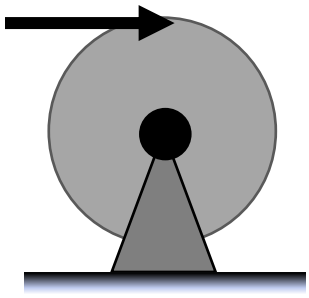
TORQUE & ACCELERATION (ROTATIONAL DYNAMICS)

● When a Force causes rotation, it produces a Torque. Think of TORQUE as the _____ equivalent of FORCE!

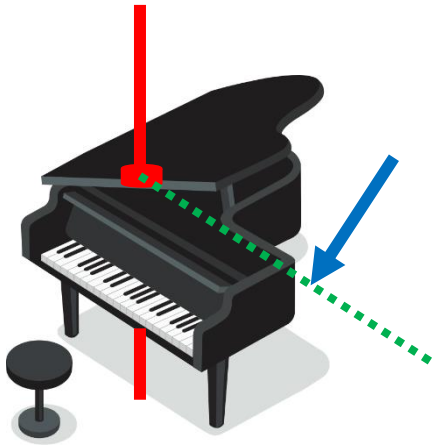
FORCE (F)	TORQUE (τ)
- Causes linear acceleration (____)	- Causes angular/rotational acceleration (____)
- Relationship between **F** & ___ → _____	- Relationship between τ & ___ → _____
- Remember: This is Newton's _____!	- _____ of Newton's _____!
- Quantity of Inertia (resistance to **a**) → _____	- Quantity of Inertia (resistance to α) → _____
- Force & Acceleration → _____	- τ & α → _____

EXAMPLE: A solid disc of mass M = 100 kg and radius R = 2 m is free to rotate around a fixed axis that is perpendicular to it, runs through its center, and is frictionless. You push tangentially on the disc with a constant force F = 50 N, as shown. **(a)** Derive an expression for the angular acceleration that the disc experiences. **(b)** Calculate this angular acceleration.



PRACTICE: TORQUE & ACCELERATION / WEIRD SHAPE (PIANO)

PRACTICE**:** Suppose that piano has a long, thin bar ran through it **(**totally random**),** shown below as the vertical red line, so that it is free to rotate about a vertical axis through the bar**.** You push the piano with a horizontal 100 N (blue arrow), causing it to spin about its vertical axis with 0.3 rad/s^2**.** Your force acts at a distance of 1.1 m from the bar, and is perpendicular to a line connecting it to the bar (green dotted line)**.** What is the piano's moment of inertia about its vertical axis**?**



TORQUE & ACCELERATION / POINT MASS

● Most Torque problems involve Shapes/Rigid Bodies, but Torque works just the same for Point Masses**!**

EXAMPLE**:** You spin a small rock of mass M = 2 kg at the end of a light string of length L = 3 m. **(a)** What Net Torque is needed to give the rock an acceleration of 4 rad/s^2 **? (b)** Calculate its *tangential acceleration* while it spins with 4 rad/s^2**.**