

59. One arm of the balance has length ℓ_1 and the other has length ℓ_2 . The two cases described in the problem are expressed (in terms of torque equilibrium) as

$$m_1\ell_1 = m\ell_2 \quad \text{and} \quad m\ell_1 = m_2\ell_2 .$$

We divide equations and solve for the unknown mass: $m = \sqrt{m_1m_2}$.