March 1, Week 7

Today: Chapter 5, Circular Dynamics

Homework Assignment #5 - Due Today.

Mastering Physics: 10 problems from chapters 4 and 5.

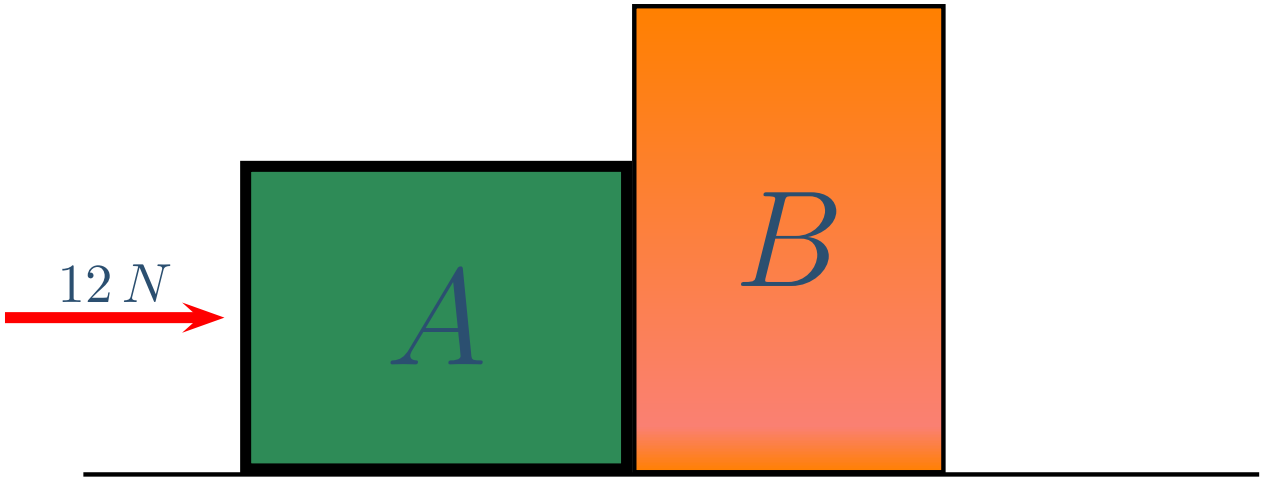
Written Questions: 5.74

Exam #2, Next Friday, March 8

Practice Exam on Website

Contact Exercise I

A $5\,kg$ mass A is placed in front of a $7\,kg$ mass B on a frictionless table. If a $12\,N$ force is applied to mass A, what is the acceleration of the masses?



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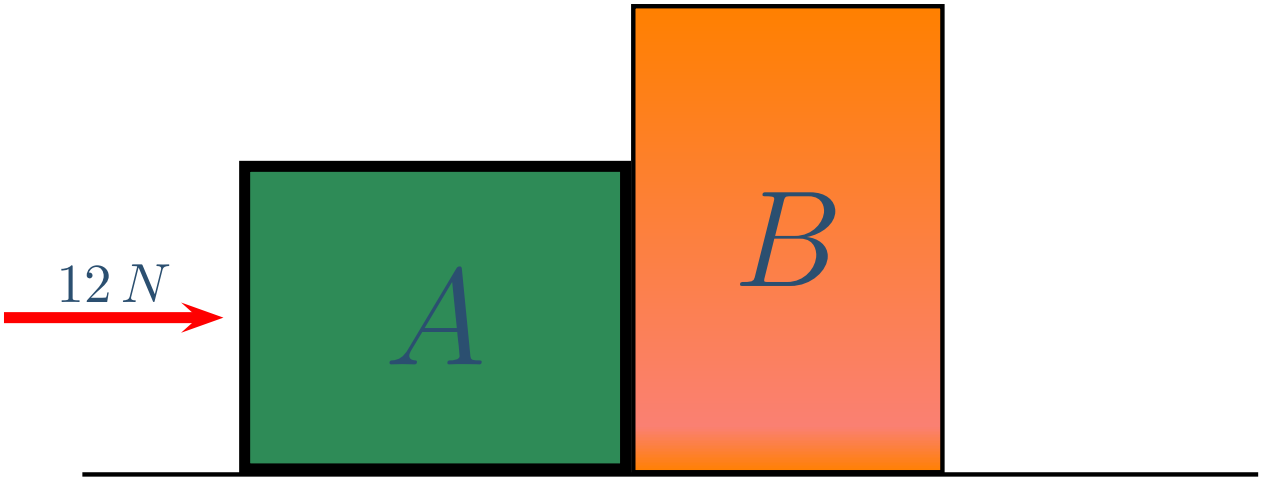

(a) $\dfrac{12\,N}{5\,kg} = 2.4\,m/s^2$

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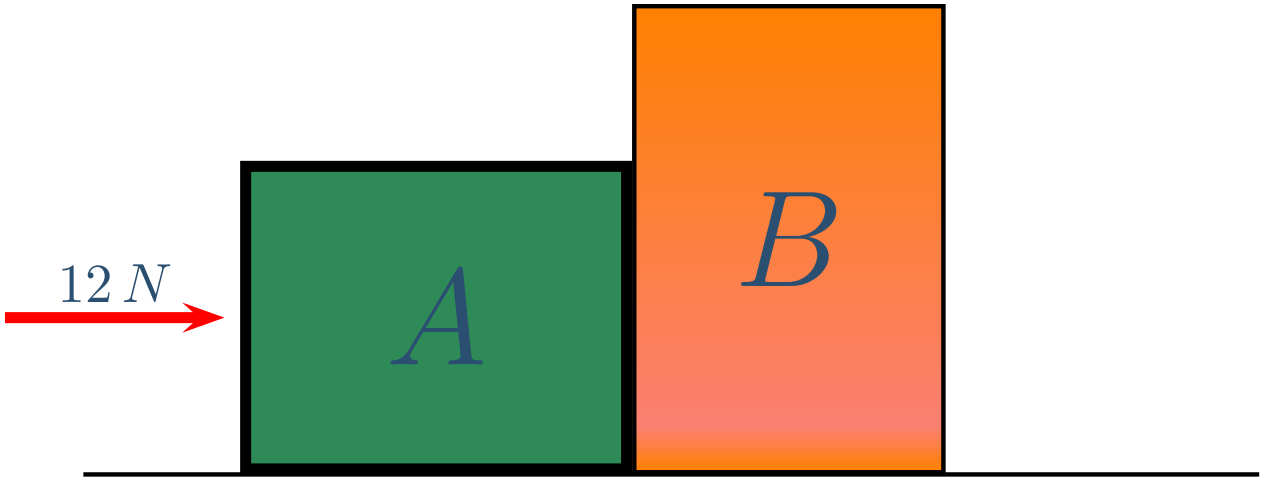

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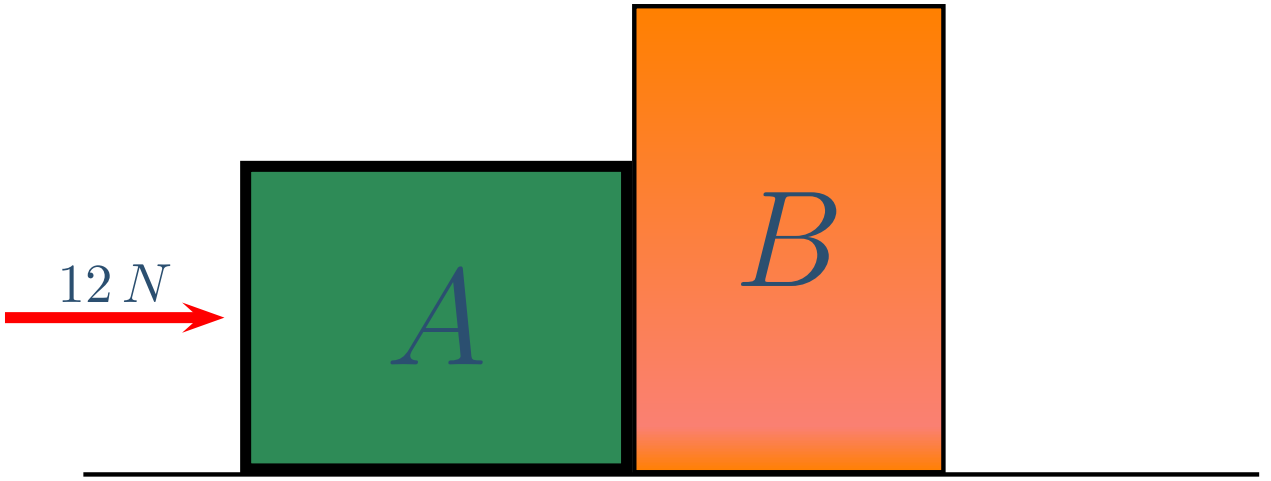

