SHT11 sensor - Compensation of RH nonlinearity

My formulas for 12bit humidity readings

- for 12bit humidity readings
- to be used in microcontroller

A) Quadratic the function in the datasheet

$$f(x) := -4 + 0.0405 \cdot x - x^2 \cdot 2.6 \cdot 10^{-6}$$

B) Linear

$$h(x) := \mathrm{trunc}\left(\frac{x}{32}\right) + 2$$

C) 3 x linear

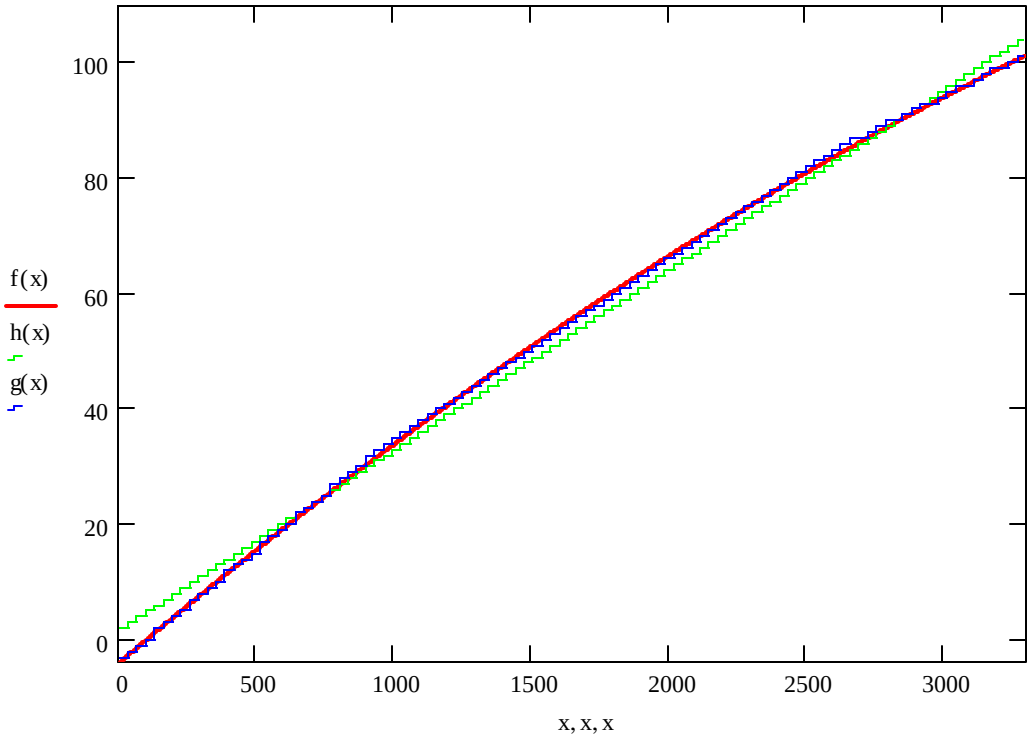
$$g(x) := \begin{cases} \mathrm{trunc}\left(\frac{x}{32}\right) + \mathrm{trunc}\left(\frac{x}{128}\right) - 3 & \text{if } 0 < x < 1024 \\ \mathrm{trunc}\left(\frac{x}{32}\right) + 4 & \text{if } 1024 \le x < 2560 \\ \mathrm{trunc}\left(\frac{x}{32}\right) - \mathrm{trunc}\left(\frac{x}{128}\right) + 24 & \text{if } 2560 \le x \le 3300 \end{cases}$$

$x := 0 .. 3300$

$$\left(\frac{\sum_{i=1}^{3300} |f(i) - h(i)|}{3300} \right) = 1.938$$

average error (%)
[0..100]% RH

$$\left(\frac{\sum_{i=1}^{3300} |f(i) - g(i)|}{3300} \right) = 0.504$$



All linear approximations use power of 2,
so there is no need of multiplication or division,
just right shifts and 8 bit additions and substractions

$$\frac{1024}{256} = 4$$

$$\frac{2560}{256} = 10$$

Sensirion formulas for 8bit humidity readings

require multiplication/division routines

$$fs(x) := -4 + 0.648 \cdot x - x^2 \cdot 7.2 \cdot 10^{-4}$$

$$hs(x) := \mathrm{trunc}(0.5 \cdot x + 0.5)$$

$$gs(x) := \begin{cases} \mathrm{trunc}\left(\frac{143 \cdot x - 512}{256}\right) & \text{if } 0 \le x \le 107 \\ \mathrm{trunc}\left(\frac{111 \cdot x + 2893}{256}\right) & \text{if } 108 \le x < 256 \end{cases}$$

$j := 0 .. 210$

$$\left(\frac{\sum_{j=0}^{210} |fs(j) - hs(j)|}{211} \right) = 2.219$$

average error (%)
[0..100]% RH

$$\left(\frac{\sum_{j=0}^{210} |fs(j) - gs(j)|}{211} \right) = 0.821$$