Section 1.3: Converting Non-integer Numbers to Decimal

Tuesday, August 18, 2020 11:43 AM

let's review once again how decimal numbers work:

12.3

the dot is called the decimal place

the first digit to the right of the decimal is in the "tenths" place - meaning that this number 12.3 is equal to 12 plus $\frac{3}{10}$

2.345

thousandths place

hundredths place

tenths place

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

$= 2 \times 10^{0} + 3 \times 10^{-1} + 4 \times 10^{-2} + 5 \times 10^{-3}$

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how does this work for non-decimal numbers?

$57.14_8 = 5 \times 8^{1} + 7 \times 8^{0} + 1 \times 8^{-1} + 4 \times 8^{-2}$

the number to the left of the dot is in

the "0" position

$= 40 + 7 + \frac{1}{8} + \frac{4}{8^2}$

(can omit this step – it's just for understanding)

and if we plug this into a calculator, we get

$= 40 + 7 + 0.125 + 0.0625$

$= 47.1875$

note: 57.14_8

↑

we can't call this the "decimal point"

– it's called the "octal point"

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

examples: convert the following numbers to decimal:

a) 11.011_2

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

$= 3.375$

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

$A0.3F6_{16} = 10 \times 16^{1} + 0 \times 16^{0} + 3 \times 16^{-1} + 15 \times 16^{-2} + 6 \times 16^{-3}$

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

$= 160.248$

c) 765.4_8

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

$= 501.5$