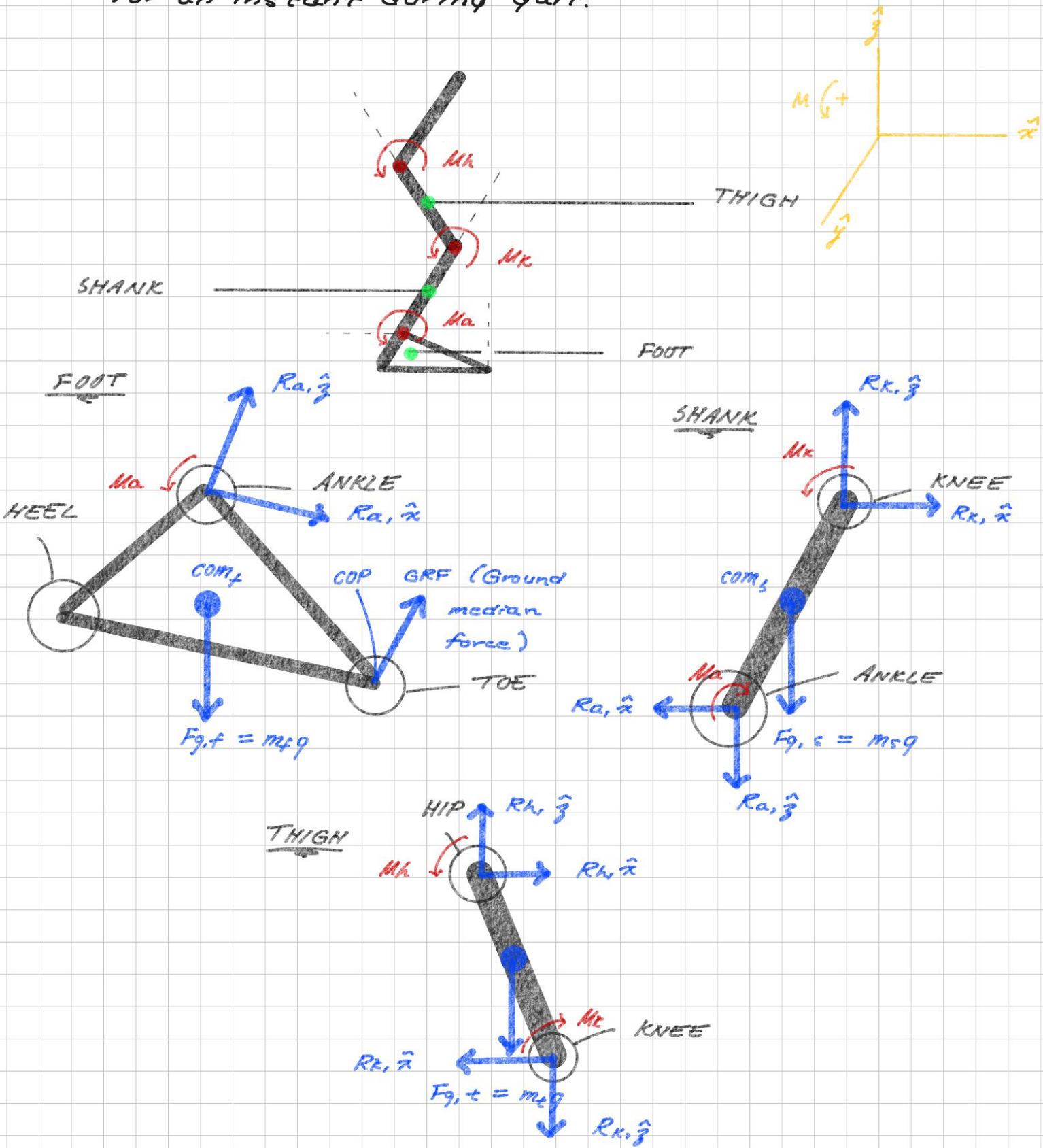
INITIAL HUMAN BODY PROJECT DELIVERABLES (4/5)