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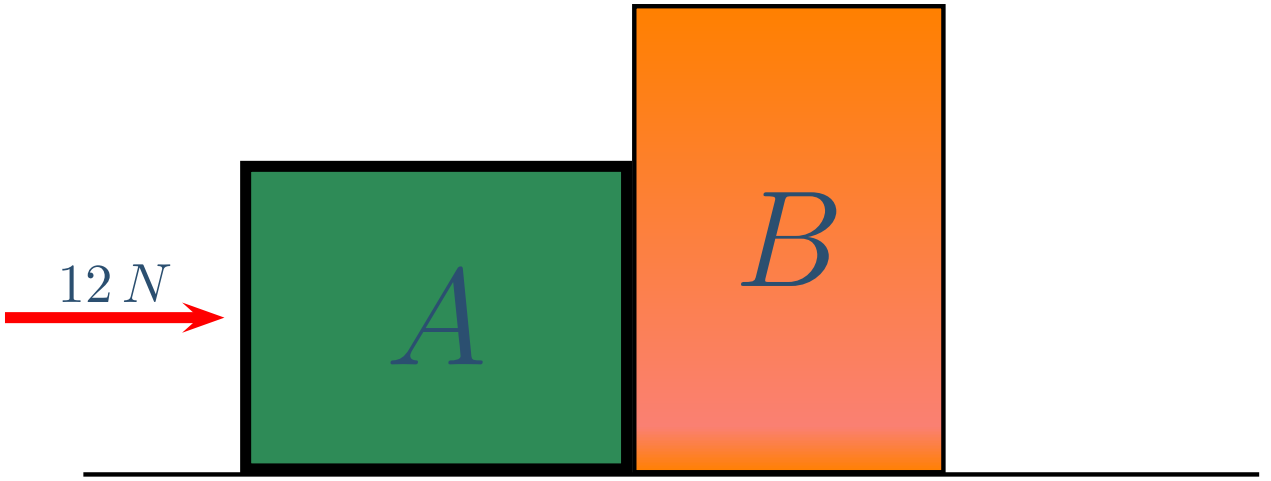

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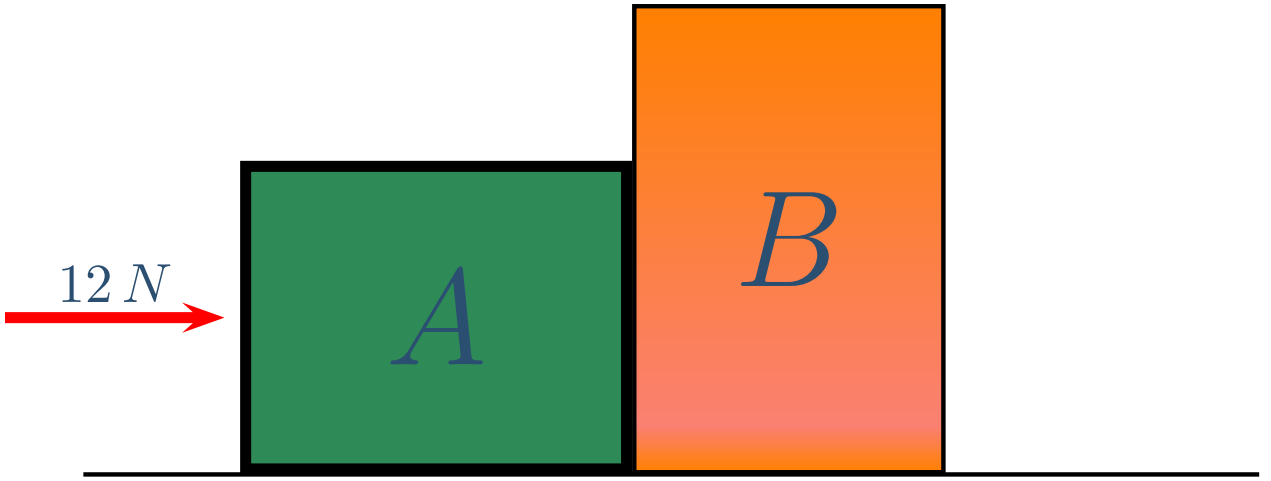

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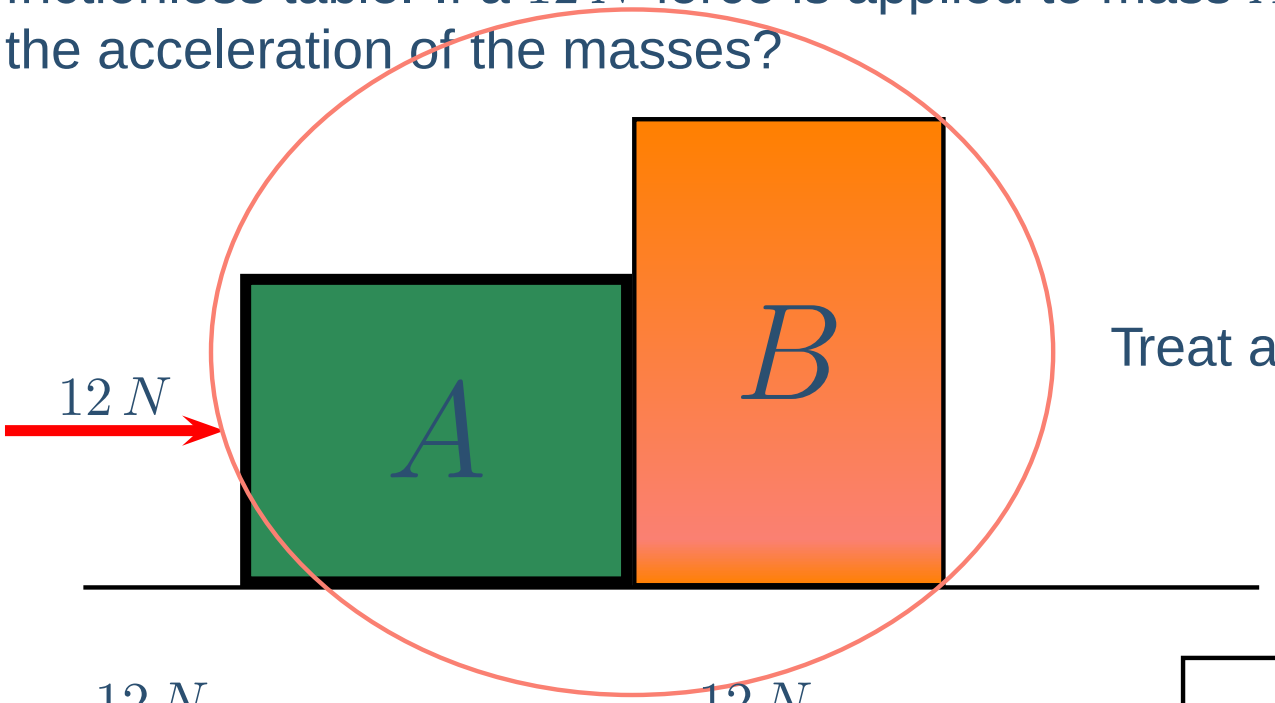

Treat as single object

(a) $\frac{12\,N}{5\,kg} = 2.4\,m/s^2$

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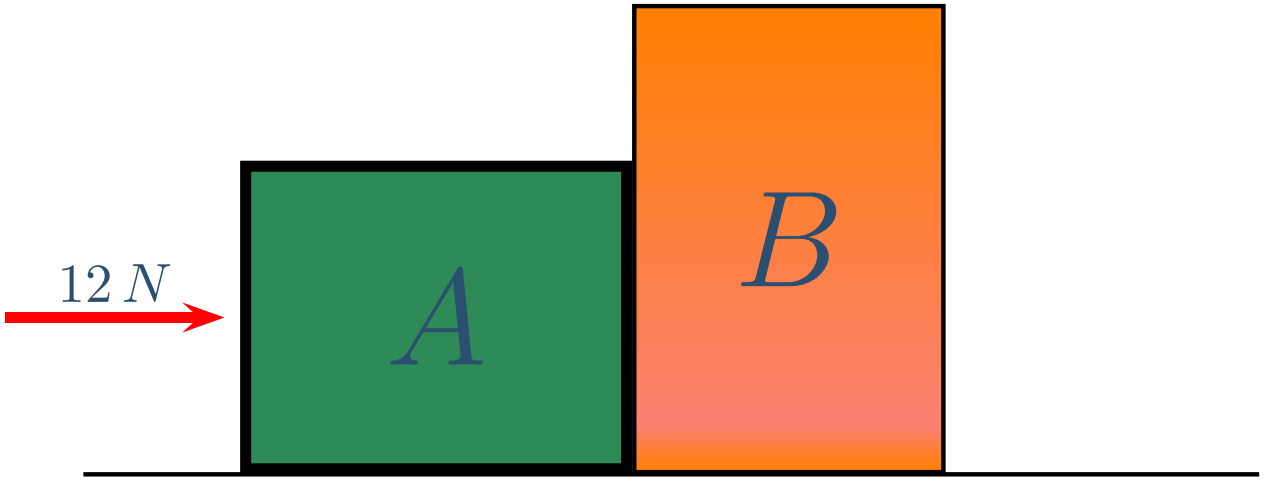

