Section 1.3: Converting Non-integer Numbers to Decimal

Thursday, September 07, 2023 5:05 PM

Let's review once again how decimal numbers work:

$$12.3$$

the dot is called the decimal point

the first digit to the right of the decimal is in the "tenths" place – meaning that this number 12.3 is equal to $12 + 3/10$

hundredths

$$2.345$$

tenths

thousandths

$$2.345 = 2 + \frac{3}{10} + \frac{4}{100} + \frac{5}{1000}$$

$$= 2\times10^{0} + 3\times10^{-1} + 4\times10^{-2} + 5\times10^{-3}$$

how does this work for non-decimal numbers?

$$57.14_8 = 5\times8^{1} + \underbrace{7\times8^{0}}_{} + 1\times8^{-1} + 4\times8^{-2}$$

the number to the left of the dot is in the ones place with exponent zero

$= 40 + 7 + 1/8 + 4/8^2$

$= 40 + 7 + 0.125 + 0.0625$

$= 47.1875$

note: 57.14_8

↑ we can't call this the "decimal point" – it's the "octal point"

or if you want the generic term, it's the "radix point"

examples: convert the following to decimal:

a) $11.011_2 = 1\times2^1 + 1\times2^0 + 0\times2^{-1} + 1\times2^{-2} + 1\times2^{-3}$

$= 3.375$

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b) $A0.3F6_{16}$ (round your answer to 3 decimal places)

$A0.3F6 = 10\times16^1 + 0\times16^0 + 3\times16^{-1} + 15\times16^{-2} + 6\times16^{-3}$

$A_{16} = 10$ $F_{16} = 15$

$= 160.248$

$(160.2475585 9375\ldots)$

(160.24755859375...)

c) $765.4_8 = 7 \times 8^2 + 6 \times 8^1 + 5 \times 8^0 + 4 \times 8^{-1}$

$= 501.5$