Confused by Conversions: Decimals ⇄ Fractions? Self-Help Guide!

Converting Decimals to Fractions

To convert a decimal to a fraction, use the decimal place value (displayed in the chart below) as the number in the fraction's denominator. The digits of the decimal will become the fraction's numerator. Simplify if necessary (if there are common factors between the numerator and denominator.)

Recall place value:

1	2	3	4	5	.	6	7	8	9	0
Ten Thousands	Thousands	Hundreds	Tens	Ones		Tenths	Hundredths	Thousandths	Ten Thousandths	Hundred Thousandths

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Example #1: Convert the decimal 0.23 to a fraction.

0.23 is read as "twenty-three hundredths."

Write as a fraction, using decimal place value as the number in the denominator:

$$\frac{23}{100}$$

Because there are no common factors between the numerator and denominator, this fraction is already in simplified form.

Example #2: Convert the decimal 0.15 to a fraction.

0.15 is read as "fifteen hundredths."

Write as a fraction, using decimal place value as the number in the denominator:

$$\frac{15}{100}$$

Simplify by dividing by the GCF:

$$\frac{15}{100} \div \frac{5}{5} = \frac{3}{20}$$

Note that dividing by a form of 1 does not change the value of the fraction but produces an equivalent fraction (a fraction equal in value to the given fraction).

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Example #3: Convert the decimal 0.0062 to a fraction.

0.0062 is read as "sixty-two ten-thousandths."

Write as a fraction, using decimal place value as the number in the denominator:

$$\frac{62}{10,000}$$

Simplify by dividing by the GCF:

$$\frac{62}{10,000} \div \frac{2}{2} = \frac{31}{5000}$$

Dividing by a form of 1 does not change the value of the fraction but produces an equivalent fraction.

Example #4: Convert the decimal 2.6 to a fraction.

2.6 is read as "two and six tenths."

Write as a fraction, using decimal place value as the number in the denominator:

$$2\frac{6}{10} \quad \text{or} \quad \frac{26}{10}$$

Simplify by dividing by the GCF:

$$\frac{26}{10} \div \frac{2}{2} = \frac{13}{5} \quad \text{or} \quad 2\frac{3}{5}$$

Dividing by a form of 1 does not change the value of the fraction but produces an equivalent fraction.

Examples 1 – 4 involve decimals that terminate (end). Decimals can also have digits that repeat (expressed with a line over those digits that repeat) as shown in the following example.

Example #5: Convert the decimal $4.\overline{16}$ to a fraction.

$4.\overline{16}$ means 4.16161616161616… The digits continue to repeat indefinitely.

A repeating decimal can be changed to a fraction as follows:

Define a variable as the repeating decimal: $\qquad$ Let $x = 4.\overline{16}$

Multiply both sides of the above equation by 100: $\qquad 100x = 416.\overline{16}$

Subtract the original equation from both sides: $\qquad -(x = \quad 4.\overline{16})$

(Note that the repeating digits are eliminated.) $\qquad 99x = 412.$

Divide both sides by 99: $\qquad x = \dfrac{412}{99} = 4\dfrac{16}{99}$

Note: If only one digit repeats, multiply by 10. If three digits repeat, multiply by 1000 so that the repeating digits line up when subtracting.

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Converting Fractions to Decimals

In a fraction, recall that the fraction bar is actually a division symbol. To convert a fraction to a decimal, divide the numerator by the denominator. To divide without a calculator, add zeros as place holders to the right of the decimal point in the dividend as necessary. Recall that the decimal point in the quotient (answer) will be directly above the decimal point in the dividend.

Example #6: Convert the fraction $\dfrac{17}{100}$ to a decimal.

Rewrite using the division symbol: $\dfrac{17}{100}$ means $17 \div 100 = 0.17$

(The division without a calculator is shown to the right.)

$$\begin{array}{r} 0.17 \\ 100\overline{)\ 17.00} \\ -\ \ 0 \\ \hline 170 \\ -\ 100 \\ \hline 700 \\ -\ 700 \\ \hline 0 \end{array}$$

Dividing by a power of 10 (10^1, 10^2, 10^3, …) will move the decimal point. In this example, dividing by 100 (10^2) moves the decimal point two place values to the left:

$$17 \div 100 = .17. \div 100 = 0.17$$

Example #7: Convert the fraction $\dfrac{2}{5}$ to a decimal.

Rewrite using the division symbol: $\dfrac{2}{5}$ means $2 \div 5 = 0.4$

(The division without a calculator is shown to the right.)

$$\begin{array}{r} 0.4 \\ 5\overline{)\ 2.0} \\ -2\,0 \\ \hline 0 \end{array}$$

Alternative method: $\dfrac{2}{5} \cdot \dfrac{2}{2} = \dfrac{4}{10}$ and $4 \div 10 = .4. \div 10 = 0.4$

(Produce a denominator that is a power of 10 to easily change to a decimal.)

(Dividing by 10 moves the decimal point one place value to the left.)

Example #8: Convert the fraction $\dfrac{3}{8}$ to a decimal.

Rewrite using the division symbol: $\dfrac{3}{8}$ means $3 \div 8 = 0.375$

(The division without a calculator is shown to the right.)

$$\begin{array}{r} 0.375 \\ 8\overline{)\ 3.000} \\ -24 \\ \hline 60 \\ -56 \\ \hline 40 \\ -40 \\ \hline 0 \end{array}$$

In this case, the alternative method would be difficult and should not be used. (There is no whole number to multiply by 8 to equal 10 or any power of 10.)

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Example #9: Convert the fraction $\dfrac{1}{3}$ to a decimal.

Rewrite using the division symbol: $\dfrac{1}{3}$ means $1 \div 3 = 0.333\ldots = 0.\overline{3}$

(The division without a calculator is shown to the right.)

$$
\begin{array}{r}
0.333 \\
3\overline{)1.000} \\
-9 \\
\hline
10 \\
-9 \\
\hline
10 \\
-9 \\
\hline
1
\end{array}
$$

Because the remainder will continue to be 1, this is a repeating decimal which will be noted with a bar above the digit(s) that repeat.

Example #10: Convert $1\dfrac{3}{4}$ to a decimal.

Recall that $1\dfrac{3}{4} = 1 + \dfrac{3}{4}$ where the whole number 1 can be written as 1.0

To complete the decimal, rewrite the fraction $\dfrac{3}{4}$ using the division symbol:

$$\dfrac{3}{4} \text{ means } 3 \div 4 = 0.75$$

(The division without a calculator is shown to the right.)

$$
\begin{array}{r}
0.75 \\
4\overline{)3.00} \\
-28 \\
\hline
20 \\
-20 \\
\hline
0
\end{array}
$$

Therefore $1\dfrac{3}{4} = 1 + \dfrac{3}{4} = 1.0 + 0.75 = 1.75$

It is also possible to change $1\dfrac{3}{4}$ to the improper fraction $\dfrac{7}{4}$ and then divide.

The alternative method could be used with either option.