	.....(at_z).....	.....(at_z).....	.....(at_z).....	.....(at_z).....

Section #	5	5	5	5	5
Item #	5	5	3	3	3

Z Table 3 - Hubble Components for "View at z"

[General]	.....CMB.....	.....Hubble.....	.....	.....	.....	.....
.....	.....Redshift.....	.....Parameter.....	.....E(Ω_s).....	.....Ω_m.....	.....Ω_v.....	.....Ω_k
.....	.....at z.....	.....at z.....	.....SQRT.....	.....Fraction.....	.....Fraction.....	.....Fraction.....
.....(z).....	.....(z).....	.....(k/s/Mpc).....	.....(at_z).....	.....(at_z).....	.....(at_z).....	.....(at_z).....

Section #	5	5	5	5	5	5
Item #	2	5	5	4	4	4

Z Table 4 - Spatial View at z Points

Table 4 - Spatial View at z Points							
For $H_0 = 69.600$ $\Omega_{\text{m}} = 0.28600000$ $\Omega_{\text{vac}} = 0.71400000$ $\Omega_k = -0.00008598$ $\Omega_r = 0.00008598$							
[General]	.....CMB_Photon.....	.....Proper.....	.....Expansion.....	.....LS_Proper.....	.....LS_Prop.....	.....CMB->z.....	.....z->Obsrv.....
.....	.....to_Obsrvr.....	.....Distance.....	.....Part_Proper.....	.....Covered.....	.....% Used Recess.....	.....Recess.....	.....
.....	.....dist_at_z.....	.....to_CMB_at_z.....	.....to_CMB_at_z.....	.....at z.....	.....at z.....	.....at z.....	.....at z.....
.....(z).....	.....(ly).....	.....(ly).....	.....(ly).....	.....(ly).....	.....(ly).....	.....(ly/y).....	.....(ly/y).....

Section #	4	6	6	6	6	7	7
Item #	8	1	2	3	3	2	3

Z Table 5 - PDtoCMB Components Analyses by z

[General]	....PDtoCMB....	...Expansion...	.LS_Proper.	LS_Prop	PDtoCMB	..at_z_Proper.
.....	....Distance...	..Part_PDtoCMB.	.Remaining.	..% Left	.Recess	...minus_DA...
.Redshift	.....at_z.....	.....at_z.....	.....at_z...	..at_z.	..at_z.	.....at_z.....
....(z) ..	....(ly) ..	....(ly) ..	....(ly) ..	..(%) ..	..(ly/y) ..	....(ly) ..

Section #	6	6	6	6	7	Calc'd
Item #	4	5	6	6	1	Value

Z Table 6 – Miscellaneous Indicators

[General]	...CMB..	.....	...Event..	.....	....CMB....	..z_value..	...Age_Light..
.....	Redshift	.Scale..	.Dilation.	...Time..	Temperature	When_Lightz	....From_z....
.Redshift	..at_z..	.Factor.	...(1+z)..	.Dilation	Degrees K.	.Hit_Obsrvr	...Hit_Obsrvr.
....(z) ..	....(z) ..	..at_z..	..(Ratio)..	..(Ratio)..	....(°K)...	....(z) ..	....(years)...

Section #	5	4	Calc'd	5	5	5	5
Item #	2	9	Value	6	1	7	7

Z Table 7 - Various Recession Rates, Volume, and Hubble Time Ratios

[General]	.....	....PDtoCMB....	.....Flat....	.PDtoCMB.	.PDtoCMB..	..Age to...
.....	....Age at....	....Distance...	....PDtoCMB..	..Recess.	..Recess..	..Hubble...
.Redshift	...Redshift...	.....at_z.....	....Volume...	...at_z..	.Ave at z.	.Time at z.
....(z) ..	....(years) ..	....(ly) ..	....(Gly^3) ..	..(ly/y) ..	..(ly/y) ..	..(Ratio-%) ..

Section #	4	6	Calc'd	7	7	Calc'd
Item #	1	4	Value	1	6	Value

Z Table 8 – CMB Evolution Table (Reverse Look)

[General]	.....	....PDtoCMB....	.....Flat....	.PDtoCMB.	.PDtoCMB..	..Age to...
.....	....Age at....	....Distance...	....PDtoCMB..	..Recess.	..Recess..	..Hubble...
.Redshift	...Redshift...	.....at_z.....	....Volume...	...at_z..	.Ave at z.	.Time at z.
....(z) ..	....(years) ..	....(ly) ..	....(Gly^3) ..	..(ly/y) ..	..(ly/y) ..	..(Ratio-%) ..

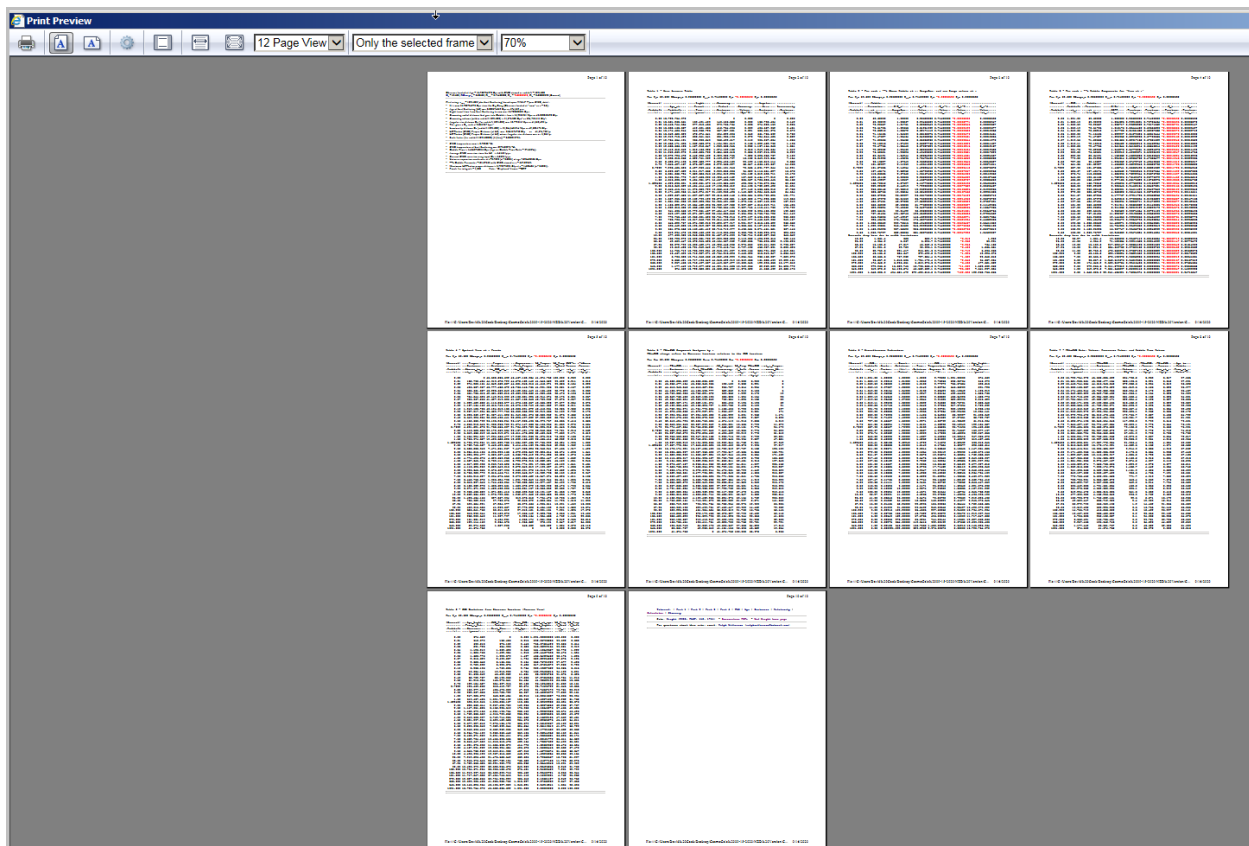
Section #	4	6	Calc'd	7	7	Calc'd
Item #	1	4	Value	1	6	Value

