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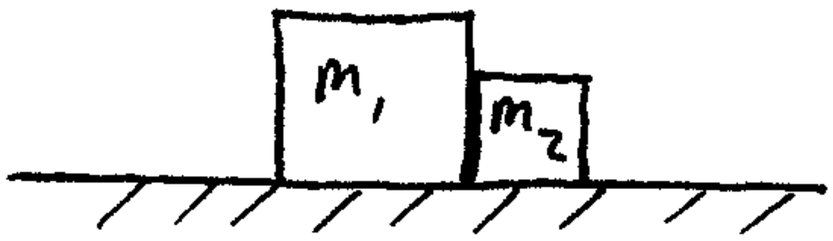
This is a force and motion problem involving Newton's laws.



Suppose a force of 10.5 N is acting on the mass m_1, towards the right, and then this same force acts on mass m_2, towards the left. Assume both masses are on a frictionless surface, with $m_1 = 3$ kg and $m_2 = 1.2$ kg. For each situation, what is the contact force between the two masses?

Solution:

Case 1: $F = 10.5$ N

Both masses move together as a single unit. Therefore, from Newton's 2nd law:

$$F = (m_1 + m_2)\,a$$

$$a = \frac{F}{m_1 + m_2} = \frac{10.5\ N}{(3+1.2)\ kg} = 2.5\ m/s^2 \rightarrow$$

The force acting on mass m_2 can also be calculated with Newton's 2nd law:

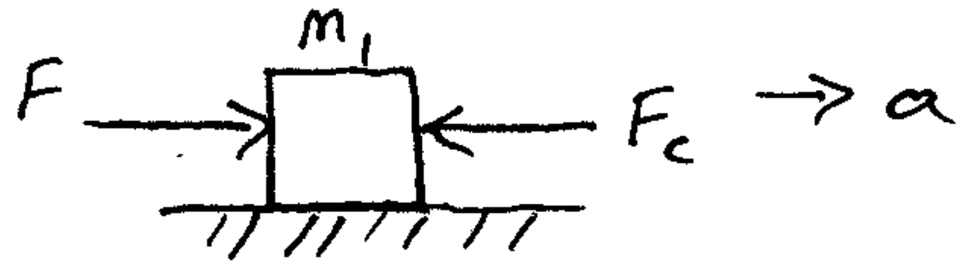
$F_c = m_2 a = (1.2)(2.5) = 3\ N \rightarrow$ (answer for Case 1)

F_c ~ contact force acting on m_2

This force is also acting on m_1, but in the opposite direction (Newton's 3rd law)

As a check (not necessary to do, however):

Apply Newton's 2nd law to mass m_1:



$F - F_c = m_1 a$

$\Rightarrow 10.5 - 3 = 3a$

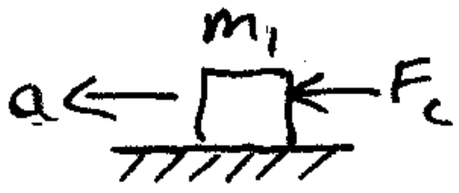
$a = 2.5\ m/s^2$ (same result as before) - as it should be.

Next, apply the 10.5 N force to mass m_2:

Apply Newton's 2nd law:

$F = (m_1 + m_2) a \Rightarrow a = 2.5\ m/s^2 \leftarrow$

As before, $F_c = m_1 a = (3)(2.5) = 7.5\ N \leftarrow$ (answer for Case 2)



F_c ~ contact force acting on m_1

The contact force acting on m_2 is $7.5\ N \rightarrow$