Torque is a rotational force which is perpendicular to the motion of the object.

That being said the formula is

or ∅)

τ = Torque

F˔ = the perpendicular component of the force applied

F is the force applied

r = distance to the axis of rotation

∅ = the angle the force is applied

If a force was applied at the r meters away from the Axis of rotation

r

Force applied

Axis of rotation

You would split the force applied into its components. Calculate sin(∅).

The Force that is applied parallel to the length of the object has no effect towards rotating the object.

Vertical component of Fa

r

Horizontal component of Fa

Force applied

The Torque generated to move the object

Vertical component of Fa

r

To see how much this affects the object’s rotation it is necessary to utilize Newton’s second law and apply it for rotation.

I = the moment of Inertia

α = angular acceleration

this will find the Inertia of a point object (mass is all at one point), add all point masses to get the sum.

For an object that has its mass evenly distributed its moment of inertia can be…

where L is the length and the axis of rotation is at the end of the object. (rod)

where the axis is at the center. (rod)

where this is a cylinder with the axis through the center

for a sphere rotating with the axis through the center

“for many common geometric shapes it is possible to find tables of equations for the rotational inertia in textbooks or other sources.”

- (<https://www.khanacademy.org/science/physics/torque-angular-momentum/torque-tutorial/a/rotational-inertia>)