How to Print the z Tables

It can be difficult to print the z Tables. The original design was for browser use and not for printing purposes.

However, in the Internet Explorer browser, it is possible to print by:

- (1) Make sure you are in the right hand Frame of the page.
- (2) Go to 12 page view – Only Selected Frame – 70% option as below:



Other browsers likely have similar options for zooming or taking screenshots of various pages also will work.

Simply copying to a text file (Ctrl-C/Ctrl-V) from the screen also works really well because of the use of monotype font spacing (“Courier New”).

z Table 1 – Main Answers

Table-1 Main_Answers_Table__ (using_pts/integral=1,000)

Input: CMBz=1091.000 H_c=69.600 Ω_m=0.28600000 Ω_{vac}=0.71400000 Ω_k=-0.00008598 Ω_Λ=0.00008598

General	.....Light....	.....Comoving...	.....Angular...	.....Age at....	.....Travel....	.....Radial....	.....Comoving	.....Size....	Luminosity
Redshift	...Redshift...	.....Time....	.....Distance...	.....Distance..	.....Distance..	.....Distance..	.....Distance..	.....Distance..	.....Distance..
... (z) ..	..... (years) ...	..... (years) ...	..... (ly) .....	..... (Gpc^3) .	..... (ly) .....	..... (Gyr) ...			
0.00	13,720,645,822	0	0	0.00	0	0.000			
0.01	13,581,155,522	139,490,300	140,185,273	0.00	138,797,300	0.142			
0.02	13,443,637,589	277,008,232	279,763,539	0.00	274,277,977	0.285			
0.03	13,308,057,470	412,588,351	418,730,765	0.01	406,534,718	0.431			
0.04	13,174,381,441	546,264,380	557,083,099	0.02	535,656,814	0.579			
0.05	13,042,576,574	678,069,247	694,816,868	0.04	661,730,328	0.730			
0.06	12,912,610,708	808,035,113	831,928,578	0.07	784,838,242	0.882			
0.07	12,784,452,421	936,193,401	968,414,913	0.11	905,060,605	1.036			
0.08	12,658,070,999	1,062,574,822	1,104,272,735	0.16	1,022,474,664	1.193			
0.09	12,533,436,419	1,187,209,403	1,239,499,084	0.23	1,137,154,996	1.351			
0.10	12,410,519,315	1,310,126,506	1,374,091,177	0.31	1,249,173,626	1.512			
0.20	11,269,779,619	2,450,866,203	2,684,639,156	2.34	2,237,198,126	3.222			
0.30	10,272,644,759	3,448,001,063	3,929,949,502	7.33	3,023,034,689	5.109			
0.40	9,397,938,307	4,322,707,515	5,109,856,148	16.11	3,649,890,329	7.154			
0.50	8,628,005,556	5,092,640,265	6,225,446,665	29.13	4,150,286,098	9.338			
0.60	7,947,998,454	5,772,647,368	7,278,759,667	46.56	4,549,207,292	11.646			
0.70	7,345,368,704	6,375,277,117	8,272,497,219	68.35	4,866,150,656	14.063			
0.7092	7,293,427,507	6,427,218,315	8,361,035,433	70.56	4,891,758,130	14.291			
0.80	6,809,483,432	6,911,162,390	9,209,776,742	94.31	5,116,511,124	16.577			
0.90	6,331,318,358	7,389,327,464	10,093,931,925	124.16	5,312,556,450	19.178			
1.00	5,903,204,810	7,817,441,012	10,928,362,247	157.57	5,464,133,742	21.857			
1.50	4,315,769,067	9,404,876,755	14,467,320,880	365.57	5,786,840,411	36.168			
1.622403	4,029,861,333	9,690,784,489	15,199,264,598	423.91	5,795,832,928	39.858			
2.00	3,316,314,141	10,404,331,681	17,198,099,800	614.10	5,732,576,825	51.593			
2.50	2,645,394,197	11,075,251,625	19,368,264,714	877.14	5,533,639,198	67.787			
3.00	2,171,463,679	11,549,182,143	21,139,092,261	1140.39	5,284,601,604	84.554			
3.50	1,822,853,182	11,897,792,640	22,616,489,232	1396.58	5,025,699,846	101.770			
4.00	1,557,943,456	12,162,702,366	23,871,940,478	1642.30	4,774,190,554	119.355			
4.50	1,351,220,287	12,369,425,535	24,955,203,112	1876.16	4,537,104,500	137.247			
5.00	1,186,313,437	12,534,332,385	25,901,931,937	2097.89	4,316,778,371	155.404			
5.50	1,052,308,236	12,668,337,585	26,738,351,480	2307.74	4,113,379,008	173.790			
6.00	941,686,072	12,778,959,750	27,484,198,918	2506.29	3,926,098,796	192.379			
6.50	849,120,853	12,871,524,968	28,154,631,869	2694.20	3,753,734,867	211.148			
7.00	770,747,318	12,949,898,504	28,761,499,417	2872.20	3,594,971,500	230.078			
7.50	703,700,603	13,016,945,219	29,314,210,464	3040.98	3,448,515,475	249.155			
8.00	645,817,619	13,074,828,202	29,820,340,695	3201.22	3,313,157,265	268.366			
8.50	595,438,146	13,125,207,676	30,286,065,662	3353.55	3,187,794,604	287.698			
9.00	551,269,172	13,169,376,649	30,716,475,626	3498.56	3,071,437,148	307.144			
9.50	512,290,402	13,208,355,419	31,115,808,309	3636.78	2,963,202,003	326.693			
10.00	477,687,180	13,242,958,641	31,487,623,613	3768.71	2,862,305,180	346.339			
25.00	130,722,230	13,589,923,592	37,008,993,915	6119.01	1,423,281,294	962.138			
53.60	42,509,109	13,678,136,713	40,184,347,394	7832.86	735,890,774	2,193.808			
67.25	30,272,558	13,690,373,264	40,928,122,513	8275.86	599,606,519	2,793.005			
90.00	19,512,272	13,701,133,549	41,770,081,461	8797.13	458,953,740	3,800.596			
135.50	10,467,615	13,710,178,206	42,763,873,637	9440.02	313,246,856	5,836.494			
181.00	6,706,249	13,713,939,573	43,352,153,361	9834.94	238,166,143	7,889.015			
272.00	3,558,393	13,717,087,429	44,043,072,555	10312.65	161,307,215	12,022.065			
363.00	2,257,445	13,718,388,377	44,449,204,082	10600.54	122,095,682	16,177.189			
545.00	1,177,433	13,719,468,389	44,921,554,150	10942.06	82,261,855	24,523.575			
1091.00	374,666	13,720,271,156	45,508,473,670	11376.52	41,668,160	49,687.781			