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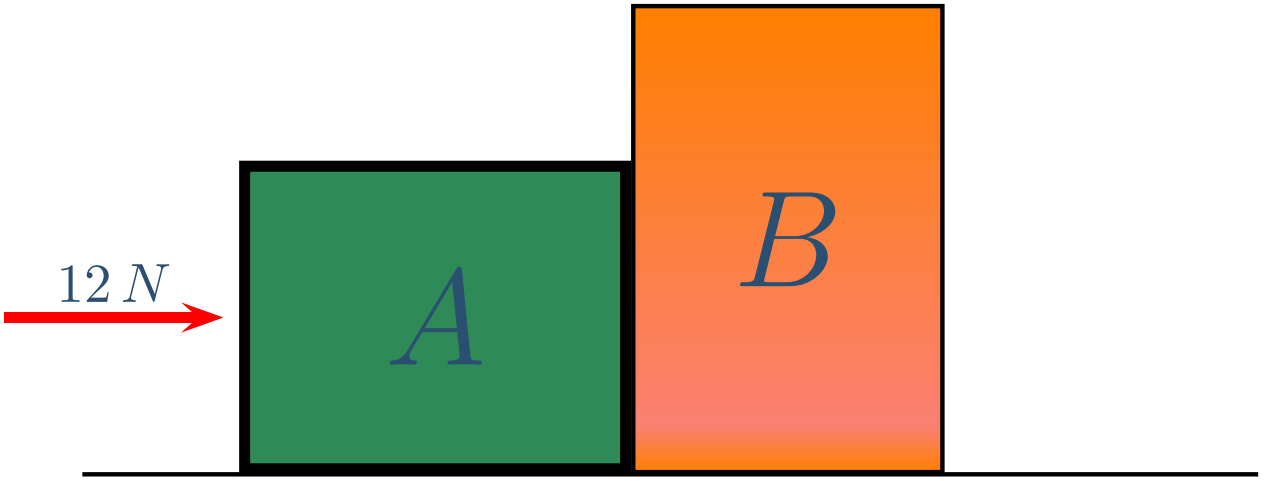

(a) $19\,N$

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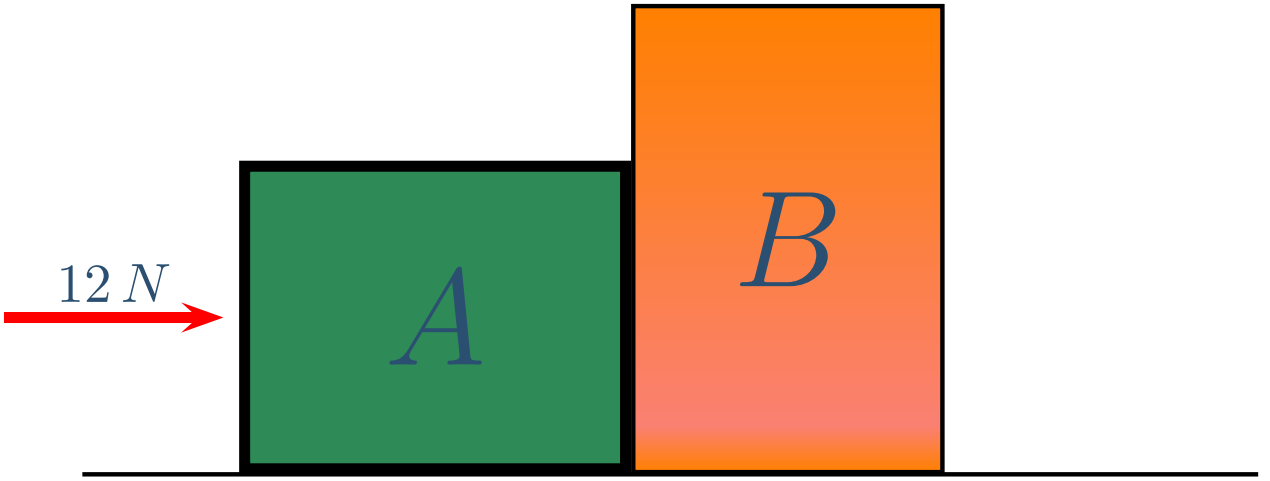

(a) $19\,N$ (b) $17\,N$

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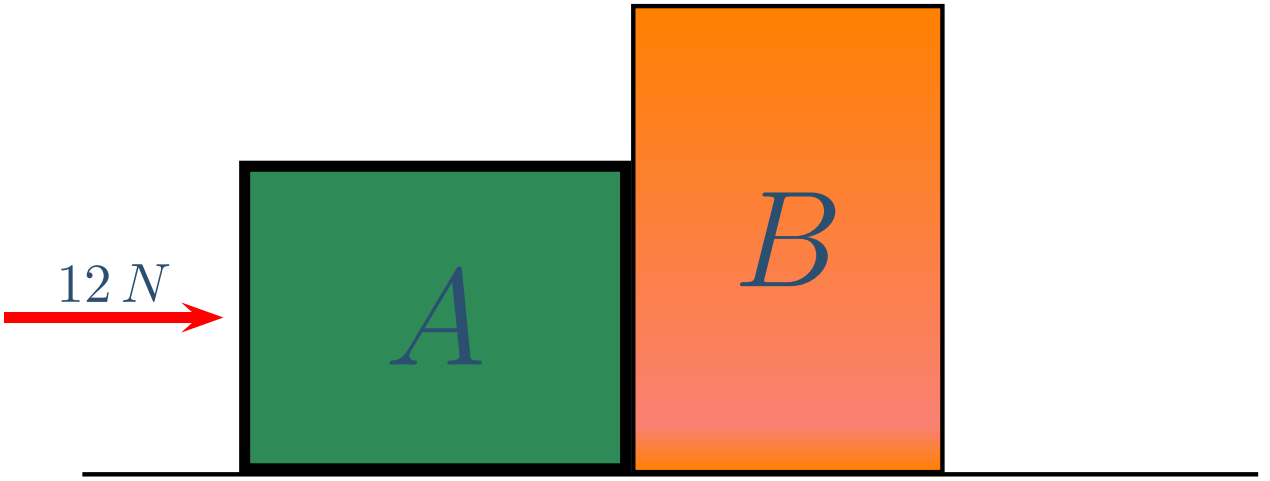

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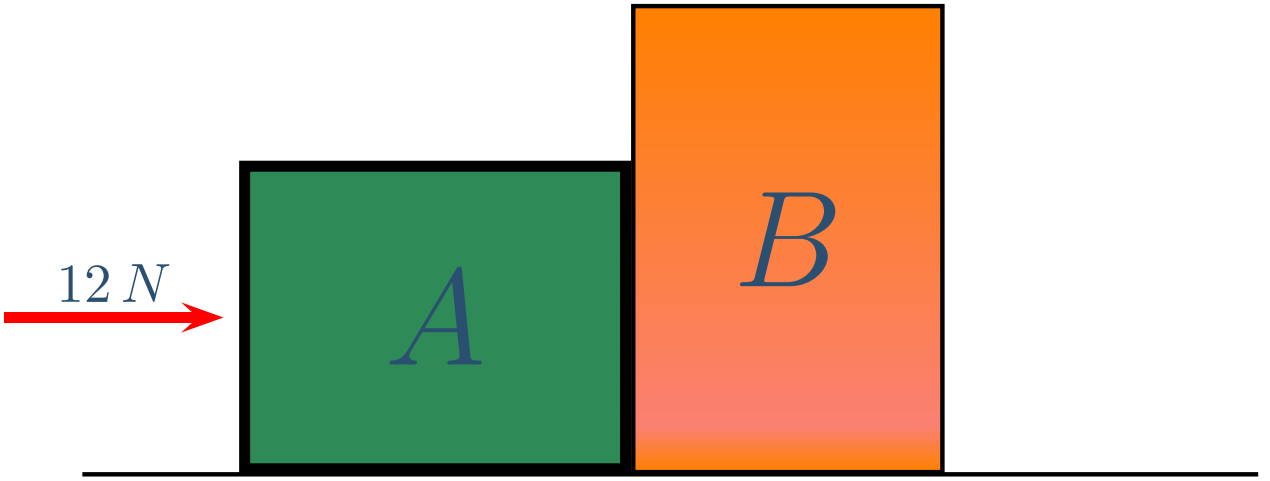

