$T_1 = T_2$ if $m_{scale} = 0$ (massless string)

N2: $a_1 = \dfrac{T_1 - m_1 g}{m_1} = \dfrac{T - m_1 g}{m_1}$

$a_2 = \dfrac{T_2 - m_2 g}{m_2} = \dfrac{T - m_2 g}{m_2}$

Move together: $a_1 = -a_2$

Elim T: $T = m_1 a_1 + m_1 g = m_1 (a_1 + g)$

$a_1 = -a_2 = -\dfrac{T - m_2 g}{m_2} = -\dfrac{m_1 (a_1 + g) - m_2 g}{m_2}$

~~$(m_2 - m_1) a_1 = (m_1 - m_2) g$~~

~~$a_1 =$~~ $(m_2 + m_1) a_1 = -m_1 g_1 + m_2 g$

$$\boxed{a_1 = \frac{m_2 - m_1}{m_1 + m_2} g}$$

Reality checks:

dimensions ✓

$m_1 > m_2 \Rightarrow a_1 < 0$ ✓

$m_1 = m_2 \Rightarrow a_1 = 0$ ✓

⋮

(b) $T = m_1 (a_1 + g) = m_1 \left[\dfrac{m_2 - m_1}{m_1 + m_2} + 1 \right] g$

$= m_1 \dfrac{m_2 - m_1 + (m_1 + m_2)}{m_1 + m_2} g$

$$\boxed{T = \frac{2 m_1 m_2}{m_1 + m_2} g} = 1.04\,N = \text{scale reading}$$