z Table 2 – Preliminary Hubble Parameter Components

Table-2 For_each_z--> Shows_Hubble_at_z, OmegaSum, _and_raw_Omega_values_at_z

Input: CMBz=1091.000 H_c=69.600 Ω_m=0.28600000 Ω_{vac}=0.71400000 Ω_k=-0.00008598 Ω_r=0.00008598

General						
.....	..Hubble..	.....	.....	.....	.....	.....
.....	..Parameter..	.....E(Ω_s)	.....Ω m^3.....	.....Ω v^1..	.....Ω k^2...	.....Ω r^4.....
Redshift	...at z.....	...OmegaSum..	.....Value.....	...Value..	...Value...	.....Value.....
... (z) ..	... (k/s/Mpc) ..	..... (at_z) ..	..... (at_z) ..	.. (at_z) ..	... (at_z) ..	..... (at_z) ..
0.00	69.60000	1.00000	0.28600000	0.71400000	-0.00008598	0.00008598
0.01	69.90099	1.00867	0.29466609	0.71400000	-0.00008771	0.00008947
0.02	70.20667	1.01751	0.30350549	0.71400000	-0.00008945	0.00009307
0.03	70.51705	1.02653	0.31251992	0.71400000	-0.00009122	0.00009677
0.04	70.83210	1.03572	0.32171110	0.71400000	-0.00009300	0.00010058
0.05	71.15185	1.04509	0.33108075	0.71400000	-0.00009479	0.00010451
0.06	71.47627	1.05464	0.34063058	0.71400000	-0.00009661	0.00010855
0.07	71.80536	1.06438	0.35036230	0.71400000	-0.00009844	0.00011270
0.08	72.13913	1.07429	0.36027763	0.71400000	-0.00010029	0.00011697
0.09	72.47755	1.08440	0.37037829	0.71400000	-0.00010215	0.00012137
0.10	72.82062	1.09469	0.38066600	0.71400000	-0.00010404	0.00012588
0.20	76.50501	1.20826	0.49420800	0.71400000	-0.00012381	0.00017829
0.30	80.64121	1.34244	0.62834200	0.71400000	-0.00014531	0.00024557
0.40	85.21228	1.49895	0.78478400	0.71400000	-0.00016852	0.00033030
0.50	90.19827	1.67949	0.96525000	0.71400000	-0.00019345	0.00043527
0.60	95.57779	1.88580	1.17145600	0.71400000	-0.00022011	0.00056348
0.70	101.32927	2.11959	1.40511800	0.71400000	-0.00024848	0.00071811
0.7092	101.87635	2.14254	1.42805418	0.71400000	-0.00025118	0.00073378
0.80	107.43174	2.38258	1.66795200	0.71400000	-0.00027857	0.00090258
0.90	113.86535	2.67648	1.96167400	0.71400000	-0.00031039	0.00112050
1.00	120.61163	3.00303	2.28800000	0.71400000	-0.00034392	0.00137568
1.50	158.49207	5.18557	4.46875000	0.71400000	-0.00053737	0.00335859
1.622403	168.70318	5.87527	5.15779803	0.71400000	-0.00059128	0.00406625
2.00	202.22592	8.44219	7.72200000	0.71400000	-0.00077382	0.00696437
2.50	250.83148	12.98810	12.26225000	0.71400000	-0.00105325	0.01290235
3.00	303.68766	19.03864	18.30400000	0.71400000	-0.00137568	0.02201083
3.50	360.37255	26.80927	26.06175000	0.71400000	-0.00174109	0.03525710
4.00	420.57978	36.51559	35.75000000	0.71400000	-0.00214950	0.05373739
4.50	484.07451	48.37333	47.58325000	0.71400000	-0.00260089	0.07867691
5.00	550.66900	62.59833	61.77600000	0.71400000	-0.00309527	0.11142985
5.50	620.20824	79.40660	78.54275000	0.71400000	-0.00363265	0.15347935
6.00	692.56101	99.01422	98.09800000	0.71400000	-0.00421301	0.20643755
6.50	767.61404	121.63746	120.65625000	0.71400000	-0.00483636	0.27204552
7.00	845.26806	147.49267	146.43200000	0.71400000	-0.00550271	0.35217334
7.50	925.43495	176.79636	175.63975000	0.71400000	-0.00621204	0.44882003
8.00	1,008.03569	209.76515	208.49400000	0.71400000	-0.00696437	0.56411359
8.50	1,092.99881	246.61580	245.20925000	0.71400000	-0.00775968	0.70031100
9.00	1,180.25923	287.56520	286.00000000	0.71400000	-0.00859798	0.85979819
9.50	1,269.75727	332.83036	331.08075000	0.71400000	-0.00947928	1.04509007
. Decimals_drop_here_due_to_width_limitations						
10.00	1,361.4	383	380.7	0.71400000	-0.010	1.259
25.00	4,954.2	5,067	5,026.7	0.71400000	-0.058	39.291
53.60	15,139.8	47,317	46,552.6	0.71400000	-0.256	764.130
67.25	21,201.0	92,789	90,923.1	0.71400000	-0.400	1,865.551
90.00	32,750.3	221,417	215,521.3	0.71400000	-0.712	5,896.063
135.50	60,565.3	757,232	727,384.4	0.71400000	-1.602	29,848.818
181.00	93,857.0	1,818,505	1,724,170.4	0.71400000	-2.848	94,337.004
272.00	174,648.2	6,296,651	5,819,075.3	0.71400000	-6.408	477,581.082
363.00	272,266.3	15,302,745	13,793,363.6	0.71400000	-11.392	1,509,392.060
545.00	512,370.8	54,193,874	46,552,602.1	0.71400000	-25.632	7,641,297.304
1091.00	1,548,003.9	494,681,472	372,420,816.8	0.71400000	-102.528	122,260,756.865

z Table 3 – Hubble Parameter Fractions at z

Table-3 For_each_z --> Hubble_Components_for_ "View_at_z"

Input: CMBz=1091.000 H₀=69.600 Ω_m=0.28600000 Ω_{vac}=0.71400000 Ω_k=-0.00008598 Ω_r=0.00008598

General	...CMB...	...Hubble...	.....	.....	.....	.....	.....	.....
.....	.Redshift	..Parameter.	.....E (Qs)	.....Ω m...	.....Ω v...	.....Ω k....	.....Ω r...	.....
Redshift	...at z...	....at_z....	.....SQRT....	.Fraction.	.Fraction.	..Fraction.	.Fraction.	.....
... (z) ..	..... (z) ..	..(k/s/Mpc).	..... (at_z)...	.. (at_z) ..	.. (at_z) ..	... (at_z) ..	.. (at_z) ..	.. (at_z) ..
0.00	1,091.00	69.60000	1.000000	0.28600000	0.71400000	-0.00008598	0.00008598	
0.01	1,080.19	69.90099	1.004325	0.29213391	0.70786434	-0.00008695	0.00008870	
0.02	1,069.59	70.20667	1.008717	0.29828282	0.70171362	-0.00008791	0.00009147	
0.03	1,059.19	70.51705	1.013176	0.30444439	0.69555020	-0.00008886	0.00009427	
0.04	1,049.00	70.83210	1.017703	0.31061630	0.68937638	-0.00008979	0.00009712	
0.05	1,039.00	71.15185	1.022297	0.31679626	0.68319444	-0.00009070	0.00010000	
0.06	1,029.19	71.47627	1.026958	0.32298203	0.67700665	-0.00009160	0.00010292	
0.07	1,019.56	71.80536	1.031686	0.32917138	0.67081522	-0.00009248	0.00010589	
0.08	1,010.11	72.13913	1.036482	0.33536213	0.66462234	-0.00009335	0.00010889	
0.09	1,000.83	72.47755	1.041344	0.34155214	0.65843014	-0.00009420	0.00011192	
0.10	991.73	72.82062	1.046273	0.34773931	0.65224073	-0.00009504	0.00011499	
0.20	909.00	76.50501	1.099210	0.40902371	0.59093120	-0.00010247	0.00014756	
0.30	839.00	80.64121	1.158638	0.46805886	0.53186645	-0.00010824	0.00018293	
0.40	779.00	85.21228	1.224314	0.52355730	0.47633477	-0.00011243	0.00022035	
0.50	727.00	90.19827	1.295952	0.57472742	0.42512860	-0.00011519	0.00025917	
0.60	681.50	95.57779	1.373244	0.62119864	0.37861928	-0.00011672	0.00029880	
0.70	641.35	101.32927	1.455880	0.66292046	0.33685798	-0.00011723	0.00033880	
0.7092	637.90	101.87635	1.463741	0.66652493	0.33324982	-0.00011723	0.00034248	
0.80	605.67	107.43174	1.543560	0.70006245	0.29967564	-0.00011692	0.00037883	
0.90	573.74	113.86535	1.635996	0.73292944	0.26676788	-0.00011597	0.00041865	
1.00	545.00	120.61163	1.732926	0.76189670	0.23775972	-0.00011452	0.00045810	
1.50	435.80	158.49207	2.277185	0.86176620	0.13768975	-0.00010363	0.00064768	
1.622403	415.41	168.70318	2.423896	0.87788228	0.12152627	-0.00010064	0.00069210	
2.00	363.00	202.22592	2.905545	0.91469151	0.08457521	-0.00009166	0.00082495	
2.50	311.00	250.83148	3.603901	0.94411429	0.05497340	-0.00008109	0.00099340	
3.00	272.00	303.68766	4.363328	0.96141345	0.03750269	-0.00007226	0.00115611	
3.50	241.67	360.37255	5.177767	0.97211725	0.02663258	-0.00006494	0.00131511	
4.00	217.40	420.57978	6.042813	0.97903394	0.01955329	-0.00005887	0.00147163	
4.50	197.55	484.07451	6.955094	0.98366711	0.01476020	-0.00005377	0.00162645	
5.00	181.00	550.66900	7.911911	0.98686332	0.01140605	-0.00004945	0.00178008	
5.50	167.00	620.20824	8.911038	0.98912122	0.00899170	-0.00004575	0.00193283	
6.00	155.00	692.56101	9.950589	0.99074654	0.00721109	-0.00004255	0.00208493	
6.50	144.60	767.61404	11.028937	0.99193333	0.00586990	-0.00003976	0.00223653	
7.00	135.50	845.26806	12.144656	0.99280866	0.00484092	-0.00003731	0.00238773	
7.50	127.47	925.43495	13.296479	0.99345796	0.00403854	-0.00003514	0.00253863	
8.00	120.33	1,008.03569	14.483271	0.99394013	0.00340381	-0.00003320	0.00268926	
8.50	113.95	1,092.99881	15.704006	0.99429659	0.00289519	-0.00003146	0.00283968	
9.00	108.20	1,180.25923	16.957747	0.99455706	0.00248292	-0.00002990	0.00298992	
9.50	103.00	1,269.75727	18.243639	0.99474324	0.00214524	-0.00002848	0.00314001	
. Decimals_drop_here_due_to_width_limitations								
10.00	98.27	1,361.4	19.560890	0.99487119	0.00186604	-0.00002719	0.00328996	
25.00	41.00	4,954.2	71.180634	0.99211583	0.00014092	-0.00001147	0.00775472	
53.60	19.00	15,139.8	217.525147	0.98384123	0.00001509	-0.00000542	0.01614909	
67.25	15.00	21,201.0	304.612730	0.97989130	0.00000769	-0.00000432	0.02010532	
90.00	11.00	32,750.3	470.550073	0.97337126	0.00000322	-0.00000322	0.02662873	
135.50	7.00	60,565.3	870.190978	0.96058286	0.00000094	-0.00000212	0.03941831	
181.00	5.00	93,857.0	1,348.519676	0.94812505	0.00000039	-0.00000157	0.05187612	
272.00	3.00	174,648.2	2,509.312784	0.92415406	0.00000011	-0.00000102	0.07584684	
363.00	2.00	272,266.3	3,911.872310	0.90136532	0.00000005	-0.00000074	0.09863538	
545.00	1.00	512,370.8	7,361.648897	0.85900118	0.00000001	-0.00000047	0.14099928	
1091.00	0.00	1,548,003.9	22,241.435921	0.75284974	0.00000000	-0.00000021	0.24715047	

z Table 4 – Spatial View at z Points

Table-4 Spatial_View_at_z_Points

Input: CMBz=1091.000 H₀=69.600 Ω_m=0.28600000 Ω_{vac}=0.71400000 Ω_k=-0.00008598 Ω_Λ=0.00008598

General	..CMB Photon.	.....Proper....	...Expansion...	LS_Proper.	LS Prop	CMB->z	z>Obsrv
.....	..to Obsrvr..	....Distance...	..Part Proper..	.Covered..	.* Used	Recess	.Recess
Redshift	..dist_at_z..	..to_CMB_at_z..	..to_CMB_at_z..	...at z...	..at z.	.at z.	..at z.
... (z) ..	..... (ly) .....	..... (ly) .....	..... (ly) .....	... (ly) ...	.. (*) ..	(ly/y)	.(ly/y)
0.00	0	45,508,473,670	45,466,799,243	41,674,426	100.000	3.239	0.000
0.01	138,797,300	44,919,321,394	44,877,775,136	41,546,259	99.692	3.211	0.010
0.02	274,277,979	44,342,310,142	44,300,891,501	41,418,641	99.386	3.184	0.020
0.03	406,534,723	43,777,090,423	43,735,798,845	41,291,578	99.081	3.157	0.029
0.04	535,656,826	43,223,326,005	43,182,160,933	41,165,072	98.778	3.131	0.039
0.05	661,730,351	42,680,693,288	42,639,654,160	41,039,128	98.476	3.106	0.048
0.06	784,838,281	42,148,880,703	42,107,966,954	40,913,749	98.175	3.081	0.057
0.07	905,060,666	41,627,588,156	41,586,799,219	40,788,937	97.875	3.057	0.066
0.08	1,022,474,755	41,116,526,493	41,075,861,797	40,664,697	97.577	3.033	0.075
0.09	1,137,155,123	40,615,417,004	40,574,875,974	40,541,030	97.280	3.011	0.084
0.10	1,249,173,798	40,123,990,945	40,083,573,006	40,417,940	96.985	2.988	0.093
0.20	2,237,199,297	35,689,493,844	35,650,274,620	39,219,224	94.109	2.792	0.175
0.30	3,023,038,078	31,987,156,869	31,949,076,920	38,079,949	91.375	2.638	0.249
0.40	3,649,897,249	28,860,268,857	28,823,268,512	37,000,345	88.784	2.515	0.318
0.50	4,150,297,777	26,193,054,884	26,157,075,413	35,979,471	86.335	2.416	0.383
0.60	4,549,224,792	23,898,078,525	23,863,063,025	35,015,500	84.022	2.336	0.445
0.70	4,866,174,835	21,908,079,509	21,873,973,524	34,105,985	81.839	2.270	0.504
0.7092	4,891,782,959	21,738,382,077	21,704,357,130	34,024,947	81.645	2.265	0.510
0.80	5,116,542,634	20,170,509,077	20,137,260,985	33,248,092	79.781	2.216	0.562
0.90	5,312,595,750	18,643,764,559	18,611,325,775	32,438,784	77.839	2.171	0.619
1.00	5,464,181,123	17,294,528,898	17,262,853,937	31,674,961	76.006	2.133	0.674
1.50	5,786,928,352	12,420,490,017	12,392,054,830	28,435,188	68.232	2.013	0.938
1.622403	5,795,930,144	11,561,710,760	11,533,945,682	27,765,078	66.624	1.995	1.000
2.00	5,732,699,933	9,440,354,286	9,414,419,247	25,935,039	62.233	1.952	1.186
2.50	5,533,789,918	7,471,791,828	7,447,843,778	23,948,051	57.465	1.917	1.420
3.00	5,284,773,065	6,095,171,675	6,072,845,039	22,326,636	53.574	1.893	1.641
3.50	5,025,886,496	5,089,656,951	5,068,683,090	20,973,861	50.328	1.876	1.852
4.00	4,774,388,096	4,329,624,811	4,309,800,522	19,824,289	47.569	1.862	2.054
4.50	4,537,309,657	3,739,081,691	3,720,249,320	18,832,371	45.189	1.851	2.246
5.00	4,316,988,656	3,269,714,518	3,251,749,053	17,965,464	43.109	1.841	2.431
5.50	4,113,592,535	2,889,526,030	2,872,326,470	17,199,560	41.271	1.833	2.609
6.00	3,926,314,131	2,576,587,499	2,560,070,913	16,516,587	39.632	1.825	2.781
6.50	3,753,950,916	2,315,428,291	2,299,525,624	15,902,667	38.159	1.818	2.947
7.00	3,595,187,427	2,094,858,891	2,079,511,939	15,346,952	36.826	1.811	3.108
7.50	3,448,730,643	1,906,609,626	1,891,768,800	14,840,826	35.611	1.805	3.264
8.00	3,313,371,188	1,744,452,176	1,730,074,823	14,377,353	34.499	1.798	3.416
8.50	3,188,006,912	1,603,616,804	1,589,665,926	13,950,879	33.476	1.793	3.564
9.00	3,071,647,563	1,480,396,230	1,466,839,488	13,556,742	32.530	1.787	3.708
9.50	2,963,410,315	1,371,870,502	1,358,679,440	13,191,063	31.653	1.782	3.848
10.00	2,862,511,238	1,275,712,183	1,262,861,602	12,850,581	30.836	1.776	3.986
25.00	1,423,422,843	327,365,390	319,570,976	7,794,414	18.703	1.659	7.212
53.60	735,977,058	97,729,298	92,842,833	4,886,465	11.725	1.513	11.396
67.25	599,679,451	67,284,442	63,079,164	4,205,278	10.091	1.459	13.003
90.00	459,011,884	41,209,339	37,775,228	3,434,112	8.240	1.380	15.374
135.50	313,288,452	20,189,716	17,666,001	2,523,714	6.056	1.251	19.405
181.00	238,198,645	11,907,703	9,923,085	1,984,617	4.762	1.143	22.864
272.00	161,329,936	5,404,188	4,053,141	1,351,047	3.242	0.965	28.816
363.00	122,113,198	2,934,550	1,956,366	978,183	2.347	0.817	34.002
545.00	82,273,909	1,087,195	543,597	543,597	1.304	0.570	43.112
1091.00	41,674,426	0	0	0	0.000	0.000	65.977

z Table 5 – PDtoCMD Analyses by z point

Table-5 PDtoCMD Component Analyses by z

. PDtoCMD_always_refers_to_Observer_location_relative_to_the_CMB_location

Input: CMBz=1091.000 H₀=69.600 Ω_m=0.28600000 Ω_b=0.01400000 Ω_k=-0.00008598 Ω_Λ=0.00008598

