Solution:
Case 1. The force $\vec{F}$ has so big magnitude that the carts A and B remain at the rest with respect to the cart C, *i.e.* they are moving with the same acceleration as the cart C is. Let $\vec{G}_1$, $\vec{T}_1$ and $\vec{T}_2$ denote forces acting on particular carts as shown in the Figure 2 and let us write the equations of motion for the carts A and B and also for whole mechanical system. Note that certain internal forces (viz. normal reactions) are not shown.

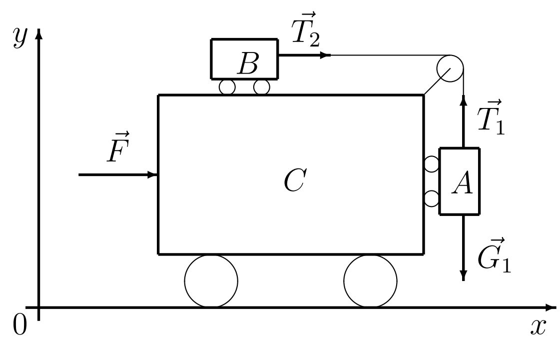

Figure 2:

The cart B is moving in the coordinate system Oxy with an acceleration a_x. The only force acting on the cart B is the force $\vec{T}_2$, thus

$$T_2 = m_2\, a_x\,. \tag{1}$$

Since $\vec{T}_1$ and $\vec{T}_2$ denote tensions in the same cord, their magnitudes satisfy

$$T_1 = T_2\,.$$

The forces $\vec{T}_1$ and $\vec{G}_1$ act on the cart A in the direction of the y-axis. Since, according to condition 1, the carts A and B are at rest with respect to the cart C, the acceleration in the direction of the y-axis equals to zero, $a_y = 0$, which yields

$$T_1 - m_1\, g = 0\,.$$

Consequently

$$T_2 = m_1\, g\,. \tag{2}$$

So the motion of the whole mechanical system is described by the equation

$$F = (m_1 + m_2 + m_3)\, a_x\,, \tag{3}$$

because forces between the carts A and C and also between the carts B and C are internal forces with respect to the system of all three bodies. Let us remark here that also the tension $\vec{T_2}$ is the internal force with respect to the system of all bodies, as can be easily seen from the analysis of forces acting on the pulley. From equations (1) and (2) we obtain

$$a_x = \frac{m_1}{m_2} g\,.$$

Substituting the last result to (3) we arrive at

$$F = (m_1 + m_2 + m_3)\,\frac{m_1}{m_2} g\,.$$

Numerical solution:

$$\begin{aligned} T_2 = T_1 &= 0.3 \cdot 9.81\ \mathrm{N} = 2.94\ \mathrm{N}\,, \\ F &= 2 \cdot \frac{3}{2} \cdot 9.81\ \mathrm{N} = 29.4\ \mathrm{N}\,. \end{aligned}$$

Case 2. If the cart C is immovable then the cart A moves with an acceleration a_y and the cart B with an acceleration a_x. Since the cord is inextensible (*i.e.* it cannot lengthen), the equality

$$a_x = -a_y = a$$

holds true. Then the equations of motion for the carts A, respectively B, can be written in following form

$$T_1 = G_1 - m_1\, a\,, \tag{4}$$

$$T_2 = m_2\, a\,. \tag{5}$$

The magnitudes of the tensions in the cord again satisfy

$$T_1 = T_2\,. \tag{6}$$

The equalities (4), (5) and (6) immediately yield

$$(m_1 + m_2)\, a = m_1\, g\,.$$

Using the last result we can calculate

$$a = a_x = -a_y = \frac{m_1}{m_1 + m_2}\, g\,,$$
$$T_2 = T_1 = \frac{m_2 m_1}{m_1 + m_2}\, g\,.$$

Numerical results:

$$a = a_x = \frac{3}{5} \cdot 9.81 \text{ m s}^{-2} = 5.89 \text{ m s}^{-2}\,,$$
$$T_1 = T_2 = 1.18 \text{ N}\,.$$