A box is attached to string that is strung around a pulley on the end of a ramp and attached to a hanging mass. If the ramp is level, is friction required to keep the box from sliding?

1. Yes
2. No
3. Depends
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Four students are studying the following situation where a rolling cart is attached via a rope around a massless, frictionless pulley to a hanging mass. There is no friction present. Which student do you agree most with regarding the tension in the rope.

1. “I think tension is equal to the weight of the hanging mass. I mean it has to hold it up.”

2. “Yeah but I think system is not in equilibrium and the hanging mass accelerates downward, meaning the tension must be less than its weight.”

3. “But it’s also moving, the force must be greatest when $M_1$ is moving the fastest, that’s when the most strain is on the rope”

4. “It also depends on which way it is moving, tension is greater when the hanging mass is moving upward and less when moving downward.”
Discussion Question: Rank the following situations, greatest to least, based on the tension in the string. Assume the hanging mass in each case is the same, friction is negligible, and the pulley and the rope are massless.
Which of the following are constraints on mass 1 and mass 2?

1. Only $|a_1| = |a_2|$
2. Only $|v_1| = 2|v_2|$
3. Only $|a_1| = 2|a_2|$
4. Only $|v_1| = |v_2|$
5. Both 1 & 2
6. Both 2 & 3
7. Both 1 & 4
The box is being lifted with the aid of some mass-less, frictionless pulleys. Assuming it is stationary and has mass \( m \), what is the tension in the rope?

1. \( mg \)
2. \( 2mg \)
3. \( mg/2 \)
4. \( mg/4 \)
5. \( 4mg \)
The box is being lifted with the aid of some mass-less, frictionless pulleys. Assuming it is accelerating downward and has mass \((m)\), what is the tension in the rope?

1. less than \(\frac{mg}{4}\)
2. greater than \(\frac{mg}{4}\)
3. \(\frac{mg}{4}\)