



$$T - f = m_1 a_1$$

Sum of forces
in x-dir on
cart



$$T - m_2 g = -m_2 a$$

Sum of forces
in y-dir on
weight

If $f = 0$

$$T = m_1 a$$

$$\rightarrow m_1 a - m_2 g = -m_2 a$$

$$a(m_1 + m_2) = m_2 g$$

$$a = \left(\frac{m_2}{m_1 + m_2} \right) g$$

If $f > 0$

What if there is non-zero friction force?

$$T = m_1 a + f$$

Sum of forces
in x-dir on cart

$$\rightarrow m_1 a + f - m_2 g = -m_2 a$$

Substitute

$$(m_1 + m_2) a = m_2 g - f$$

$$a = \frac{m_2 g - f}{(m_1 + m_2)}$$

So, if friction is present, to find friction force f ,

- 1) compute acceleration, using graph
- 2) calculate

$$a(m_1 + m_2) - m_2 g = -f$$

or

$$f = m_2 g - (m_1 + m_2) a$$