



The Dozenal Society of America

DECIMAL–DOZENAL CONVERSION RULES

Methods of Conversion

Proficiency in duodecimal arithmetic demands the ability to convert decimal quantities to dozenal, and the reverse. The following rules will acquaint you with most of the methods that are available.

DSA Dozenal Conventions

Let's explain some of the conventions the Dozenal Society of America uses in representing dozenal numbers. Dozenal numbers require two additional (transdecimal) digits, ones that represent the digits ten and eleven. The DSA does not endorse any particular symbols for these digits. For uniformity in our publications, here, and in the *Duodecimal Bulletin*, we use transdecimal digits designed by William Addison Dwiggins in the 1930s. The number range runs as follows, decimal equivalents on the top row, the Dwiggins-DSA dozenal numerals on the bottom row:

0	1	2	3	4	5	6	7	8	9	10	11
0	1	2	3	4	5	6	7	8	9	χ	£

Whatever symbols are used, the numbers commonly called “ten”, “eleven”, and “twelve” are pronounced “dek”, “el” and “dough” in the duodecimal system.

When it is not clear from the context whether a numeral is decimal or dozenal, we use a period as a unit point for base ten and a semicolon, or Humphrey point, as a unit point for base twelve. Thus $\frac{1}{2} = 0;6 = 0.5$, $2\frac{2}{3} = 2;8 = 2.66666\dots$, $6\frac{3}{8} = 6;46 = 6.375$. In dealing with the digital representation or expansion of a common fraction in dozenal, we term what are commonly called “decimals” as “fractionals”. Thus decimal 0.5 is the dozenal fractional 0;6.

Conversion of Whole Numbers

RULE 1. DECIMAL TO DOZENAL by multiplication.¹

STEP 1. Multiply the left-hand digit — dozenally — by χ, and add the next digit to the product.

STEP 2. Multiply this total by χ, and add the next digit, and so on to the end of the number.

STEP 3. The final product is the corresponding dozenal number.

Examples: Convert the following decimal numbers to dozenal.

$\begin{array}{r} 100 \\ \times \chi \\ \chi \\ + 0 \\ \chi \\ \times \chi \\ 84 \\ + 0 \\ \hline \end{array}$ <p>ANSWER: 84</p>	$\begin{array}{r} 2458 \\ \times \chi \\ 18 \\ + 4 \\ 20 \\ \times \chi \\ 180 \\ + 5 \\ 185 \\ \times \chi \\ 1502 \\ + 8 \\ \hline \end{array}$ <p>ANSWER: 150X</p>	$\begin{array}{r} 17279 \\ \times \chi \\ \chi \\ + 7 \\ 15 \\ \times \chi \\ 122 \\ + 2 \\ 124 \\ \times \chi \\ \text{££4} \\ + 7 \\ \text{£££} \\ \times \chi \\ 9\text{££2} \\ + 9 \\ \hline \end{array}$ <p>ANSWER: 9£££</p>
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RULE 2. DECIMAL TO DOZENAL by division.

STEP 1. Divide the number decimally by 12. and set aside the remainder as the last figure of the answer. If there is no remainder, write zero as the remainder. If any of the remainders are 10. or 11., note them as χ or £, respectively.

STEP 2. Divide the quotient by 12. and set aside the remainder as before. Continue until the quotient is less than 12.

STEP 3. The successive remainders form the dozenal number, the last remainder serves as the first digit, the first remainder the last.

Examples: Convert the following decimal numbers to dozenal.

$\begin{array}{r} 12 \overline{)100} \\ \underline{12} \\ 8 \\ 8 \\ \hline \end{array}$	$\begin{array}{r} 12 \overline{)2458} \\ \underline{12} \chi \\ \underline{204} \\ \underline{17} \\ \underline{1} \\ 1 \\ \hline \end{array}$	$\begin{array}{r} 12 \overline{)17279} \\ \underline{12} \chi \\ \underline{1439} \\ \underline{119} \\ \underline{9} \\ 1 \\ \hline \end{array}$
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ANSWER: 84 ANSWER: 150X ANSWER: 9£££

RULE 3. DOZENAL TO DECIMAL by multiplication.

STEP 1. Multiply the left-hand digit — decimally — by 12., and add the next digit to the product.

STEP 2. Multiply this total by 12., and add the next digit, and so on to the end of the number.

STEP 3. The final product is the decimal equivalent.

Examples: Convert the following dozenal numbers to decimal.