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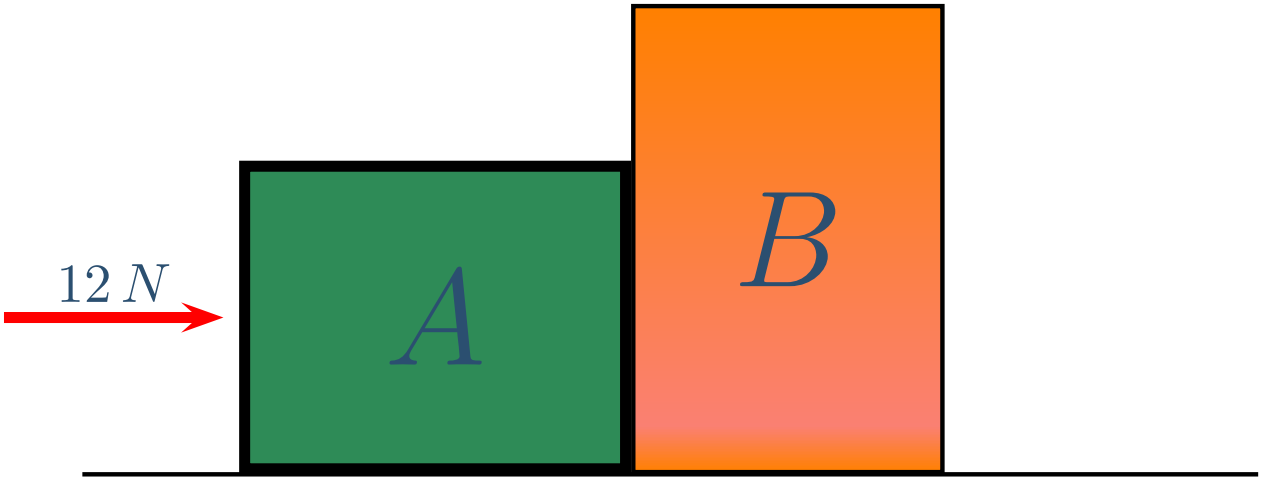

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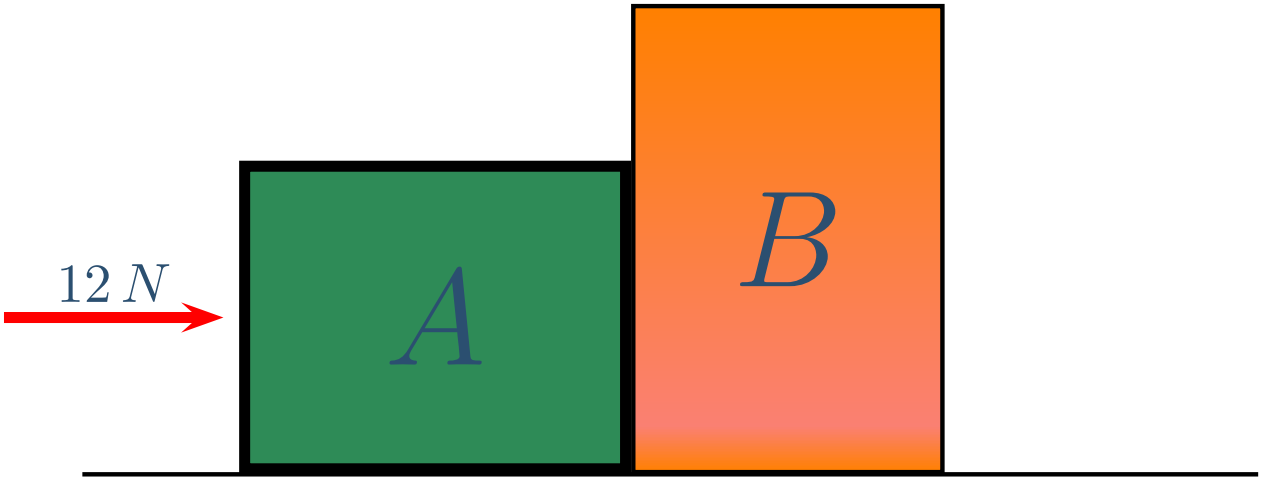

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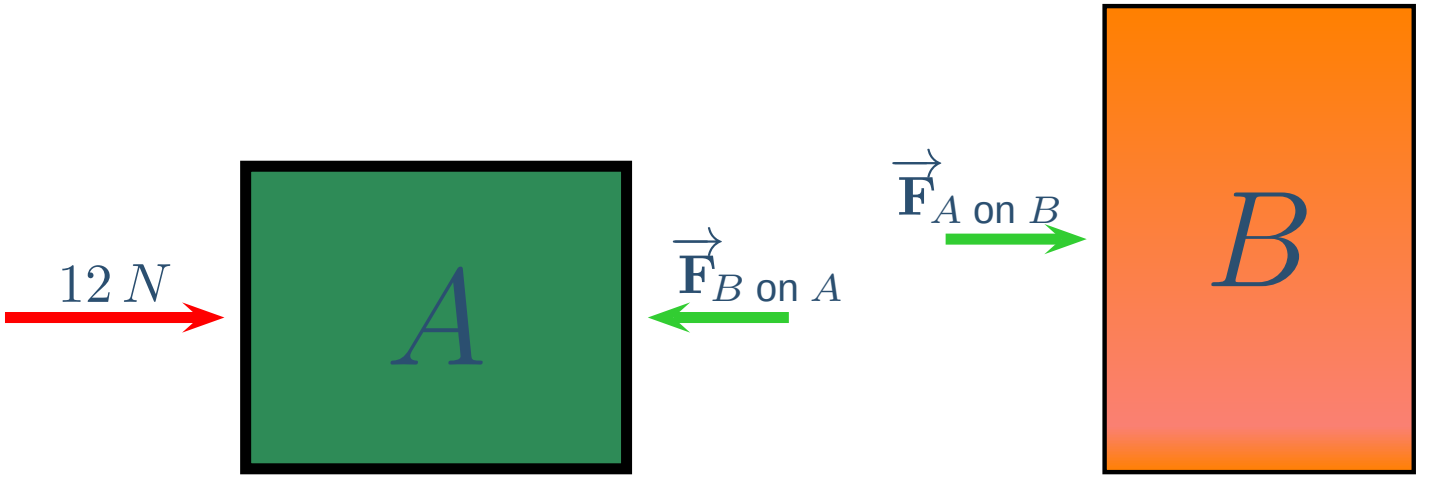
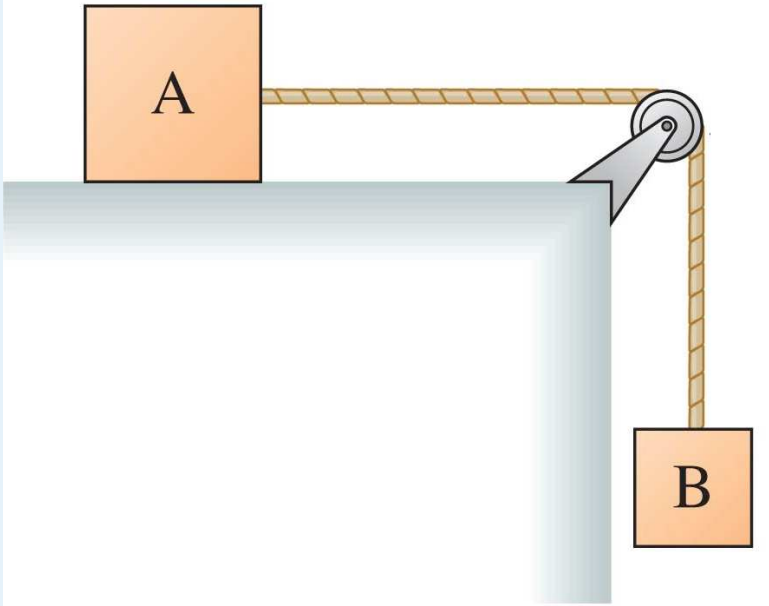


$$\sum F_{Bx} = M_B a_{Bx} \Rightarrow F_{A \text{ on } B} = (7\,kg)(1\,m/s^2)$$

(d) $7\,N$

Pulley and Ropes Exercise

A $M_A = 3\,kg$ block is placed on a frictionless table. It is connected, by a massless rope and over a perfect pulley, to another block $M_B = 2\,kg$. When released, both masses accelerate. Which of the following are the correct accelerations?



