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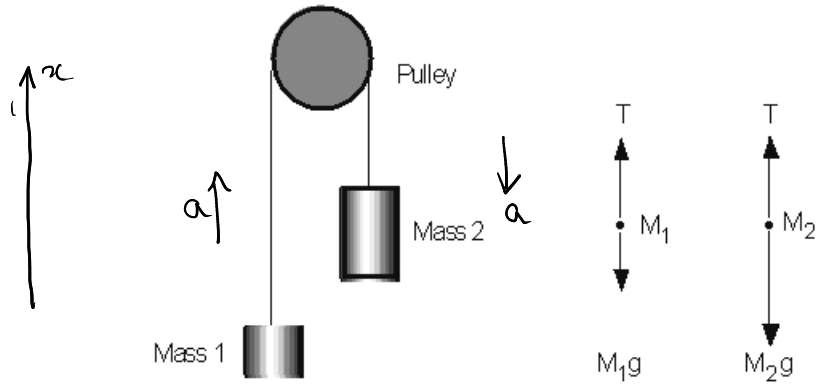
Date	12.09.2024
Lab session (Day & time)	Thu, 12.09.2024, 9 AM – 10:50 AM
Lab partner	—— (don't know yet)

M1 The Atwood Machine Lab Report

A. Answer the following question BEFORE the lab session (15 pts)

1. The acceleration of an object depends on the net applied force and the object's mass. In an Atwood's machine, as shown below, the difference in weight between the two hanging masses determines the net force acting on the system of *both* masses. This net force accelerates both of the hanging masses; the heavier mass is accelerated downward, and the lighter mass is accelerated upward.



In the free body diagram shown above, T is the tension in the string, M_1 is the lighter mass, M_2 is the heavier mass, and g is the acceleration due to gravity. Assuming that the pulley has no mass, the string has no mass and doesn't stretch, and that there is no friction, show that the acceleration a of the entire system is given by

$$a = g\left(\frac{M_2 - M_1}{M_1 + M_2}\right)$$

Both masses accelerate with the same magnitude, but in opposite directions.

Newton's second law for M_1: $\Sigma F = M_1 a$

$T - M_1 g = M_1 a$

$T = M_1 a + M_1 g$ (1)

—— for M_2: $\Sigma F = -M_2 a$

$T - M_2 g = -M_2 a$

$T = -M_2 a + M_2 g$ (2)

(1) & (2): $M_1 a + M_1 g = -M_2 a + M_2 g$

$a(M_1 + M_2) = g(M_2 - M_1)$

$a = g \cdot \frac{M_2 - M_1}{M_1 + M_2}$