$\begin{array}{r} 84 \\ \times 12 \\ \underline{96} \\ + 4 \\ \hline \end{array}$ <p>ANSWER: 100</p>	$\begin{array}{r} 150X \\ \times 12 \\ \underline{12} \\ + 5 \\ 17 \\ \times 12 \\ \underline{204} \\ + 0 \\ 204 \\ \times 12 \\ \underline{2448} \\ + 10 \\ \hline \end{array}$ <p>ANSWER: 2458</p>	$\begin{array}{r} 9\text{£££} \\ \times 12 \\ \underline{108} \\ + 11 \\ 119 \\ \times 12 \\ \underline{1428} \\ + 11 \\ 1439 \\ \times 12 \\ \underline{17268} \\ + 11 \\ \hline \end{array}$ <p>ANSWER: 17279</p>
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RULE 4. DOZENAL TO DECIMAL by division.

STEP 1. Divide dozenally by χ. Set aside the remainder as the last figure of the answer. If there is no remainder, write zero as the remainder.

STEP 2. Divide the quotient by χ and set aside the remainder as before. Continue until the quotient is less than χ.

STEP 3. The successive remainders form the decimal equivalent, the last remainder serves as the first digit, the first remainder the last.

Examples: Convert the following dozenal numbers to decimal.

$\begin{array}{r} \chi \overline{)84} \\ \chi \\ 1 \\ \hline \end{array}$	$\begin{array}{r} \chi \overline{)150X} \\ \chi 8 \\ 2 \\ 4 \\ 2 \\ \hline \end{array}$	$\begin{array}{r} \chi \overline{)9\text{£££}} \\ \chi 9 \\ 7 \\ 2 \\ 1 \\ \hline \end{array}$
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ANSWER: 100 ANSWER: 2458 ANSWER: 17279

Conversion of Fractions

RULE 5. Common Fractions.

Simply convert the numerator and the denominator separately as whole numbers. Examples:

$$\frac{3}{4} \text{ decimal} = \frac{3}{4} \text{ dozenal}, \quad \frac{75}{144} \text{ decimal} = \frac{63}{100} \text{ dozenal}$$

RULE 6. DECIMAL TO DOZENAL.

STEP 1. Multiply the fractional by 12. and set aside the last figure carried, as the first figure of the answer.

STEP 2. Multiply the remaining fractional by 12., and set off the last figure, as before.

STEP 3. Continue to as many places as the original fractional. If the remaining fractional is greater than 0.5, add 1 to the final figure of your result.

Examples: Convert the following decimal numbers to dozenal.

$\begin{array}{r} .8247 \\ \times 12 \\ \hline 9 \ .8964 \\ \times 12 \\ \hline \chi \ .7568 \\ \times 12 \\ \hline 9 \ .0816 \\ \times 12 \\ \hline 0 \ .9792 \\ \hline .9792 > 0.5 \\ \text{ANSWER: } 0;9\chi91 \end{array}$	$\begin{array}{r} .04167 \\ \times 12 \\ \hline 0 \ .50004 \\ \times 12 \\ \hline 6 \ .00048 \\ \times 12 \\ \hline 0 \ .00576 \\ \times 12 \\ \hline 0 \ .06192 \\ \times 12 \\ \hline 0 \ .82944 \\ \hline .82944 > 0.5 \\ \text{ANSWER: } 0;06001 \end{array}$	$\begin{array}{r} .015625 \\ \times 12 \\ \hline 0 \ .187500 \\ \times 12 \\ \hline 2 \ .250000 \\ \times 12 \\ \hline 3 \ .000000 \\ \times 12 \\ \hline 0 \ .000000 \\ \times 12 \\ \hline 0 \ .000000 \\ \times 12 \\ \hline 0 \ .000000 \\ \hline .000000 < 0.5 \\ \text{ANSWER: } 0;023 \end{array}$
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RULE 7. DOZENAL TO DECIMAL.

STEP 1. Multiply the fractional by χ and set aside the last figure carried, as the first figure of the answer.

STEP 2. Multiply the remaining fractional by χ , and set off the last figure, as before.

STEP 3. Continue to as many places as the original fractional. If the remaining fractional is greater than 0;6, add 1 to the final figure of your result.

Examples: Convert the following dozenal numbers to decimal.