1. FBD of the **foot**, **shank**, & **thigh** segments for an instant during gait.



2. Motions of equation for each segment.

	FOOT	SHANK	THIGH
− ← x → +	$\Sigma F_x = m_f(a_{com,f})\hat{x}$ $R_{a,x}\hat{x} + GRF\hat{x} = m_f(a_{comf})\hat{x}$	$\Sigma F_x = m_s(a_{coms})\hat{x}$ $R_{t,x}\hat{x} - R_{a,x}\hat{x} = m_s(a_{coms})\hat{x}$	$\Sigma F_x = m_t(a_{comt})\hat{x}$ $R_{h,x}\hat{x} - R_{t,x}\hat{x} = m_t(a_{comt})\hat{x}$
− ↓ y ↑ +	$\Sigma F_y = m_f(a_{comf})\hat{y}$ $R_{a,y} - F_{g,f} + GRF\hat{y} = m_f(a_{comf})\hat{y}$	$\Sigma F_y = m_s(a_{coms})\hat{y}$ $R_{t,y} - R_{a,y} - F_{g,s} = m_s(a_{coms})\hat{y}$	$\Sigma F_y = m_t(a_{comt})\hat{y}$ $R_{h,y} - F_{g,t} - R_{t,y} = m_t(a_{comt})\hat{y}$
− (M) +	$\Sigma M_{comf} = I_{comf}\alpha_f$ $M_a - R_{a,x}\lvert(y_a - y_{comf})\rvert - R_{a,y}\lvert(x_{comf} - x_a)\rvert + GRF_x(y_{com_f} - y_{COP}) + GRF_y(x_{COP} - x_{com_f}) = I_{comf}\alpha_f$ $M_a = R_{a,x}\lvert(y_a - y_{comf})\rvert + R_{a,y}\lvert(x_{comf} - x_a)\rvert - GRF_x\lvert(y_{comf} - y_{cop})\rvert - GRF_y\lvert(x_{cop} - x_{comf})\rvert + I_{comf}\alpha_f$	$\Sigma M_{coms} = I_{coms}\alpha_s$ $M_t - M_a + R_{t,y}(x_t - x_{coms}) - R_{t,x}(y_t - y_{coms}) - R_{a,x}(y_{coms} - y_a) + R_{a,y}(x_{coms} - x_a)$ $M_t = M_a - R_{t,y}(x_t - x_{coms}) + R_{t,x}(y_t - x_{coms}) + R_{a,x}(y_{coms} - y_a) - R_{a,y}(x_{coms} - x_a)$	$\Sigma M_{comt} = I_{comt}\alpha_t$ $M_h - M_t - R_{h,y}(x_{comt} - x_h) - R_{h,x}(y_h - y_{comt}) - R_{t,x}(y_{comt} - y_t) - R_{t,y}(x_t - x_{comt})$ $M_h = M_t + R_{h,y}(x_{comt} - x_h) - R_{h,x}(y_h - y_{comt}) - R_{t,x}(y_{comt} - y_t) - R_{t,y}(x_t - x_{comt})$

○ ⇝ Solve for this

3. Forces + moments of each segment.

	Mass (Kg)	Icom ($kg \cdot m^2$)	$a_{com,\hat{x}}$ (m/s^2)	$a_{com,\hat{z}}$ (m/s^2)	α (rad/s^2)	GRF$_x$ (N)	GRF$_z$ (N)
foot	0.86	0.0037	0.0328	0.3992	-2.8752	18.53	595.9
shank	2.75	0.0237	1.5369	-0.2395	-5.6788		
thigh	8.92	0.1905	1.6365	-0.9012	2.7077		

	x(m)	z(m)
Ankle	0.189	0.121
comf	0.225	0.063
cop	0.307	0

	x(m)	z(m)
knee	0.298	0.483
coms	0.246	0.322

	x(m)	z(m)
hip	0.3577	0.9183
comt	0.3308	0.7385

$R_{a,\hat{x}} = -18.5\ N$
$R_{a,\hat{z}} = -587.1\ N$
$M_a = -71.26\ N \cdot m$
$R_{k,\hat{x}} = -14.2\ N$
$R_{k,\hat{z}} = -560.99\ N$
$M_k = -18.12\ N \cdot m$
$R_{h,\hat{x}} = 0.3976\ N$
$R_{h,\hat{z}} = -479.74\ N$
$M_h = 23.94\ N \cdot m$

~ POTENTIAL ISSUES / REASONS FOR DIFF. VALUES ~

- Our shank & thigh FBDs were not oriented the same way.