

The Decimal Calendar

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In orthodontics it is frequently necessary to calculate age, duration of treatment and similar intervals of time. The method to be described here is offered as a substitute for conventional methods on the basis of simplicity, accuracy and applicability. It is especially valuable where this type of information is to be handled by auxiliary personnel or subjected to statistical analysis.

Orthodontic intervals are usually measured by a combination of years, months and days. When these different units are combined, their irregular mathematical relationships introduce numerous problems and errors.

The proposed method uses only one unit of time, the *year*. Smaller intervals, down to a single day, are represented by decimal parts of a year. This provides all of the usual advantages of the decimal system in ease and accuracy of calculation. Dates and intervals of time are recorded in less space, and they can be readily manipulated in pencil calculations as well as by mass data handling techniques.

It is possible to convert dates to decimal values, calculate an interval such as age and reconvert the result to conventional units with an improvement in both speed and reliability over the usual method. For most applications, the decimal values can be used directly, so that the final step (reconversion to years, months, and days) can be omitted. Further gains in time and reliability are possible through the use of an adding machine.

Conversion to decimal values and re-conversion to conventional units is accomplished with the decimal calendar (Fig. 1). This is in the form of a table

arranged so that any date can be located rapidly. Following each date is a three digit decimal figure which represents the actual fraction of a year which has elapsed up to the beginning of that day (midnight).

Values in the table have been calculated to the nearest thousandth, based on a year of 365 days. One thousandth of 365 days is actually 8 hours, 45 minutes, and 36 seconds, so that a single day is slightly less than .003 year. For this reason, the interval between days in the table varies periodically from .003 to .002. For other applications, a table calculated for additional decimal places might be desirable, but this is not necessary for orthodontic purposes. For the same reason, no attempt has been made to compensate for leap years since this would ultimately require the use of an astronomical calendar and special tables for each year.

DETERMINING THE DECIMAL VALUE FOR A DATE

Dates are represented by the year, followed by the three digit decimal value from the table. Since current dates all begin with 19, this can be omitted from the written date.

Example: 60.987 is the decimal date for Christmas, 1960.

DETERMINING AGE OR ELAPSED TIME

Age, or any other interval between dates, is determined from decimal dates by simple subtraction. The value for the earlier date (small figure) is subtracted from that for the later date (larger figure).

The Decimal Calendar

Showing elapsed part of a 365 day year at the beginning of each day

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1 .000	1 .085	1 .162	1 .247	1 .329	1 .414	1 .496	1 .581	1 .666	1 .748	1 .833	1 .915
2 .003	2 .088	2 .164	2 .249	2 .332	2 .416	2 .499	2 .584	2 .668	2 .751	2 .836	2 .918
3 .005	3 .090	3 .167	3 .252	3 .334	3 .419	3 .501	3 .586	3 .671	3 .753	3 .838	3 .921
4 .008	4 .093	4 .170	4 .255	4 .337	4 .422	4 .504	4 .589	4 .674	4 .756	4 .841	4 .923
5 .011	5 .096	5 .173	5 .258	5 .340	5 .425	5 .507	5 .592	5 .677	5 .759	5 .844	5 .926
6 .014	6 .099	6 .175	6 .260	6 .342	6 .427	6 .510	6 .595	6 .679	6 .762	6 .847	6 .929
7 .016	7 .101	7 .178	7 .263	7 .345	7 .430	7 .512	7 .597	7 .682	7 .764	7 .849	7 .932
8 .019	8 .104	8 .181	8 .266	8 .348	8 .433	8 .515	8 .600	8 .685	8 .767	8 .852	8 .934
9 .022	9 .107	9 .184	9 .268	9 .351	9 .436	9 .518	9 .603	9 .688	9 .770	9 .855	9 .937
10 .025	10 .110	10 .186	10 .271	10 .353	10 .438	10 .521	10 .605	10 .690	10 .773	10 .858	10 .940
11 .027	11 .112	11 .189	11 .274	11 .356	11 .441	11 .523	11 .608	11 .693	11 .775	11 .860	11 .942
12 .030	12 .115	12 .192	12 .277	12 .359	12 .444	12 .526	12 .611	12 .696	12 .778	12 .863	12 .945
13 .033	13 .118	13 .195	13 .279	13 .362	13 .447	13 .529	13 .614	13 .699	13 .781	13 .866	13 .948
14 .036	14 .121	14 .197	14 .282	14 .364	14 .449	14 .532	14 .616	14 .701	14 .784	14 .868	14 .951
15 .038	15 .123	15 .200	15 .285	15 .367	15 .452	15 .534	15 .619	15 .704	15 .786	15 .871	15 .953
16 .041	16 .126	16 .203	16 .288	16 .370	16 .455	16 .537	16 .622	16 .707	16 .789	16 .874	16 .956
17 .044	17 .129	17 .205	17 .290	17 .373	17 .458	17 .540	17 .625	17 .710	17 .792	17 .877	17 .959
18 .047	18 .132	18 .208	18 .293	18 .375	18 .460	18 .542	18 .627	18 .712	18 .795	18 .879	18 .962
19 .049	19 .134	19 .211	19 .296	19 .378	19 .463	19 .545	19 .630	19 .715	19 .797	19 .882	19 .964
20 .052	20 .137	20 .214	20 .299	20 .381	20 .466	20 .548	20 .633	20 .718	20 .800	20 .885	20 .967
21 .055	21 .140	21 .216	21 .301	21 .384	21 .468	21 .551	21 .636	21 .721	21 .803	21 .888	21 .970
22 .058	22 .142	22 .219	22 .304	22 .386	22 .471	22 .553	22 .638	22 .723	22 .805	22 .890	22 .973
23 .060	23 .145	23 .222	23 .307	23 .389	23 .474	23 .556	23 .641	23 .726	23 .808	23 .893	23 .975
24 .063	24 .148	24 .225	24 .310	24 .392	24 .477	24 .559	24 .644	24 .729	24 .811	24 .896	24 .978
25 .066	25 .151	25 .227	25 .312	25 .395	25 .479	25 .562	25 .647	25 .732	25 .814	25 .899	25 .981
26 .068	26 .153	26 .230	26 .315	26 .397	26 .482	26 .564	26 .649	26 .734	26 .816	26 .901	26 .984
27 .071	27 .156	27 .233	27 .318	27 .400	27 .485	27 .567	27 .652	27 .737	27 .819	27 .904	27 .986
28 .074	28 .159	28 .236	28 .321	28 .403	28 .488	28 .570	28 .655	28 .740	28 .822	28 .907	28 .989
29 .077	29 .162	29 .238	29 .323	29 .405	29 .490	29 .573	29 .658	29 .742	29 .825	29 .910	29 .992
30 .079	30 .164	30 .241	30 .326	30 .408	30 .493	30 .575	30 .660	30 .745	30 .827	30 .912	30 .995
31 .082	31 .167	31 .244	31 .326	31 .411	31 .496	31 .578	31 .663	31 .748	31 .830	31 .915	31 .997
$\frac{1}{12}$ year	$\frac{2}{12}$ year	$\frac{3}{12}$ year	$\frac{4}{12}$ year	$\frac{5}{12}$ year	$\frac{6}{12}$ year	$\frac{7}{12}$ year	$\frac{8}{12}$ year	$\frac{9}{12}$ year	$\frac{10}{12}$ year	$\frac{11}{12}$ year	$\frac{12}{12}$ year
.083	.167	.250	.333	.417	.500	.583	.667	.750	.833	.917	1.000