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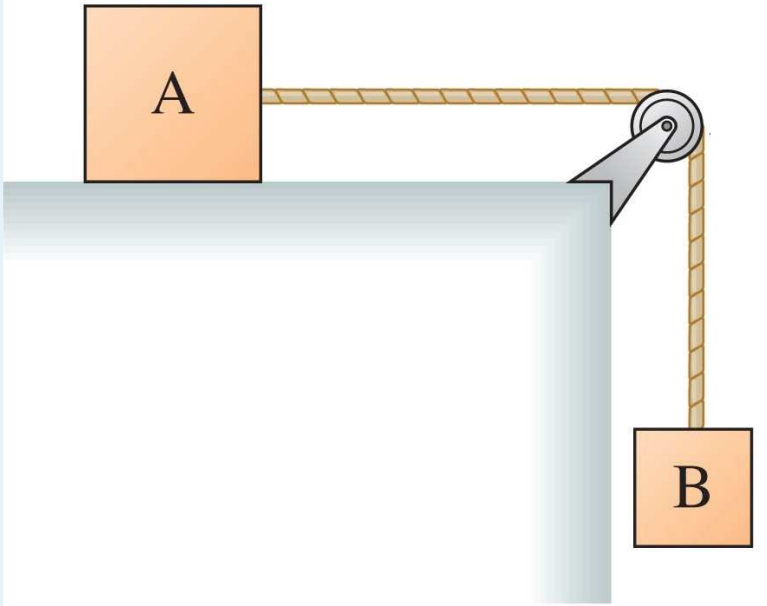

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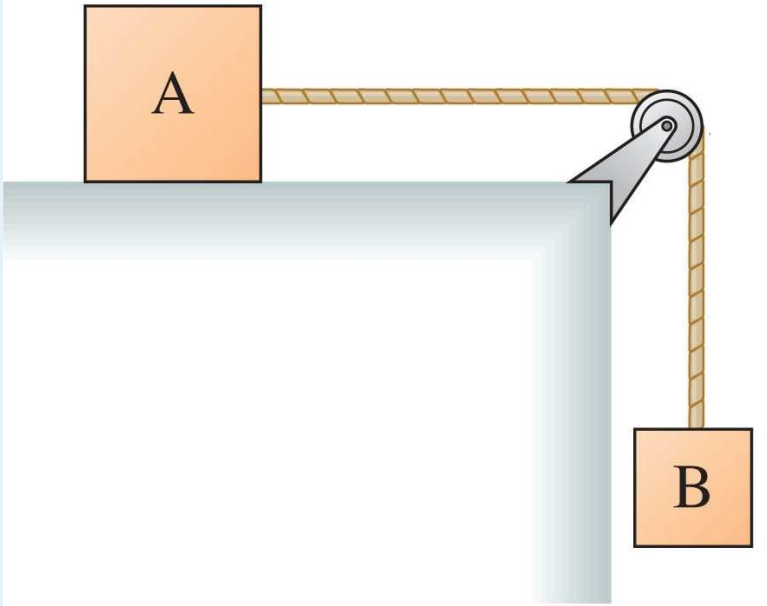

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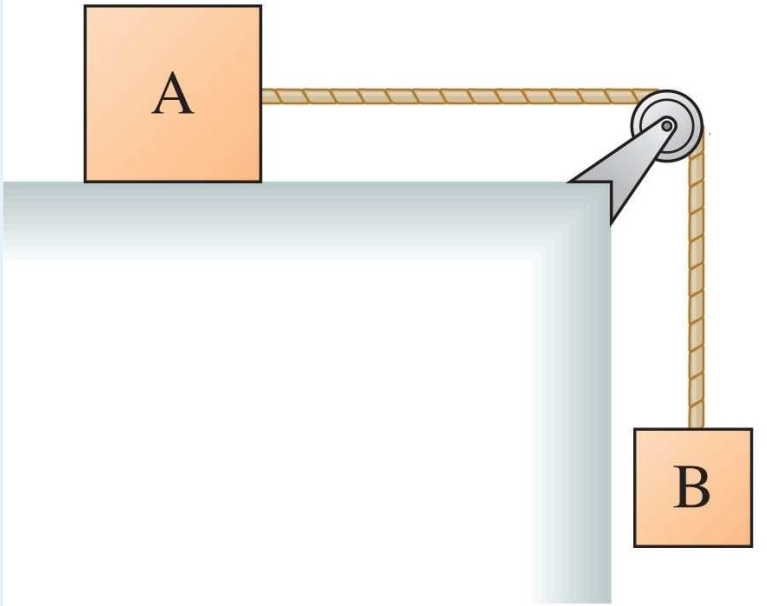

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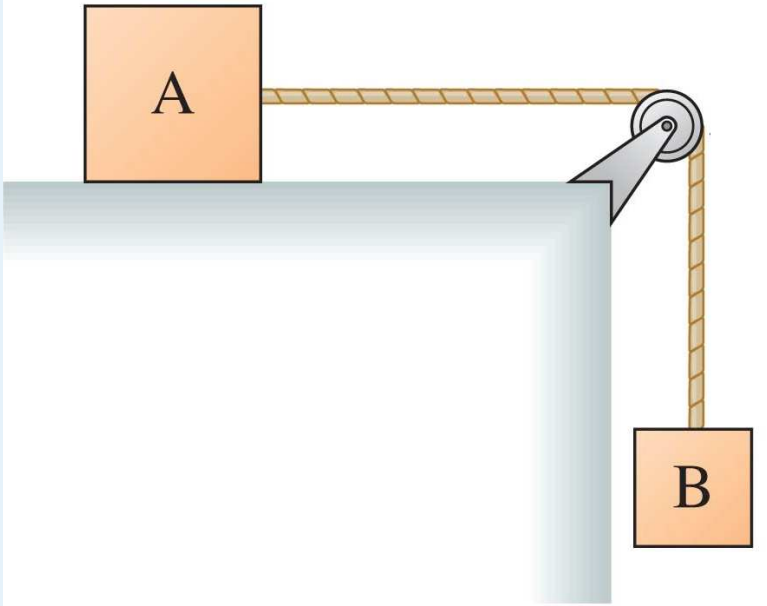

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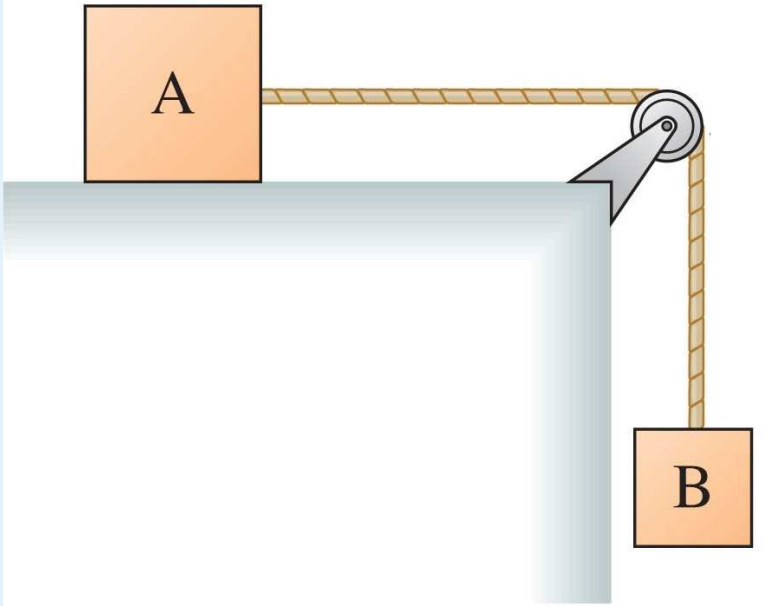

