

Scaled Binary

$$5/9 = .555\underline{5} = .\underline{5}$$

How to represent in integers
using scaled binary

Convert to Base 16

$$5/9 \times 16 = 80/9 = 8 \frac{8}{9}$$

$$8/9 \times 16 = 128/9 = E \frac{2}{9}$$

$$2/9 \times 16 = 32/9 = 3 \frac{5}{9}$$

$$5/9 \times 16 = 80/9 = 8 \frac{8}{9}$$

$$8/9 \times 16 = 128/9 = E \frac{2}{9}$$

$$2/9 \times 16 = 32/9 = 3 \frac{5}{9}$$

$$5/9 = \underline{8E38E3} \times 16^0$$

$$\text{Scaled to 1 Byte} = 8E \times 16^{-2}$$

$$2 \text{ Bytes} = 8E38 \times 16^{-4}$$

$$3 \text{ Bytes} = 8E38E3 \times 16^{-6}$$

$$\begin{aligned} \text{or } & 8E \times 2^{-8} \\ & 8E38 \times 2^{-16} \\ & 8E38E3 \times 2^{-24} \end{aligned}$$

1 Byte
2 Byte rounded up
3 Byte

Now let's write computer code
and see what this achieves
when multiplying

$$254 \times 5/9 = 141.\underline{1}$$

But just using integer math

$$255 \times 5/9 = 141 \quad \text{truncated}$$

Using scaled Binary

$$25 \times 8E \times 2^{-8} = 140$$

$$25 \times 8F \times 2^{-8} = 141$$

$$25 \times 8E38 \times 2^{-16} = 141$$

$$25 \times 8E39 \times 2^{-16} = 141$$

$$25 \times 8E38E3 \times 2^{-24} = 141$$

$$25 \times 8E38E4 \times 2^{-24} = 141$$

See computer program for example