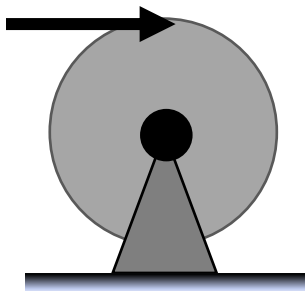


TORQUE & ACCELERATION (ROTATIONAL DYNAMICS)

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

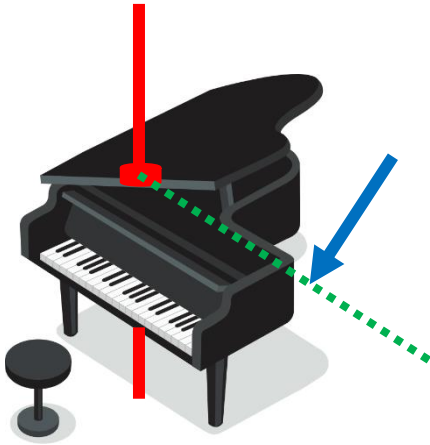
FORCE (F)	TORQUE (τ)
- Causes <u>linear</u> acceleration (____)	- Causes <u>angular/rotational</u> acceleration (____)
- Relationship between F & ____ $\rightarrow$ _____	- Relationship between τ & ____ $\rightarrow$ _____
- Remember: This is Newton's _____!	- _____ of Newton's _____!
- Quantity of Inertia (resistance to a) $\rightarrow$ _____	- Quantity of Inertia (resistance to α) $\rightarrow$ _____
- Force & Acceleration $\rightarrow$ _____	- τ & α $\rightarrow$ _____

EXAMPLE: A solid disc of mass $M = 100 \text{ kg}$ and radius $R = 2 \text{ m}$ 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 $F = 50 \text{ N}$, 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 $M = 2 \text{ kg}$ at the end of a light string of length $L = 3 \text{ m}$. **(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 .