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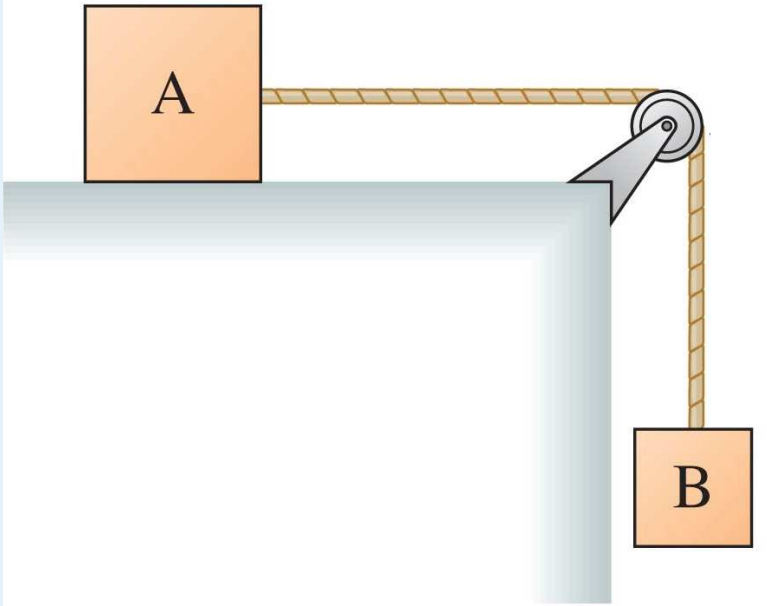

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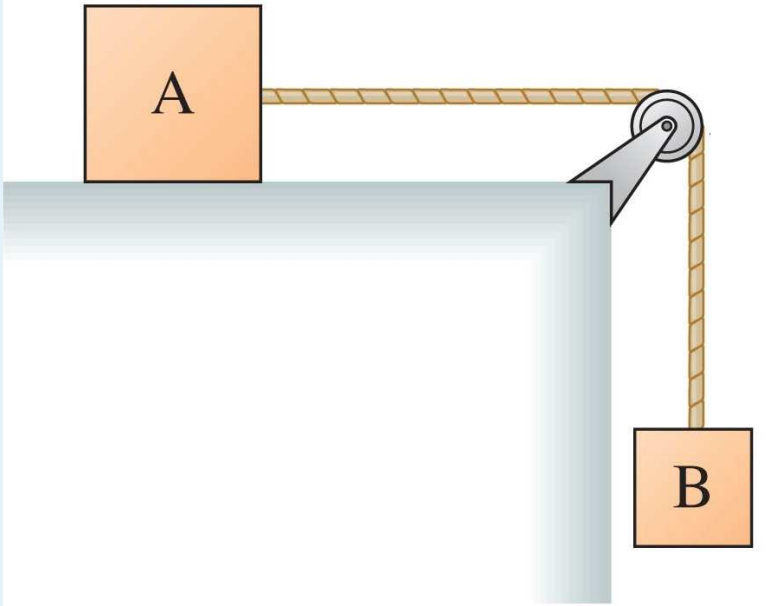
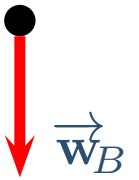


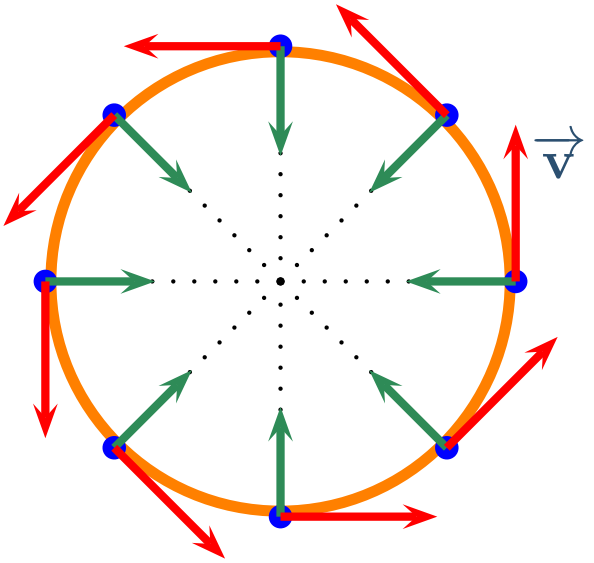
When treated as a single $5\,kg$ object, the only force is the weight of B



$$\sum F_y = Ma_y \Rightarrow$$
$$M_B g = (M_A + M_B)a_y$$
$$a_y = \left(\frac{M_B}{M_A + M_B}\right) g = \frac{2}{5}g$$

Centripetal Acceleration

The inwards acceleration needed to go around a circle is given a special name and has its own equation



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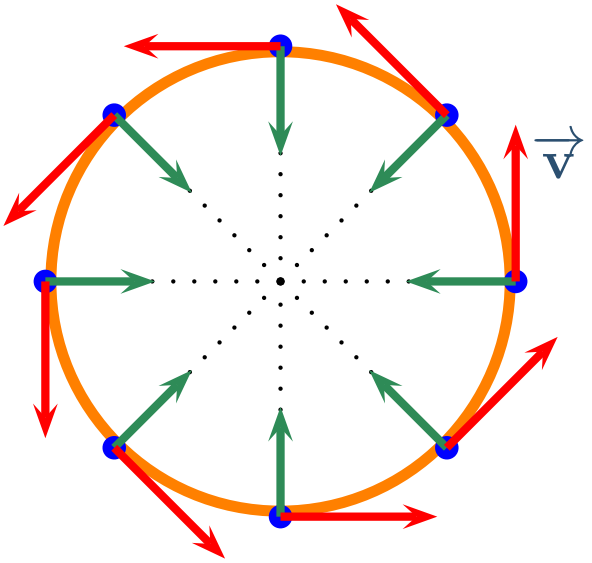

Centripetal Acceleration, a_{rad} - inwards acceleration necessary for circular motion

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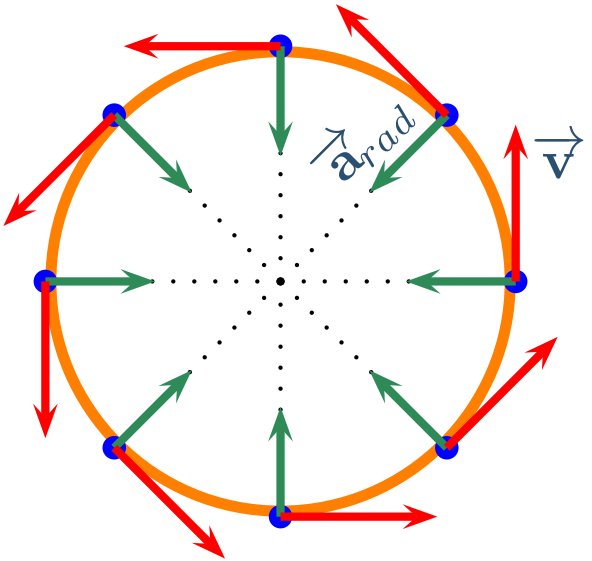

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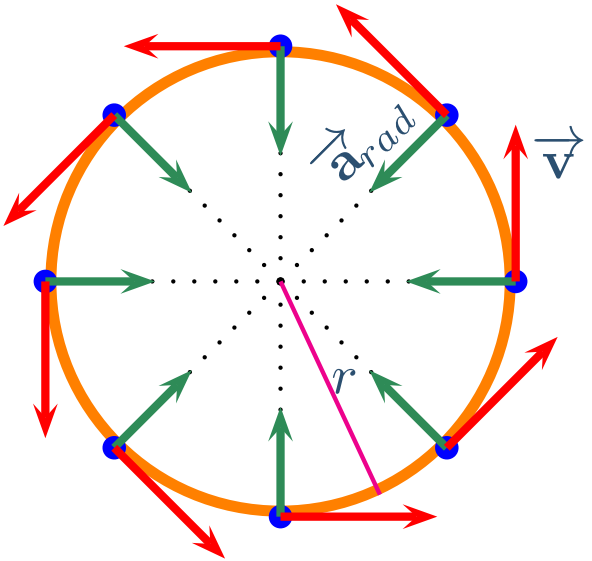

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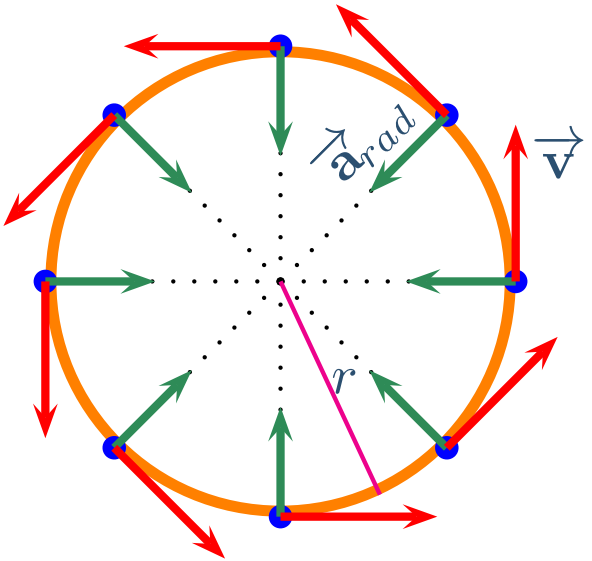

