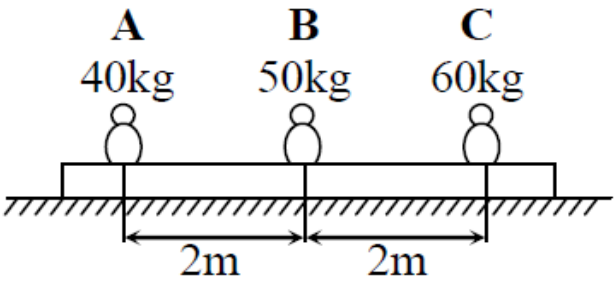
## Answer on Question #58744, Physics / Mechanics | Relativity |

Three men A, B & C of mass 40kg, 50kg & 60kg are standing on a plank of mass 90kg, which is kept on a smooth horizontal plane. B sits in the middle of the plane and A and C sit 2 metres away on opposite sides. If A & C exchange their positions then mass B will shift how many meters and in which direction?

**Solution:**




The physics of this problems is that the center of mass (CM) cannot move. All of the forces are "internal forces" so the CM of the system must remain in the same place. We can now write the position of the CM before the switch and after the exchange, and then set them equal.

The CM from the center of plank is

$$x_{cm} = \frac{m_A x_A + m_B x_B + m_C x_C}{m_A + m_B + m_C + M}$$

1)

$$x_{cm1} = \frac{40 \cdot (-2) + 50 \cdot 0 + 60 \cdot 2}{40 + 50 + 60 + 90} = \frac{1}{6}\ \text{m}$$

2)

$$x_{cm2} = \frac{60 \cdot (-2) + 50 \cdot 0 + 40 \cdot 2}{40 + 50 + 60 + 90} = -\frac{1}{6}\ \text{m}$$

Thus, mass B will shift $x_{cm1} - x_{cm2} = \frac{2}{6} = \frac{1}{3}$ m towards right.

**Answer:** 1/3m towards right.