# Physics Experiment -- Rotational Dynamics


## Abstract

In this experiment, the relationship between torque, moment of inertia, and angular acceleration was demonstrated. The torque was calculated for a series of different moments of inertia and accelerations. The graph of the values produced a line, but its slope and y-intercept did not match the calculated values, probably due to measurement errors. The slope represents the moment of inertia and the y-intercept represents the torque when no moment of inertia applied, i.e., 0.

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## Discussion

This experiment in rotational dynamics demonstrated the principles of torque and angular momentum. Torque is a force that will cause the rotation of an object to change. In this experiment, the torque resulted from the added mass, or the moment of inertia in the context of rotation. Angular momentum, which is analogous to linear momentum, will change if the moment of inertia and/or the angular velocity change. The angular velocity changed each time a different mass was applied, i.e. when a different torque was applied.

The moment of inertia of a disk is calculated by the formula:

$I = 1/2\ M\ R^2$

Then,

$\tau = I\ \alpha$ (similar to F=ma for linear motion)

The following graph indicates the change in torque versus angular acceleration:

The slope of the line was 38.704 and the y-intercept was -0.2414. These figures did not match the calculated values which were 20.17 and .019 respectively.

## Questions

1. The movement of the mass produced a moment of inertia (I) which placed a torque (rotational force) on the disk. The torque caused the angular acceleration, and the disk began to spin.

2. The slope of the graph was identified as I, which is the moment of inertia, or the "best fit I."

3. The y-intercept is the best fit value of the torque when there is no mass or moment of inertia applied. In this case it was a negative number, which does not make sense. Uncertainty in measuring and calculation is most likely responsible for these variations.

4. I would expect the y-intercept to be 0, because there should be 0 torque when there is no moment of inertia applied.