Example 1.9

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

.345	
× 2	
0.690	
× 2	
1.380	
× 2	
0.760	Multiply fractions only
× 2	
1.520	
× 2	
1.040	
× 2	
0.080	$= (.010110)_2$

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

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

.345	
× 8	
2.760	
× 8	
6.080	
× 8	
0.640	
× 8	
5.120	$= (.2605)_8$

Example 1.11

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

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

.45	
× 2	
0.90	
× 2	
1.80	
× 2	
1.60	*
× 2	
1.20	
× 2	
0.40	
× 2	
0.80	
× 2	
1.60	*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.

Example 1.12

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

Convert to base 10:

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