Example 1.9

$$(.345)_{10} = (?)_2$$

$$\begin{array}{r}
.345 \\
\times\ 2 \\ \hline
0.690 \\
\times\ 2 \\ \hline
1.380 \\
\times\ 2 \\ \hline
0.760 \\
\times\ 2 \\ \hline
1.520 \\
\times\ 2 \\ \hline
1.040 \\
\times\ 2 \\ \hline
0.080
\end{array} = (.010110)_2$$

Multiply fractions only

The fraction may never reach 0; stop when the required number of fraction digits is obtained; the fraction will not be accurate.

Example 1.10

$$(.345)_{10} = (?)_8$$

$$\begin{array}{r}
.345 \\
\times\ 8 \\ \hline
2.760 \\
\times\ 8 \\ \hline
6.080 \\
\times\ 8 \\ \hline
0.640 \\
\times\ 8 \\ \hline
5.120
\end{array} = (.2605)_8$$

Example 1.11

$$(242.45)_{10} = (?)_2$$

$$\begin{array}{r|rl}
2 & 242 & \\
2 & 121 & 0 \\
2 & 60 & 1 \\
2 & 30 & 0 \\
2 & 15 & 0 \\
2 & 7 & 1 \\
2 & 3 & 1 \\
2 & 1 & 1 \\
 & 0 & 1
\end{array}
\qquad
\begin{array}{r}
.45 \\
\times\ 2 \\ \hline
0.90 \\
\times\ 2 \\ \hline
1.80 \\
\times\ 2 \\ \hline
1.60\ * \\
\times\ 2 \\ \hline
1.20 \\
\times\ 2 \\ \hline
0.40 \\
\times\ 2 \\ \hline
0.80 \\
\times\ 2 \\ \hline
1.60
\end{array}$$

*repeats

$$= (1111\ 0010\ .\ 01\ \overline{11\ 00})_2$$

The radix divide and multiply algorithms are applicable to the conversion of numbers from any base to any other base. ~~When a number~~ is converted from base p to base q, the number in base p is divided (or multiplied) by q in *base p arithmetic*. Because of our familiarity with decimal arithmetic, these methods are convenient when p equals 10. In general, it is easier to convert a base p number to base q ($p \neq 10$, $q \neq 10$) by first converting the number to decimal from ~~base p and then converting~~ that decimal number to base q (i.e., $(N)_p \rightarrow (?)_{10} \rightarrow (?)_q$), as shown by the following example. if the base isn't 10 converted to a

Example 1.12

$$(25.34)_8 = (?)_5$$

Convert to base 10:

$$\begin{aligned}
(25.34)_8 &= 2 \times 8^1 + 5 \times 8^0 + 3 \times 8^{-1} + 4 \times 8^{-2} \quad \text{decimal} \\
&= 16 + 5 + \tfrac{3}{8} + \tfrac{4}{64} \quad \text{decimal} \\
&= (21\tfrac{28}{64})_{10} \\
&= (21.4375)_{10}
\end{aligned}$$