$\begin{array}{r} ;9\chi91 \\ \times \chi \\ \hline 8 \ ;2\epsilon6\chi \\ \times \chi \\ \hline 2 \ ;5784 \\ \times \chi \\ \hline 4 \ ;84\epsilon4 \\ \times \chi \\ \hline 7 \ ;0154 \\ \hline ;0154 > 0;6 \\ \text{ANSWER: } 0.8247 \end{array}$	$\begin{array}{r} ;49725 \\ \times \chi \\ \hline 4 \ ;00002 \\ \times \chi \\ \hline 0 \ ;00018 \\ \times \chi \\ \hline 0 \ ;00128 \\ \times \chi \\ \hline 0 \ ;00\epsilon48 \\ \times \chi \\ \hline 0 \ ;095\chi8 \\ \hline ;095\chi8 > 0;6 \\ \text{ANSWER: } 0.40000 \end{array}$	$\begin{array}{r} ;023000 \\ \times \chi \\ \hline 0 \ ;1\chi6000 \\ \times \chi \\ \hline 1 \ ;690000 \\ \times \chi \\ \hline 5 \ ;760000 \\ \times \chi \\ \hline 6 \ ;300000 \\ \times \chi \\ \hline 2 \ ;600000 \\ \times \chi \\ \hline 5 \ ;000000 \\ \hline ;000000 < 0;6 \\ \text{ANSWER: } 0.015625 \end{array}$
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Conversion of Mixed Numbers

For mixed numbers, the simplest way will usually be to convert the whole number and the fractional separately. But there is a method for converting mixed numbers that employs only the rules for conversion of integers.² This method facilitates writing software or building machines to convert between bases.

RULE 8. DECIMAL TO DOZENAL.

STEP 1. Ignore the fraction point, and convert as a whole number.

STEP 2. Divide the result by χ as many times as there places in the fractional.

Examples: Convert the following decimal numbers to dozenal.

$\begin{array}{r} 2784 \\ \hline 2784. \text{ (2 PLACES)} \\ \rightarrow 1740;00 \\ \chi) 1740;00 \\ \chi) \underline{1\epsilon2;4\chi} \\ 23;\chi1 \text{ ANSWER} \end{array}$	$\begin{array}{r} 34.567 \\ \hline 34567. \text{ (3 PLACES)} \\ \rightarrow 18007;000 \\ \chi) 18007;000 \\ \chi) \underline{2000;84\chi} \\ \chi) \underline{249;806} \\ 2\chi;698 \text{ ANSWER} \end{array}$	$\begin{array}{r} 144.25 \\ \hline 14425. \text{ (2 PLACES)} \\ \rightarrow 8421;00 \\ \chi) 8421;00 \\ \chi) \underline{\chi02;60} \\ 100;30 \text{ ANSWER} \end{array}$
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RULE 9. DOZENAL TO DECIMAL.

STEP 1. Ignore the fraction point, and convert as a whole number.

STEP 2. Divide the result by 12. as many times as there places in the fractional.

Examples: Convert the following dozenal numbers to decimal.

$\begin{array}{r} 23;\chi1 \\ \hline 23\chi1; \text{ (2 PLACES)} \\ \rightarrow 4009.00 \\ 12) 4009.00 \\ 12) \underline{334.08} \\ 27.84 \text{ ANSWER} \end{array}$	$\begin{array}{r} 2\chi;698 \\ \hline 2\chi698; \text{ (3 PLACES)} \\ \rightarrow 59732.000 \\ 12) 59732.000 \\ 12) \underline{4977.667} \\ 12) \underline{414.806} \\ 34.567 \text{ ANSWER} \end{array}$	$\begin{array}{r} 100;30 \\ \hline 10030; \text{ (2 PLACES)} \\ \rightarrow 20772.00 \\ 12) 20772.00 \\ 12) \underline{1731.00} \\ 144.25 \text{ ANSWER} \end{array}$
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Practice

Try the following exercises. Answers are printed below, upside down.

Convert DECIMAL to DOZENAL.

3455	72,057	0.875
78.125	840.56	3.14159

Convert DOZENAL to DECIMAL.

$\chi,323$	200,10 ϵ	0;12497
1;5	2;875	$\epsilon\chi;987$

NOTES

1. This method was "originally suggested by Robert Morris Pierce (1898.), and recently recommended by Nelson B. Gray." (DUODECIMAL SOCIETY OF AMERICA, *Manual of the Dozen System*, 1960., page 1 χ .)

2. This floating point method was developed by Member Howard Seely. (DUODECIMAL SOCIETY OF AMERICA, *Manual of the Dozen System*, 1960., page 20.)

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142.810	2.718	1.4
00001.0	497819	637.1
Convert DOZENAL to DECIMAL.		
3;18480	5 χ 0;69	091;69
09 χ ;0	35,849	3331
Convert DECIMAL to DOZENAL.		

Answers