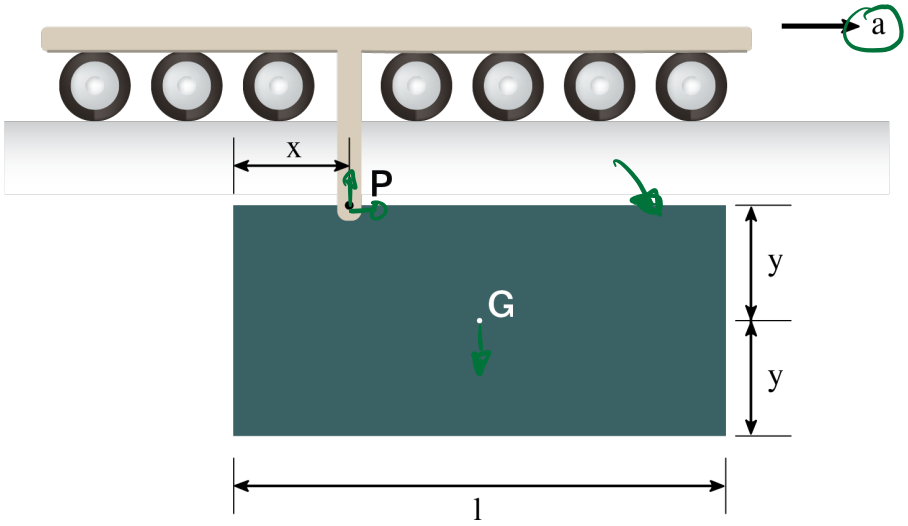
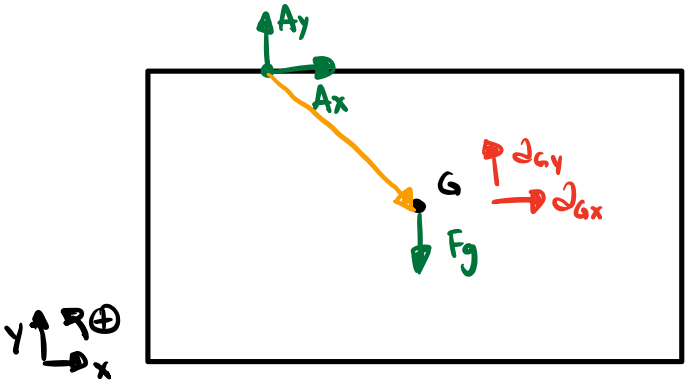
An engineering student is testing a component of her vehicle for a design competition. The $5kg$ rectangular plate is pinned to a carriage at P. If the track is given an acceleration of $2m/s^2$, determine the reaction forces at P and the angular acceleration of the plate. The height of the plate is $h = 2y$ and G is located a vertical distance $y = 0.8m$ from P. The plate has a length $l = 2m$ and point P is a horizontal distance $x = 0.6m$ from the edge.





$$I_G = \frac{1}{12} m (l^2 + w^2)$$

$$= \frac{1}{12} (5kg)(2^2 + 1.6^2)$$

$$I_G = \frac{41}{15} kg\,m^2$$

$$\sum F_x = m a_{Gx} \Rightarrow A_x = m a_{Gx}$$

$$\sum F_y = m a_{Gy} \Rightarrow A_y - F_g = m a_{Gy}$$

$$\sum M_G = I_G \alpha \Rightarrow -A_x (0.8m) - A_y (0.4m) = I_G \alpha$$

$$\vec{a}_G = \vec{a}_P + \vec{\alpha} \times \vec{r}_{G/P} - \cancel{\omega^2 \vec{r}_{G/P}}$$

$$a_{Gx}\hat{i} + a_{Gy}\hat{j} = 2\,m/s^2\,\hat{i} + \alpha\hat{k} \times (0.4\hat{i} - 0.8\hat{j})$$

$$a_{Gx}\hat{i} + a_{Gy}\hat{j} = 2\,m/s^2\,\hat{i} + 0.4\alpha\hat{j} + 0.8\alpha\hat{i}$$

$$\therefore \quad a_{Gx} = 2\,m/s^2 + 0.8\alpha$$

$$a_{Gy} = 0.4\alpha$$

$$\Rightarrow \quad A_x = 5\,kg\; a_{Gx}$$

$$A_y - (9.81\,m/s^2)(5\,kg) = 5\,kg\; a_{Gy}$$

$$-A_x(0.8\,m) - A_y(0.4\,m) = \frac{41}{15}\alpha$$

$$a_{Gx} = 2\,m/s^2 + 0.8\alpha$$

$$a_{Gy} = 0.4\alpha$$

$A_x = -6.4\,N$	$a_{Gx} = -1.28\,m/s^2$
$A_y = 40.8\,N$	$a_{Gy} = -1.64\,m/s^2$
$\alpha = -4.1\,rad/s^2$	