General	....PDtoCMD....	...Expansion...	.LS Proper.	LS Prop	PDtoCMD	..at_z Proper.
.....	....Distance...	..Part_PDtoCMD.	.Remaining.	.%_Left	.Recess	...minus DA...
Redshift	.....at z.....	.....at z.....	.....at z...	..at z.	..at z.	.....at z.....
...(z)..	.....(ly).....	.....(ly).....	.....(ly)...	..(%)..	.(ly/y)	.....(ly).....
0.00	45,508,473,670	45,508,473,670	0	0.000	3.239	0
0.01	45,058,118,694	45,057,990,527	128,168	0.308	3.221	0
0.02	44,616,588,121	44,616,332,336	255,785	0.614	3.204	2
0.03	44,183,625,146	44,183,242,298	382,848	0.919	3.186	5
0.04	43,758,982,832	43,758,473,478	509,354	1.222	3.170	12
0.05	43,342,423,639	43,341,788,341	635,298	1.524	3.154	23
0.06	42,933,718,984	42,932,958,307	760,678	1.825	3.138	39
0.07	42,532,648,822	42,531,763,332	885,489	2.125	3.123	62
0.08	42,139,001,248	42,137,991,518	1,009,730	2.423	3.109	91
0.09	41,752,572,127	41,751,438,731	1,133,397	2.720	3.095	127
0.10	41,373,164,743	41,371,908,256	1,256,487	3.015	3.081	171
0.20	37,926,693,141	37,924,237,939	2,455,202	5.891	2.967	1,171
0.30	35,010,194,947	35,006,600,469	3,594,478	8.625	2.887	3,390
0.40	32,510,166,106	32,505,492,024	4,674,082	11.216	2.833	6,919
0.50	30,343,352,660	30,337,657,705	5,694,955	13.665	2.799	11,679
0.60	28,447,303,316	28,440,644,390	6,658,927	15.978	2.781	17,499
0.70	26,774,254,344	26,766,685,902	7,568,442	18.161	2.775	24,179
0.7092	26,630,165,036	26,622,515,557	7,649,479	18.355	2.775	24,829
0.80	25,287,051,711	25,278,625,376	8,426,335	20.219	2.778	31,510
0.90	23,956,360,309	23,947,124,667	9,235,642	22.161	2.790	39,300
1.00	22,758,710,021	22,748,710,556	9,999,465	23.994	2.807	47,381
1.50	18,207,418,370	18,194,179,131	13,239,239	31.768	2.951	87,941
1.622403	17,357,640,904	17,343,731,555	13,909,349	33.376	2.995	97,216
2.00	15,173,054,219	15,157,314,832	15,739,387	37.767	3.138	123,108
2.50	13,005,581,747	12,987,855,371	17,726,376	42.535	3.336	150,720
3.00	11,379,944,741	11,360,596,950	19,347,790	46.426	3.534	171,461
3.50	10,115,543,447	10,094,842,882	20,700,565	49.672	3.728	186,650
4.00	9,104,012,907	9,082,162,770	21,850,137	52.431	3.916	197,542
4.50	8,276,391,348	8,253,549,293	22,842,055	54.811	4.097	205,157
5.00	7,586,703,174	7,562,994,212	23,708,962	56.891	4.273	210,286
5.50	7,003,118,565	6,978,643,698	24,474,867	58.729	4.442	213,528
6.00	6,502,901,630	6,477,743,790	25,157,840	60.368	4.606	215,335
6.50	6,069,379,207	6,043,607,448	25,771,760	61.841	4.765	216,049
7.00	5,690,046,318	5,663,718,843	26,327,475	63.174	4.919	215,927
7.50	5,355,340,268	5,328,506,668	26,833,601	64.389	5.069	215,168
8.00	5,057,823,365	5,030,526,291	27,297,073	65.501	5.214	213,923
8.50	4,791,623,716	4,763,900,169	27,723,548	66.524	5.356	212,308
9.00	4,552,043,792	4,523,926,108	28,117,684	67.470	5.495	210,415
9.50	4,335,280,817	4,306,797,453	28,483,364	68.347	5.630	208,313
10.00	4,138,223,420	4,109,399,574	28,823,846	69.164	5.762	206,057
25.00	1,750,788,233	1,716,908,221	33,880,012	81.297	8.871	141,549
53.60	833,706,356	796,918,395	36,787,962	88.275	12.909	86,285
67.25	666,963,892	629,494,743	37,469,149	89.909	14.461	72,932
90.00	500,221,224	461,980,909	38,240,315	91.760	16.754	58,145
135.50	333,478,167	294,327,455	39,150,712	93.944	20.656	41,596
181.00	250,106,347	210,416,538	39,689,809	95.238	24.007	32,502
272.00	166,734,124	126,410,745	40,323,379	96.758	29.781	22,721
363.00	125,047,748	84,351,505	40,696,243	97.653	34.820	17,516
545.00	83,361,103	42,230,274	41,130,829	98.696	43.682	12,054
1091.00	41,674,426	0	41,674,426	100.000	65.977	6,266

z Table 6 – Miscellaneous Indicators

Table-6 Miscellaneous_Indicators

Input: CMBz=1091.000 H_c=69.600 Ω_m=0.28600000 Ω_{vac}=0.71400000 Ω_k=-0.00008598 Ω_r=0.00008598