Fig. 1

Example:

Date of examination =
 Jan. 27, 1961 = 61.071
 Date of birth =
 Apr. 15, 1944 = 44.285
 Age at examination = 16.786 years

RECONVERSION TO YEARS, MONTHS, AND DAYS

Two methods are available for re-converting decimal values to conventional units depending on the degree of accuracy desired. The short method provides accuracy comparable to that obtained when all calculations have been made in conventional units, and is adequate for most purposes. The 'standardizing' method uses standardized months each 1/12 year in length. This provides more consistent accuracy by eliminating the errors introduced by calendar months of different length.

In either method of reconversion, the decimal value being converted may sometimes fall between two figures in the table. In this situation, the *next lower* figure (*not* the nearest figure) represents the correct date. This is because each figure in the table represents the *beginning* of the day.

RECONVERSION BY THE SHORT METHOD

Locate the date in the table which corresponds to the decimal value being converted (for intermediate figures, take the next lower date as explained above). Use the number of months and days represented by the date shown.

Example: Convert age 16.786 years into months and days.

October 15 is the date corresponding to .786.

October 15 is 9 months and 15 days after the first of the year.

Therefore, 16.786 years = 16 years, 9 months, 15 days.

RECONVERSION BY THE STANDARDIZING METHOD

Standardized monthly intervals of 1/12 year are shown at the bottom of the calendar table. The largest of these values which is included in the value being converted indicates the number of whole standardized months included in that figure. Subtracting this value leaves a remainder which represents the number of days. The table for the month of January is consulted for the highest value included in the remainder, and the number of days read directly.

Example: Convert 16.786 years into years, standardized months, and days.

The largest standardized monthly value included in 16.786 is .750 (9/12 year).

Subtracting,	.786
	-.750
	<hr/>
	.036

Consulting the table for January, .036 = 14 days.

Therefore, 16.786 years = 16 years, 9 months, 14 days.

The standardized monthly intervals in the table represent units of a complete twelfth of a year, not the beginning of the last day of the month. These values actually represent the beginning of the first day of the following month, so that a value coinciding with one of these figures will represent a number of months plus one day. On the other hand, a value just below one of the 1/12 year figures will yield a result showing one month less, plus thirty or thirty-one days. This may be changed to show an additional whole month (1/12 year = 30.417 days).

SUMMARY

Dates may be recorded in less space, and ages and similar periods of time may be calculated with greater speed and accuracy through the use of decimal fractions of a year. A calendar-table is presented making conversion to and from these units both rapid and simple.

Additional details which might be required for special purposes or maximum accuracy are also presented.

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