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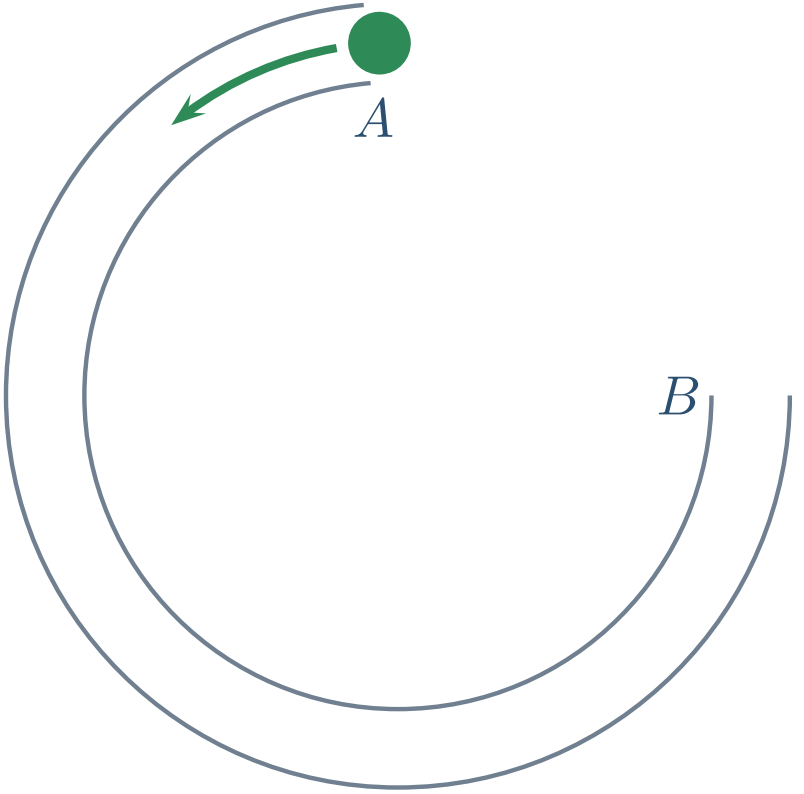
The centripetal acceleration like any other is **NOT** put on free-body diagrams. It is created by other forces like weight, tension, normal, *etc.*

Centripetal Acceleration Exercise

The figure shows a *top view* of a plastic tube that is fixed on a horizontal table top. A marble is shot into the tube at A. Which of the following is the correct trajectory for the marble after it leaves the tube at B?



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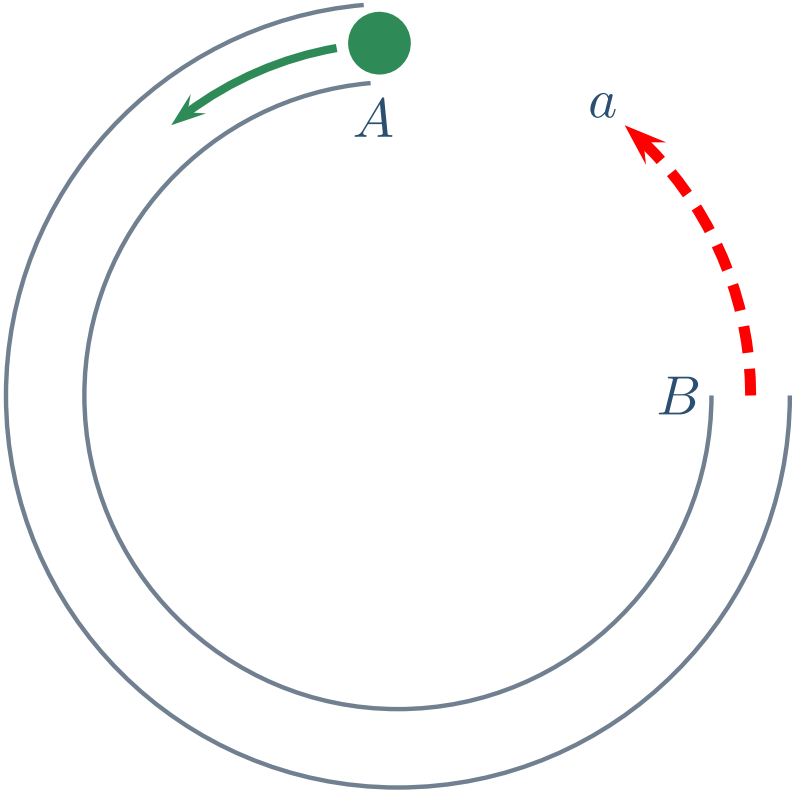

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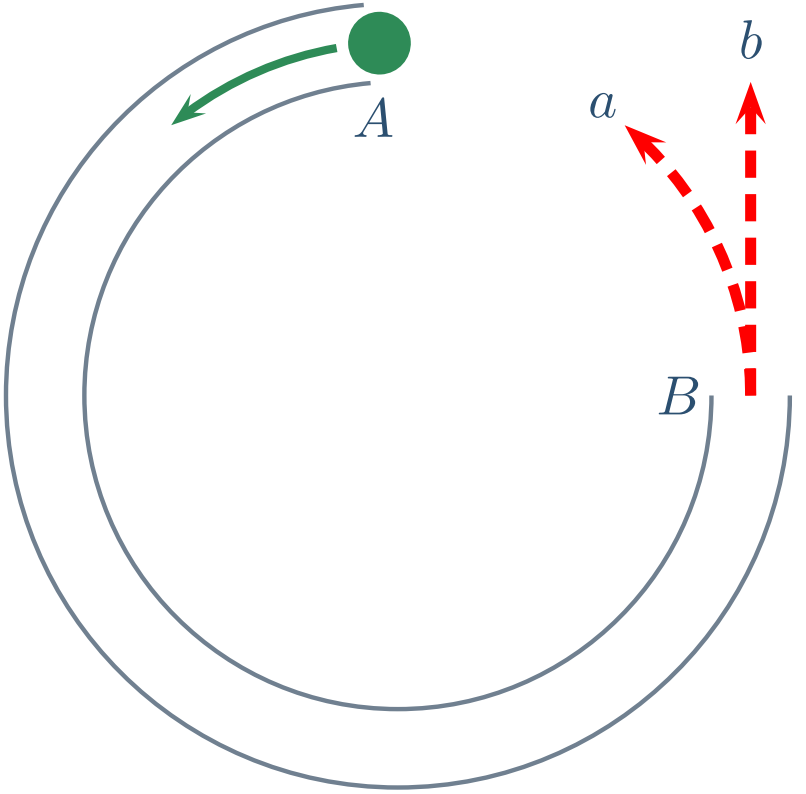

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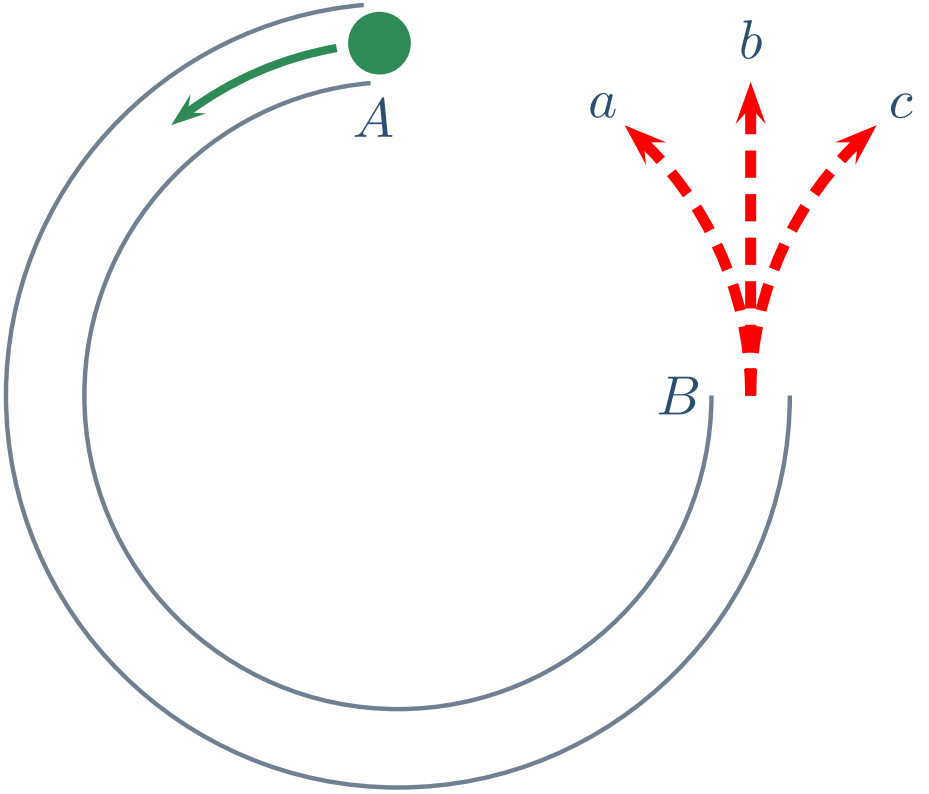

