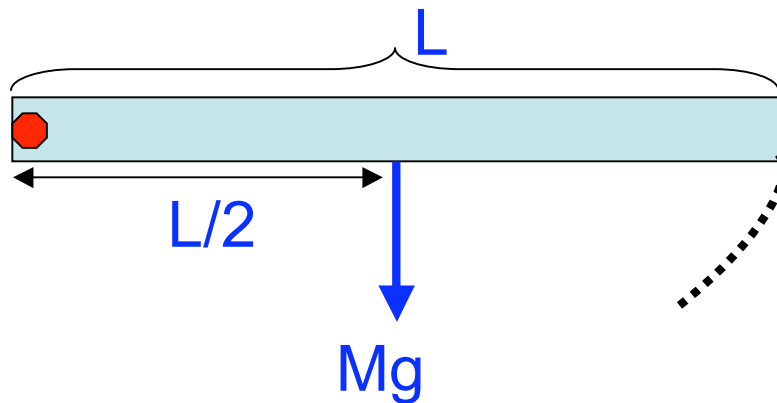# Rotational Acceleration of Falling Rod

1) A uniform horizontal rod has a length $L$ and a mass $M$
2) The rod is free to rotate vertically about a pivot at the left end of the rod
3) What is the *initial* <u>angular acceleration</u> $\alpha$ of the rod?
4) What is the *initial linear acceleration* of the right end of the rod?

$L$

$L/2$

$Mg$

$$\tau_{gravity} = Mg(L/2)\sin 90^o$$
$$\tau_{gravity} = MgL/2$$
$$\tau_{gravity} = I_{rod}\alpha$$
$$I_{rod} = (ML^2)/3$$
$$\tau_{gravity} = (ML^2)\,\alpha/3 = MgL/2$$
$$\alpha = 3g/2L$$
$$a\ (\text{right end}) = L\,\alpha = 3g/2$$
$$a > g\ !$$

The linear acceleration at the right end of the rod is 14.7 m/s$^2$ !