General	...CMB..	.....	.Distance.	.....	....CMB....	..z_value..	...Age Light..
.....	Redshift	.Scale..	.Dilation.	...Time..	Temperature	When Lightz	....From z....
Redshift	..at z..	.Factor.	... (1+z)..	.Dilation	.Degrees K.	.Hit_Obsvr	...Hit Obsvr.
... (z)..	... (z)..	..at_z..	..(Ratio)..	.(Ratio).	.... (°K)....	....(z)....	....(years)...
0.00	1091.00	1.00000	1.00000	1.0000	2.72528	1,091.00000	374,666
0.01	1080.19	0.99010	1.01000	1.0050	2.75253	898.32339	518,718
0.02	1069.59	0.98039	1.02000	1.0100	2.77979	755.97221	690,213
0.03	1059.19	0.97087	1.03000	1.0149	2.80704	647.10884	890,689
0.04	1049.00	0.96154	1.04000	1.0198	2.83429	561.58410	1,121,653
0.05	1039.00	0.95238	1.05000	1.0247	2.86154	492.92599	1,384,571
0.06	1029.19	0.94340	1.06000	1.0296	2.88880	436.82158	1,680,851
0.07	1019.56	0.93458	1.07000	1.0344	2.91605	390.28616	2,011,864
0.08	1010.11	0.92593	1.08000	1.0392	2.94330	351.19397	2,378,932
0.09	1000.83	0.91743	1.09000	1.0440	2.97056	317.99309	2,783,314
0.10	991.73	0.90909	1.10000	1.0488	2.99781	289.52335	3,226,240
0.20	909.00	0.83333	1.20000	1.0955	3.27034	139.52452	10,008,709
0.30	839.00	0.76923	1.30000	1.1406	3.54286	84.05366	21,636,609
0.40	779.00	0.71429	1.40000	1.1843	3.81539	57.17450	38,603,351
0.50	727.00	0.66667	1.50000	1.2271	4.08792	42.00577	61,063,846
0.60	681.50	0.62500	1.60000	1.2689	4.36045	32.55219	88,920,036
0.70	641.35	0.58824	1.70000	1.3101	4.63298	26.23158	121,898,479
0.7092	637.90	0.58507	1.70920	1.3139	4.65805	25.75720	125,176,941
0.80	605.67	0.55556	1.80000	1.3507	4.90550	21.77776	159,614,846
0.90	573.74	0.52632	1.90000	1.3909	5.17803	18.50856	201,624,098
1.00	545.00	0.50000	2.00000	1.4307	5.45056	16.02913	247,457,373
1.50	435.80	0.40000	2.50000	1.6252	6.81320	9.41663	518,465,791
1.622403	415.41	0.38133	2.62240	1.6720	7.14678	8.53744	591,929,365
2.00	363.00	0.33333	3.00000	1.8149	8.17584	6.63238	827,122,677
2.50	311.00	0.28571	3.50000	2.0014	9.53848	5.14290	1,145,241,014
3.00	272.00	0.25000	4.00000	2.1854	10.90112	4.22609	1,458,403,380
3.50	241.67	0.22222	4.50000	2.3673	12.26376	3.60761	1,759,828,764
4.00	217.40	0.20000	5.00000	2.5475	13.62640	3.16273	2,046,701,945
4.50	197.55	0.18182	5.50000	2.7262	14.98904	2.82725	2,318,225,890
5.00	181.00	0.16667	6.00000	2.9035	16.35168	2.56498	2,574,611,291
5.50	167.00	0.15385	6.50000	3.0796	17.71432	2.35404	2,816,552,226
6.00	155.00	0.14286	7.00000	3.2547	19.07696	2.18047	3,044,948,466
6.50	144.60	0.13333	7.50000	3.4288	20.43960	2.03494	3,260,765,144
7.00	135.50	0.12500	8.00000	3.6020	21.80224	1.91101	3,464,955,193
7.50	127.47	0.11765	8.50000	3.7744	23.16488	1.80406	3,658,423,130
8.00	120.33	0.11111	9.00000	3.9461	24.52752	1.71073	3,842,011,803
8.50	113.95	0.10526	9.50000	4.1171	25.89016	1.62847	4,016,493,633
9.00	108.20	0.10000	10.00000	4.2874	27.25280	1.55535	4,182,574,123
9.50	103.00	0.09524	10.50000	4.4571	28.61544	1.48987	4,340,892,704
10.00	98.27	0.09091	11.00000	4.6263	29.97808	1.43083	4,492,028,323
25.00	41.00	0.03846	26.00000	9.5474	70.85728	0.72495	7,205,797,540
53.60	19.00	0.01832	54.60000	18.5850	148.80029	0.41982	9,237,522,380
67.25	15.00	0.01465	68.25000	22.8295	186.00036	0.35544	9,773,758,230
90.00	11.00	0.01099	91.00000	29.8492	248.00048	0.28522	10,411,823,557
135.50	7.00	0.00733	136.50000	43.7622	372.00072	0.20558	11,210,535,707
181.00	5.00	0.00549	182.00000	57.5735	496.00096	0.15992	11,708,368,658
272.00	3.00	0.00366	273.00000	85.0251	744.00144	0.10755	12,318,785,886
363.00	2.00	0.00275	364.00000	112.3416	992.00192	0.07734	12,691,534,585
545.00	1.00	0.00183	546.00000	166.7536	1,488.00288	0.04265	13,139,305,053
1091.00	0.00	0.00092	1092.00000	329.2252	2,976.00576	0.00000	13,720,645,822

z Table 7 – PDtoCMB, Volume, Recession Rates, and Hubble Time Ratios

Table-7 PDtoCMB_Data, Volume, Recession Rates, and Hubble Time Ratios

Input: CMBz=1091.000 H₀=69.600 Ω_m=0.28600000 Ω_{vac}=0.71400000 Ω_k=-0.00008598 Ω_Λ=0.00008598

General	.....PDtoCMB....	.....Flat....	.PDtoCMB.	.PDtoCMB..	..Age to...	
.....Age at....	.....Distance...	.....PDtoCMB..	..Recess.	..Recess..	..Hubble...	
Redshift ..Redshift...	.....at z.....	.....Volume...	...at z..	.Ave at z.	.Time at z.	
... (z) ..	..... (years)...	..... (l̄y).....	..... (Gly^3) ..	.. (ly/y) .	.. (Ratio-τ̄) .	
0.00	13,720,645,822	45,508,473,670	394,789.3	3.239	3.317	97.665
0.01	13,581,155,522	45,058,118,694	383,184.4	3.221	3.318	97.090
0.02	13,443,637,589	44,616,588,121	372,029.8	3.204	3.319	96.527
0.03	13,308,057,470	44,183,625,146	361,303.9	3.186	3.320	95.976
0.04	13,174,381,441	43,758,982,832	350,986.4	3.170	3.322	95.436
0.05	13,042,576,574	43,342,423,639	341,058.0	3.154	3.323	94.908
0.06	12,912,610,708	42,933,718,984	331,500.5	3.138	3.325	94.391
0.07	12,784,452,421	42,532,648,822	322,296.7	3.123	3.327	93.884
0.08	12,658,070,999	42,139,001,248	313,430.5	3.109	3.329	93.388
0.09	12,533,436,419	41,752,572,127	304,886.6	3.095	3.331	92.902
0.10	12,410,519,315	41,373,164,743	296,650.3	3.081	3.334	92.427
0.20	11,269,779,619	37,926,693,141	228,519.6	2.967	3.365	88.178
0.30	10,272,644,759	35,010,194,947	179,751.4	2.887	3.408	84.721
0.40	9,397,938,307	32,510,166,106	143,928.3	2.833	3.459	81.901
0.50	8,628,005,556	30,343,352,660	117,025.2	2.799	3.516	79.591
0.60	7,947,998,454	28,447,303,316	96,429.9	2.781	3.579	77.691
0.70	7,345,368,704	26,774,254,344	80,397.2	2.775	3.644	76.121
0.7092	7,293,427,507	26,630,165,036	79,106.1	2.775	3.650	75.990
0.80	6,809,483,432	25,287,051,711	67,730.3	2.778	3.712	74.817
0.90	6,331,318,358	23,956,360,309	57,590.5	2.790	3.783	73.729
1.00	5,903,204,810	22,758,710,021	49,377.8	2.807	3.854	72.817
1.50	4,315,769,067	18,207,418,370	25,283.3	2.951	4.216	69.955
1.622403	4,029,861,333	17,357,640,904	21,905.9	2.995	4.304	69.529
2.00	3,316,314,141	15,173,054,219	14,632.1	3.138	4.571	68.588
2.50	2,645,394,197	13,005,581,747	9,214.6	3.336	4.910	67.862
3.00	2,171,463,679	11,379,944,741	6,173.2	3.534	5.233	67.442
3.50	1,822,853,182	10,115,543,447	4,335.7	3.728	5.539	67.183
4.00	1,557,943,456	9,104,012,907	3,160.7	3.916	5.831	67.012
4.50	1,351,220,287	8,276,391,348	2,374.7	4.097	6.110	66.895
5.00	1,186,313,437	7,586,703,174	1,829.1	4.273	6.377	66.810
5.50	1,052,308,236	7,003,118,565	1,438.7	4.442	6.634	66.747
6.00	941,686,072	6,502,901,630	1,151.9	4.606	6.882	66.699
6.50	849,120,853	6,069,379,207	936.5	4.765	7.121	66.660
7.00	770,747,318	5,690,046,318	771.7	4.919	7.352	66.628
7.50	703,700,603	5,355,340,268	643.4	5.069	7.576	66.602
8.00	645,817,619	5,057,823,365	542.0	5.214	7.794	66.579
8.50	595,438,146	4,791,623,716	460.8	5.356	8.006	66.559
9.00	551,269,172	4,552,043,792	395.1	5.495	8.212	66.542
9.50	512,290,402	4,335,280,817	341.3	5.630	8.413	66.526
10.00	477,687,180	4,138,223,420	296.8	5.762	8.609	66.511
25.00	130,722,230	1,750,788,233	22.5	8.871	13.172	66.233
53.60	42,509,109	833,706,356	2.4	12.909	18.914	65.819
67.25	30,272,558	666,963,892	1.2	14.461	21.055	65.639
90.00	19,512,272	500,221,224	0.5	16.754	24.140	65.355
135.50	10,467,615	333,478,167	0.2	20.656	29.162	64.837
181.00	6,706,249	250,106,347	0.1	24.007	33.233	64.372
272.00	3,558,393	166,734,124	0.0	29.781	39.705	63.558
363.00	2,257,445	125,047,748	0.0	34.820	44.802	62.859
545.00	1,177,433	83,361,103	0.0	43.682	52.606	61.698
1091.00	374,666	41,674,426	0.0	65.977	0.000	59.316

z Table 8 –CMB Evolution From Observer Location

Table-8 CMB_Evolution_from_Observer_Location_(Reverse_View)

Input: CMBz=1091.000 H_c=69.600 Ω_m=0.28600000 Ω_{vac}=0.71400000 Ω_k=-0.00008598 Ω_Λ=0.00008598

General	...Age Light..	...CMB Proper..	.Then CMB.	.z val at age.	LS Prop	LS Prop
.....	..From_z Hit..	.....Radial....	.Redshift.	..When Lightz.	..% Used	..% Left
Redshift	...Observer...	...Dist Then...	..At Age..	..Hit Obsrvr..	..at z.	..at z.
... (z) ..	..... (years) ...	..... (ly) .....	... (z) .....	..... (z) (%) (%) ..
0.00	374,666	0	0.000	1,091.00000000	100.000	0.000
0.01	518,718	158,181	0.214	898.32339334	99.692	0.308
0.02	690,213	374,345	0.443	755.97221125	99.386	0.614
0.03	890,689	653,412	0.685	647.10884045	99.081	0.919
0.04	1,121,653	1,000,198	0.941	561.58409816	98.778	1.222
0.05	1,384,571	1,419,406	1.211	492.92598623	98.476	1.524
0.06	1,680,851	1,915,581	1.494	436.82157678	98.175	1.825
0.07	2,011,864	2,493,156	1.791	390.28616039	97.875	2.125
0.08	2,378,932	3,156,415	2.101	351.19397270	97.577	2.423
0.09	2,783,314	3,909,478	2.423	317.99309293	97.280	2.720
0.10	3,226,240	4,756,355	2.759	289.52335399	96.985	3.015
0.20	10,008,709	19,159,243	6.771	139.52451743	94.109	5.891
0.30	21,636,609	46,286,893	11.839	84.05365649	91.375	8.625
0.40	38,603,351	87,941,802	17.771	57.17450014	88.784	11.216
0.50	61,063,846	144,883,939	24.392	42.00577319	86.335	13.665
0.60	88,920,036	217,081,052	31.546	32.55218579	84.022	15.978
0.70	121,898,479	303,939,571	39.100	26.23158347	81.839	18.161
0.7092	125,176,941	312,635,468	39.811	25.75719922	81.645	18.355
0.80	159,614,846	404,499,132	46.941	21.77776244	79.781	20.219
0.90	201,624,098	517,585,798	54.975	18.50855634	77.839	22.161
1.00	247,457,373	641,926,252	63.125	16.02912695	76.006	23.994
1.50	518,465,791	1,389,049,943	103.832	9.41663167	68.232	31.768
1.622403	591,929,365	1,593,819,204	113.496	8.53744425	66.624	33.376
2.00	827,122,677	2,253,464,791	142.075	6.63237509	62.233	37.767
2.50	1,145,241,014	3,153,065,488	176.766	5.14289916	57.465	42.535
3.00	1,458,403,380	4,044,981,575	207.952	4.22608579	53.574	46.426
3.50	1,759,828,764	4,908,515,687	235.999	3.60760838	50.328	49.672
4.00	2,046,701,945	5,734,626,512	261.328	3.16273242	47.569	52.431
4.50	2,318,225,890	6,520,276,606	284.322	2.82725433	45.189	54.811
5.00	2,574,611,291	7,265,475,780	305.313	2.56498148	43.109	56.891
5.50	2,816,552,226	7,971,735,696	324.577	2.35404068	41.271	58.729
6.00	3,044,948,466	8,641,244,782	342.346	2.18046827	39.632	60.368
6.50	3,260,765,144	9,276,446,120	358.809	2.03494270	38.159	61.841
7.00	3,464,955,193	9,879,800,645	374.127	1.91101068	36.826	63.174
7.50	3,658,423,130	10,453,672,830	388.435	1.80406496	35.611	64.389
8.00	3,842,011,803	11,000,285,071	401.844	1.71072770	34.499	65.501
8.50	4,016,493,633	11,521,686,161	414.451	1.62846749	33.476	66.524
9.00	4,182,574,123	12,019,756,862	426.339	1.55534868	32.530	67.470
9.50	4,340,892,704	12,496,208,160	437.578	1.48986650	31.653	68.347
10.00	4,492,028,323	12,952,594,229	448.229	1.43083312	30.836	69.164
25.00	7,205,797,540	21,452,720,313	632.062	0.72494929	18.703	81.297
53.60	9,237,522,380	28,298,228,404	768.112	0.41981972	11.725	88.275
67.25	9,773,758,230	30,190,609,607	804.640	0.35544328	10.091	89.909
90.00	10,411,823,557	32,494,802,209	848.659	0.28522217	8.240	91.760
135.50	11,210,535,707	35,465,163,856	904.786	0.20558335	6.056	93.944
181.00	11,708,368,658	37,368,175,481	940.441	0.15992426	4.762	95.238
272.00	12,318,785,886	39,759,017,667	984.956	0.10755425	3.242	96.758
363.00	12,691,534,585	41,251,558,259	1,012.609	0.07733858	2.347	97.653
545.00	13,139,305,053	43,078,592,462	1,046.334	0.04264752	1.304	98.696
1091.00	13,720,645,822	45,508,473,670	1,091.000	0.00000000	0.000	100.000

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