# 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 | Ɛ |

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 ½ = 0;6 = 0.5, 2⅔ = 2;8 = 2.66666..., 6⅜ = 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.
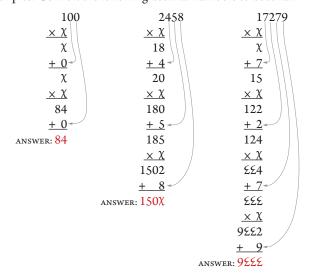
### Conversion of Whole Numbers
#### Rule 1. decimal to dozenal by multiplication.[1]

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.

```
     100          2458         17279
   × χ          × χ          × χ
     χ            18            χ
   + 0          + 4          + 7
     χ            20            15
   × χ          × χ          × χ
     84           180           122
   + 0          + 5          + 2
 ANSWER: 84       185           124
                × χ          × χ
                  1502          ƐƐ4
                + 8          + 7
              ANSWER: 150χ       ƐƐƐ
                              × χ
                                9ƐƐ2
                              + 9
                            ANSWER: 9ƐƐƐ
```

#### 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 Ɛ, 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.

```
 12)100        12)2458        12)17279
 12)  8  4     12)  204  χ     12)  1439  Ɛ
      0  8     12)   17  0     12)   119  Ɛ
               12)    1  5           9  Ɛ
                     0  1                  9
 ANSWER: 84    ANSWER: 150χ    ANSWER: 9ƐƐƐ
```

#### 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 equicalent.

Examples: Convert the following dozenal numbers to decimal.

```
     84          150χ          9ƐƐƐ
   × 12         × 12          × 12
     96            12            108
   + 4          + 5          + 11
 ANSWER: 100      17            119
                × 12          × 12
                  204           1428
                + 0          + 11
                  204           1439
                × 12          × 12
                  2448          17268
                + 10         + 11
              ANSWER: 2458    ANSWER: 17279
```

#### 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.

```
 χ)84         χ)150χ         χ)9ƐƐƐ
 χ)  χ  0     χ)  185  8     χ)  ƐƐƐ  9
      1  0    χ)   20  5     χ)  124  7
         1         2  4      χ)   15  2
                                 1  7
                                       1
 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:

¾ decimal = ¾ dozenal,    ⁷⁵/₁₄₄ decimal = ⁶³/₁₀₀ 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.

```
      .8247              .04167              .015625
    ×  12              ×   12              ×     12
  9 .8964           0 .50004            0 .187500
    ×  12              ×   12              ×     12
  X .7568           6 .00048            2 .250000
    ×  12              ×   12              ×     12
  9 .0816           0 .00576            3 .000000
    ×  12              ×   12              ×     12
  0 .9792           0 .06192            0 .000000
                      ×   12              ×     12
  .9792 > 0.5       0 .82944            0 .000000
answer: 0;9X91       .82944 > 0.5       .000000 < 0.5
                   answer: 0;06001     answer: 0;023
```

## Rule 7. dozenal to decimal.

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

step 2. Multiply the remaining fractional by X, 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.

```
    ;9X91             ;49725             ;023000
   ×   X             ×   X              ×    X
 8 ;2£6X           4 ;00002           0 ;1X6000
   ×   X             ×   X              ×    X
 2 ;5784           0 ;00018           1 ;690000
   ×   X             ×   X              ×    X
 4 ;84£4           0 ;00128           5 ;760000
   ×   X             ×   X              ×    X
 7 ;0154           0 ;00£48           6 ;300000
 ;0154 > 0;6         ×   X             ×    X
answer: 0.8247     0 ;095X8           2 ;600000
                   ;095X8 > 0;6         ×    X
                 answer: 0.40000      5 ;000000
                                      ;000000 < 0;6
                                    answer: 0.015625
```

## 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 X as many times as there places in the fractional.

Examples: Convert the following decimal numbers to dozenal.

```
    27.84               34.567               144.25
    2784. (2 places)    34567. (3 places)    14425. (2 places)
  → 1740;00          → 18007;000          →  8421;00

  X)1740;00           X)18007;000          X)8421;00
  X)  1£2;4X          X)  2000;84X         X)  X02;60
    23;X1 answer      X)   249;806         100;30 answer
                         2X;698 answer
```

## 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.

```
    23;X1               2X;698               100;30
    23X1; (2 places)    2X698; (3 places)    10030; (2 places)
  → 4009.00          → 59732.000          → 20772.00

  12)4009.00          12)59732.000         12)20772.00
  12)  334.08         12)  4977.667        12)  1731.00
    27.84 answer      12)   414.806        144.25 answer
                        34.567 answer
```

# 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.

| | | |
|---|---|---|
| X,323 | 200,10£ | 0;12497 |
| 1;5 | 2;875 | £X;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 1X;.)

2. This floating point method was developed by Member Howard Seely. (Duodecimal Society of America, *Manual of the Dozen System*, 1960., page 20;.)

~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~

## Answers

11£7;

### Convert decimal to dozenal.

| | | |
|---|---|---|
| 333£ | 35,849 | 0;X60 |
| 66,160 | 5X0,69 | 3;18480 |

### Convert dozenal to decimal.

| | | |
|---|---|---|
| 17,739 | 49,819 | 0.10000 |
| 1.4 | 2,718 | 142.810 |