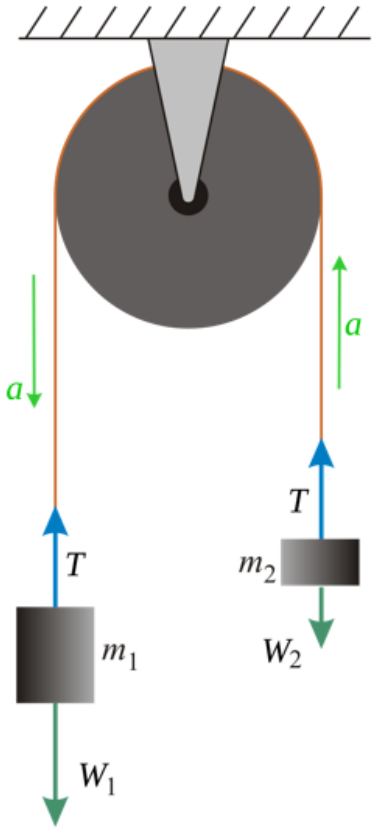
SQUARECAP

Last time we were discussing this system and found some equations…

Let's say $m_1 = 10kg$ and $m_2 = 5kg$. What's the acceleration of the masses and what's the tension in the string connecting them?



$$T - m_1 g = m_1(-a)$$
$$T - m_2 g = m_2 a$$

How could we use these to find a and T?

SQUARECAP

Concept Check

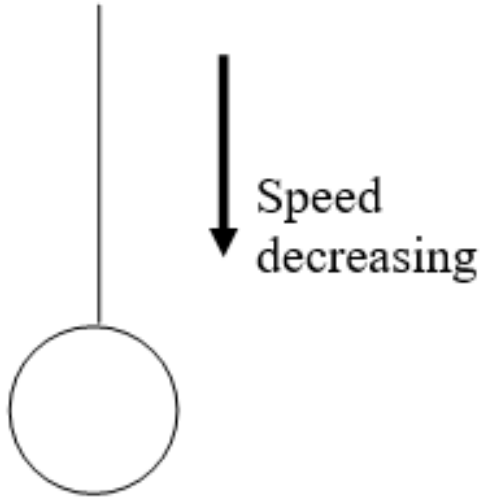
An object is being lowered on a cord at a speed, which is decreasing. There are two forces on the object, the weight, magnitude mg, and the tension, magnitude T, in the cord.

Which equation is true:

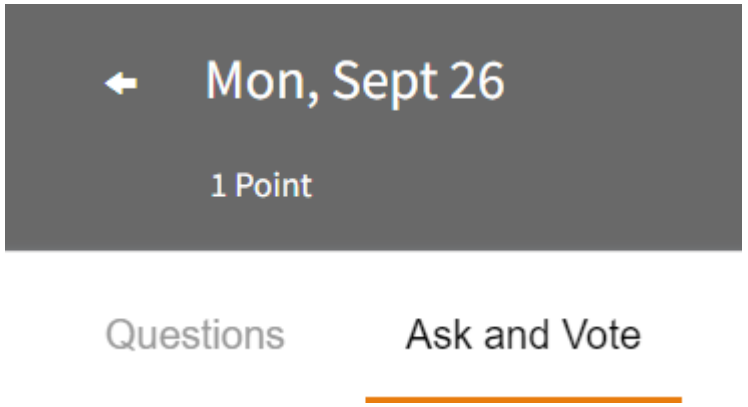
A: $T = mg$

B: $T > mg$

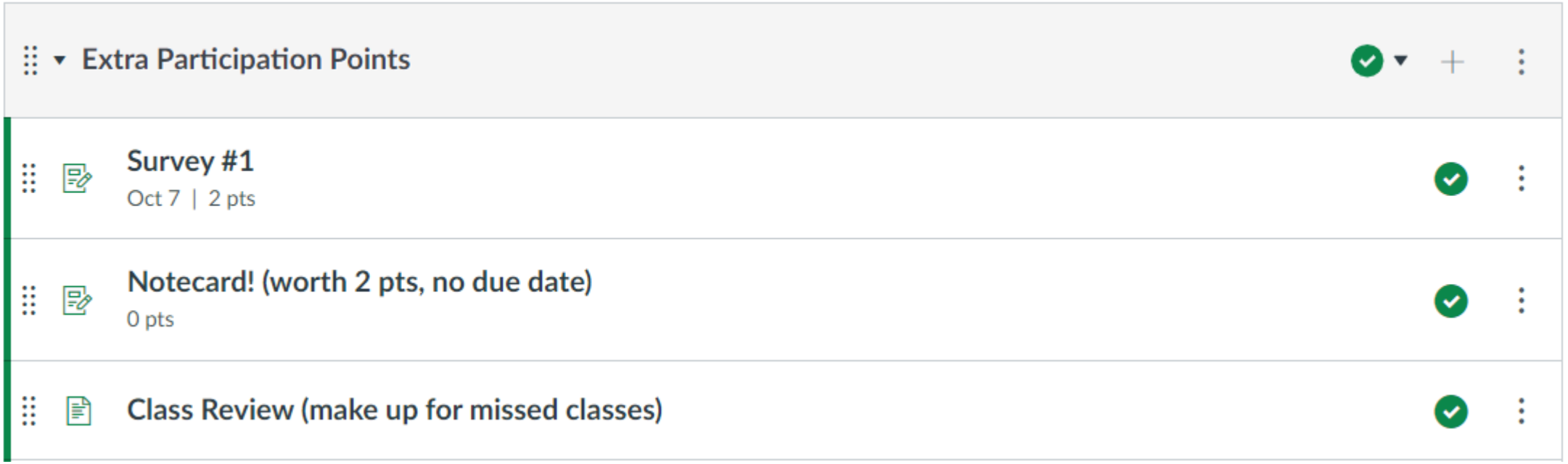
C: $T < mg$



Note: Ask and Vote



Participation Points: Survey #1 (Remember – 20% of grade!)



Recap: Non-Inertial Frames

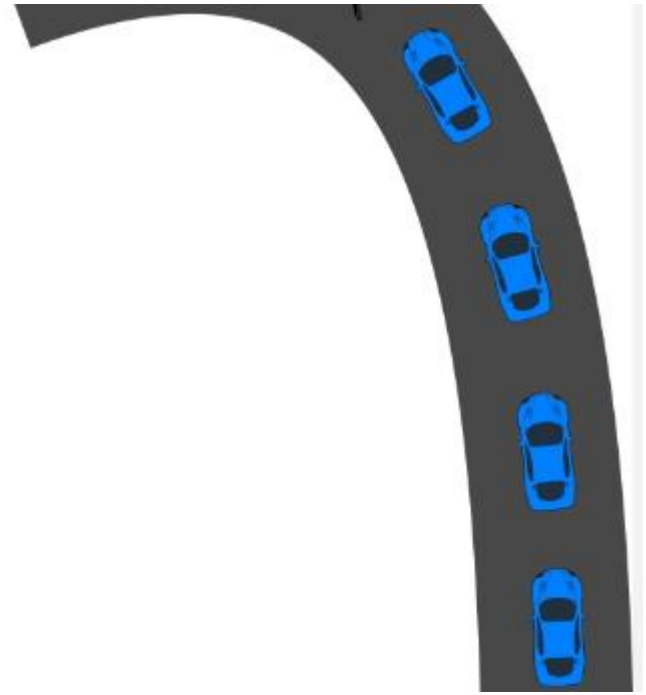
A **fictitious force** is a force that appears to act on a mass whose motion is described using a non-inertial frame of reference, such as a linearly accelerating or rotating reference frame.[1] Fictitious forces are invoked to maintain the validity and thus use of Newton's second law of motion, in frames of reference which are *not* inertial.[2]

$$F = ma = m\underbrace{(a - a_{rf})}_{a'} + ma_{rf}$$

$$F - ma_{rf} = ma'$$

$$F + F_{fict} = ma'$$

Example: $a_{cp} = \frac{v^2}{r}$ inwards → F_{cf} outwards



How do we spot fictitious forces?
Do we know of any more?

Prelecture Review: Action and Reaction

"To every action, there is always opposed an equal reaction; or, the mutual actions of two bodies upon each other are always equal, and directed to contrary parts"

$$\vec{F}_{12} = -\vec{F}_{21}$$

The third law is very powerful, but it is often not understood and is associated with misconceptions. Consider the following: a small car collides head on with a large semi truck. Which vehicle experiences a larger force? What does Newton's third law say about this?

What are our questions and/or comments?