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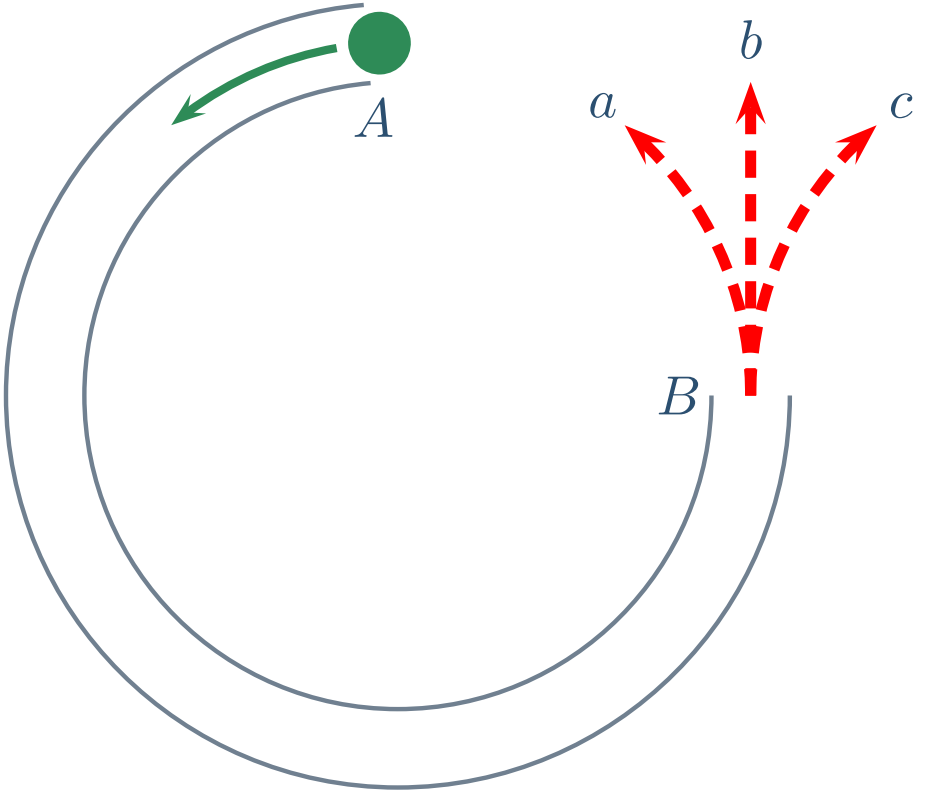

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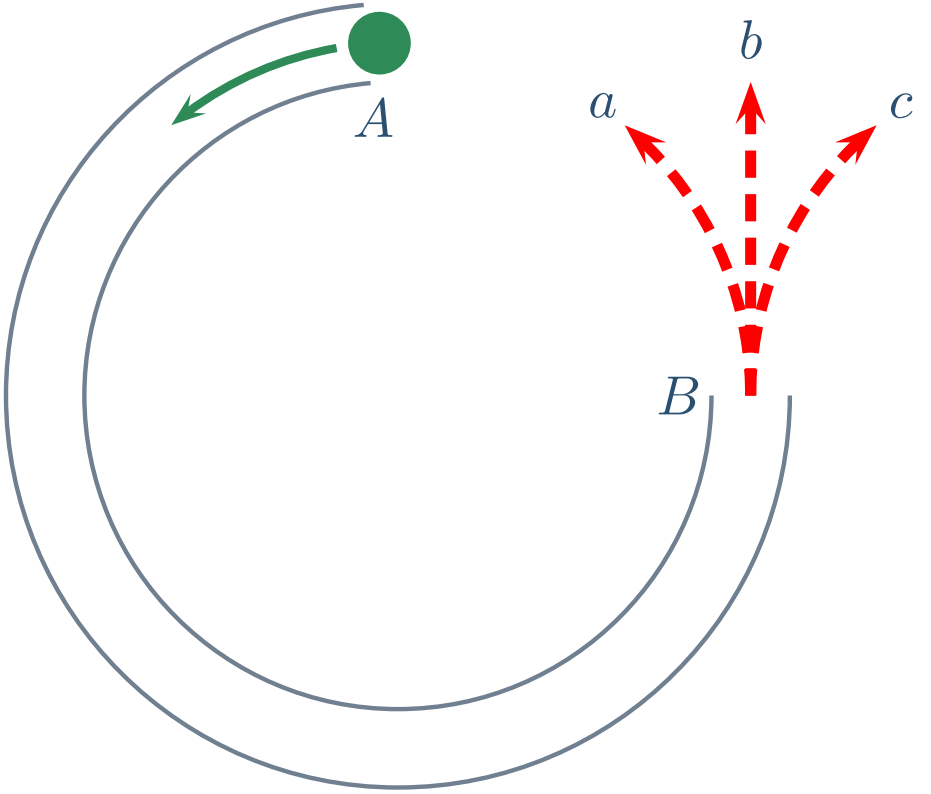

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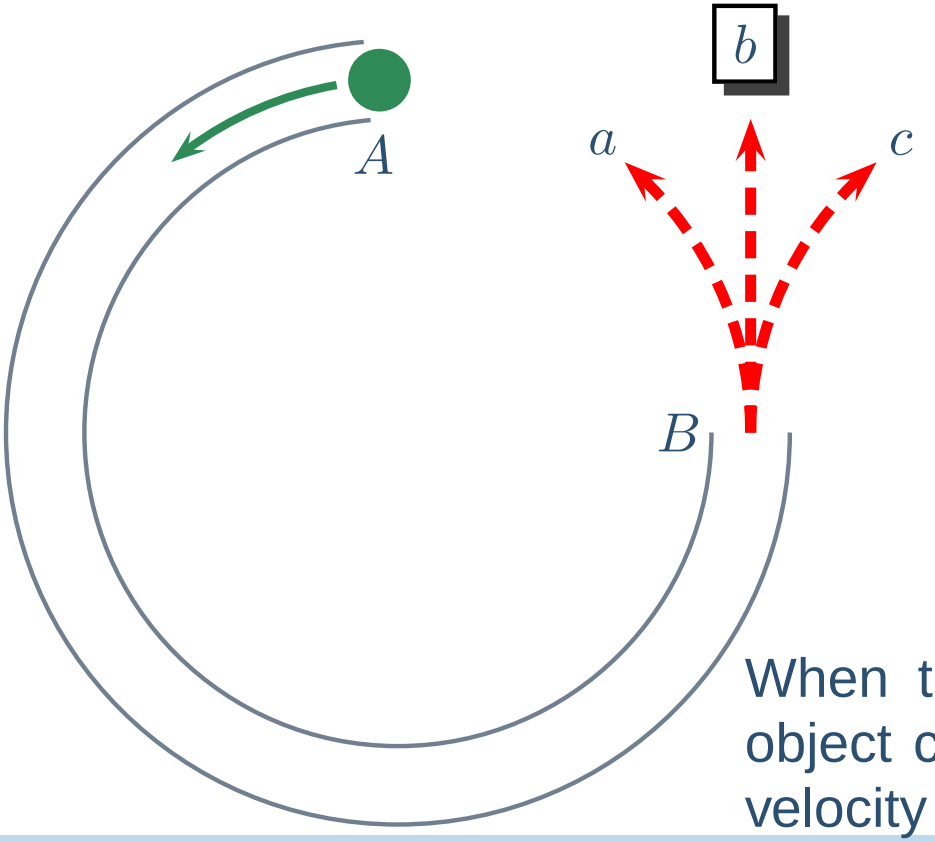
(e) None of these are possible.

Centripetal Acceleration Exercise

The figure shows a *top view* of a plastic tube that is fixed on a horizontal table top. A marble is shot into the tube at A. Which of the following is the correct trajectory for the marble after it leaves the tube at B?



(d) Any of these are possible.

(e) None of these are possible.

When the centripetal force ends, an object continues in the direction of its velocity

Example

Example: An $50\,kg$ man rides a skateboard on a flat road with a constant speed of $15\,m/s$, what is his apparent weight?

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- The man rides into a $100-m$ radius half-pipe. If he maintains a constant $15\,m/s$ speed, what is his apparent weight at the bottom of the half-pipe?