Example #1: Use binary expansion to convert binary fractions into decimals.

\[ 101.1101_2 = (1 \times 2^3) + (0 \times 2^2) + (1 \times 2^1) + (1 \times 2^0) + (0 \times 2^{-1}) + (1 \times 2^{-2}) + (0 \times 2^{-3}) + (1 \times 2^{-4}) \]

\[ = 4 + 0 + 1 + 0.5 + 0.25 + 0 + 0.0625 = 5.8125_{10} \]

In a binary fraction, the point here is referred to as a “binary point”.

Example #2: Convert 13.6875\(_{10}\) to a binary fraction.

PART A:
Convert 13 to binary in the ordinary way.

\[ \begin{array}{c|c c c}
2 & 13 & R=1 \\
2 & 6 & R=0 \\
2 & 3 & R=1 \\
2 & 1 & R=1 \uparrow \text{read} \uparrow \\
0 & & \\
\end{array} \]

Therefore, \(13_{10} = 1101_2\)

Hence,
\(13.6875_{10} = 1101.1011_2\)

Now you try some:
Find the decimal equivalent for each binary fraction.

a. \(1101.0111\)

b. \(111.111\)

c. \(101.01011\)

Now you try some: Find the decimal equivalent for each binary fraction.

a. 32.45  b. 28.555  c. 7.0202