Comments and Questions

- Just out of curiosity: How does air resistance and friction apply, or even effects, Newton's Third Law?
- How can Newton's 3rd law be applied to space?
- I understand that every object has a force pair, so how come that acceleration exists if all forces should theoretically cancel out with each other?

My Comments and Questions

- Comment: Generality in physics/philosophical significance

SQUARECAP

Concept Check

What is the “equal and opposite” force to the gravitational force of the Earth acting on a person?

A) The contact (normal) force of the ground on the person, keeping them from traveling towards the center of the Earth.
B) The gravitational force, exerted by the person on the Earth.
C) Since the person is not moving, there is no reaction force in this situation.
D) The mutual gravitational interaction between the Earth and the person.

Complete(?): The Laws of Motion

Net external force $\vec{F}_{net} = \sum \vec{F} = \vec{F}_1 + \vec{F}_2 + \cdots$

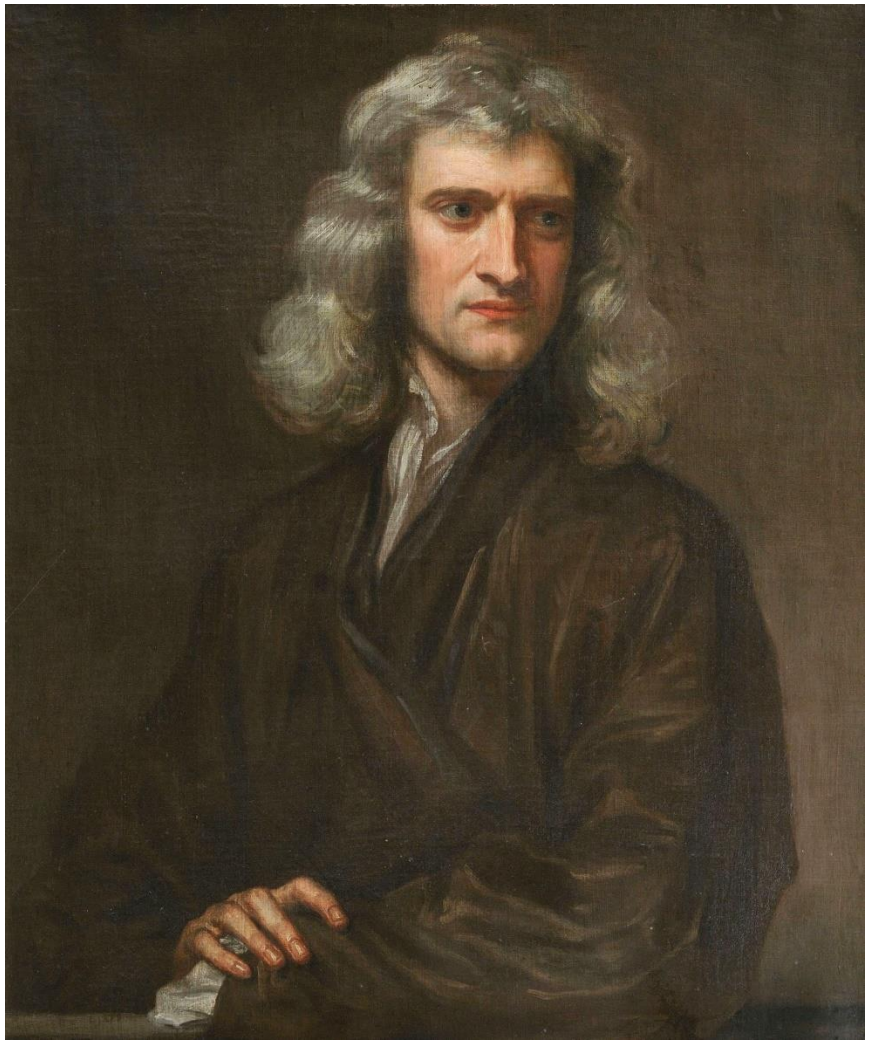
Newton's first law $\vec{v} = \text{constant when } \vec{F}_{net} = \vec{0}\ \text{N}$

Newton's second law, vector form $\vec{F}_{net} = \sum \vec{F} = m\vec{a}$

Definition of weight, vector form $\vec{w} = m\vec{g}$

Newton's third law $\vec{F}_{AB} = -\vec{F}_{BA}$

We'll see…



Example: