

## Unitless unity (1) conversion constants:

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Similarly to Linear conversion constant  $L_c$  :

$$\underbrace{1 \text{ in}}_{LHS} \equiv \underbrace{2.54 \text{ cm}}_{RHS} \Rightarrow \frac{1 \text{ in}}{2.54 \text{ cm}} = L_c = 1 = \frac{2.54 \text{ cm}}{1 \text{ in}}$$

The gravitational conversion constant,  $g_c$ , is:

$$\underbrace{1 \text{ lb}_f}_{LHS} \equiv \underbrace{1 \text{ lb}_m 32.174 \frac{ft}{s^2}}_{RHS} \Rightarrow \frac{1 \text{ lb}_m 32.174 \frac{ft}{s^2}}{1 \text{ lb}_f} = g_c = 1 = \frac{1 \text{ lb}_f}{1 \text{ lb}_m 32.174 \frac{ft}{s^2}}$$

$$g_c = 32.174 \left( \frac{\text{lb}_m \frac{ft}{s^2}}{\text{lb}_f} \right) = 1 \left( \frac{\text{slug} * \frac{ft}{s^2}}{\text{lb}_f} \right) = 1 \left( \frac{\text{kg} * \frac{m}{s^2}}{N} \right) = 1$$

Note that,

$$\underbrace{g_c = 32.174 \left( \frac{\text{lb}_m \frac{ft}{s^2}}{1 \text{ lb}_f} \right)}_{g_c} \neq \underbrace{g = 32.174 \frac{ft}{s^2}}_g$$

**NOT**

**We may freely multiply and/or divide any expression** with 1 (unitless unity conversion constant,  $g_c$  or  $L_c$  or similar, i.e., 1) without affecting the outcome, **however** only one way will lead to reduced, desired result, while the other will result in more compound, undesired dimension, but still correct result.

**For Example:** Convert 2 in into cm.

If multiplied by  $L_c$  :

$$2 \text{ in} (1 \text{ in}/2.54 \text{ cm}) = \left(\frac{2}{2.54}\right) \frac{\text{in}^2}{\text{cm}} \text{ correct, but undesired result}$$

If divided by  $L_c$  :

$$\frac{2 \text{ in}}{1 \text{ in}} = (2 * 2.52) \text{ cm} \text{ correct and desired result}$$