**** Pages 1-3 to be completed in class****
**** Page 4 to be completed after class****
**** Turn in ALL pages with Homework 3****

Madison Longboard
Choosing a Truck

Your Name: (first and last)

_____

Your Pod: (circle)

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Your Lab Teammates: (first and last names)

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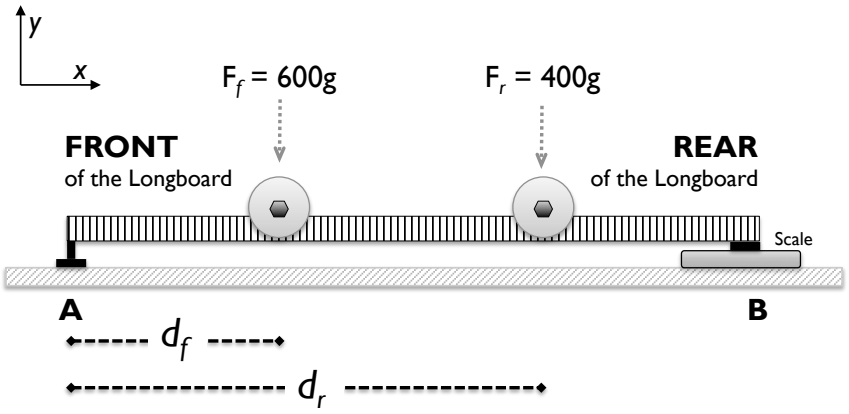
Part (1): Determine Forces on the Front and Rear of the Test Rig for Three Fixed Stances (team work)

TEST RIG

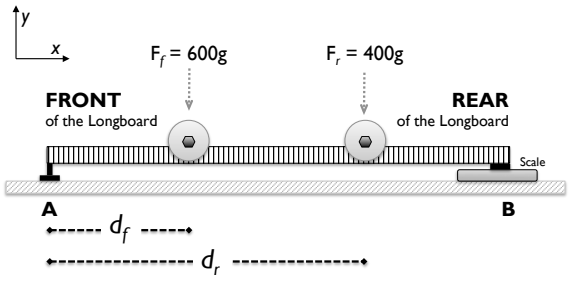
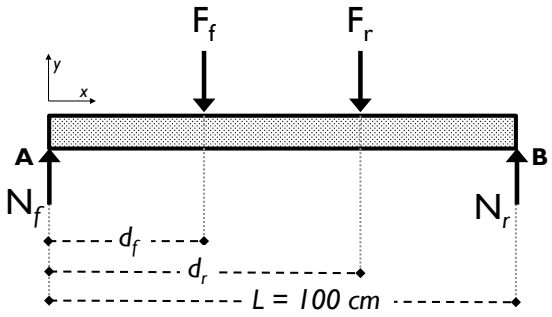


In this test rig, Point A represents the location of the front truck and point B represents the location of the rear truck. Your measurements will tell you what the forces are on these trucks for different rider stances.

STANCE	Front Truck		Rear Truck	
	Mass (g)	Force (N)	Mass (g)	Force (N)
Forward (d_f =10 cm; d_r = 70 cm)				
Center (20 cm; 80 cm)				
Rear (30 cm; 90 cm)				

Reminder: 1,000 grams weighs 9.8 Newtons on Earth

Part (2): Writing the Truck Force Equations with Variables (team work)

Physical Situation	Free Body Diagram
	

* Assume the weight of the deck and trucks are negligible compared to the rider, and that the deck is rigid and does not deflect.

Write an expression for N_f as a function of dimensions d_f and d_r (which are variables) and F_f and F_r, using moment equilibrium:	
$\sum M_{z@B} = 0 =$	$\rightarrow N_f =$ Equation #1
Write an expression for N_r as a function of variables d_f and d_r and forces F_f and F_r, using moment equilibrium:	
$\sum M_{z@A} = 0 =$	$\rightarrow N_r =$ Equation #2

Part (3): Accounting for Variability in Stance: Use the equations developed in Part (2) to see how N_f and N_r may vary due to kick style (i.e., placement of the feet). Identify the dimensions that give maximum truck forces and calculate those maximum forces **(team work)**

	Normal Kick Style			**Mongo Kick Style**		
	Front foot fixed at:	Rear foot may vary btwn:		Rear foot fixed at:	Front foot may vary btwn:	
Stance:	**d_f=**	**d_{r1}=**	**d_{r2}=**	**d_r=**	**d_{f1}=**	**d_{f2}=**
Front	f =10 cm	60 cm	80 cm	r =70 cm	1 cm	19 cm
Center	f =20 cm	70 cm	90 cm	r =80 cm	11 cm	29 cm
Rear	f =30 cm	80 cm	100 cm	r =90 cm	21 cm	39 cm

Which values of d_f and d_r from the table above will give the ***maximum*** values of N_f and N_R using Equations #1 and #2 from Part (2)? Calculate these forces below based on ideal masses of 600g (.6kg) and 400g (.4kg) for the front and rear foot, respectively.

Normal Kick Style		
d_f =	**d_r =**	**Force in Newtons**
		$N_{F,max}$=
		$N_{R,max}$=

Mongo Kick Style		
		$N_{F,max}$=
		$N_{R,max}$=

Part (4): Experimental Verification of Calculations for Maximum Possible Forces (team work)

Transfer the calculated maximum values for $N_{F,max}$ and $N_{R,max}$ to the tables below. Perform the experimental measurements for the dimensions you identified as causing maximum forces using your test rig to confirm predictions.

Normal Kick	N_{max} (from Part (3))	Test Rig Measurement (grams)	N_{meas} (N)	% Diff $\frac{N_{max} - N_{meas}}{N_{max}} x\,100$	**Mongo Kick**	N_{max} (from Part (3))	Test Rig Measurement (grams)	N_{meas} (N)	% Diff $\frac{N_{max} - N_{meas}}{N_{max}} x\,100$
$N_{F,max}$					$N_{F,max}$				
$N_{R,max}$					$N_{R,max}$				

Part (5): Summary of Maximum Possible Truck Forces to Identify Vendors (team work)

Here you will convert the calculated maximum values for $N_{F,max}$ and $N_{R,max}$ from Part (4) into vendor specifications. Transfer the maximum values from above, scale to a 100kg rider and apply the Impact Load Factor (ILF).

Normal Kick	N_{max} (from Part (3))	Scaled to a 100kg rider (N)	**Max F** w 3.0 ILF (N)	**Mongo Kick**	N_{max} (from Part (3))	Scaled to a 100kg rider (N)	**Max F** w 3.0 ILF (N)
$N_{F,max}$				$N_{F,max}$			
$N_{R,max}$				$N_{R,max}$			

Compare the **Max F** calculation with the truck specifications from vendors in the Case Study. How does this calculation help you decide which vendor to choose?

Table 3: Truck Supplier Comparison

	Brand	**Price**	**Load Force Capacity**	**Mass (g)**	**Finish**	**Axle Length**	**Wheel Capacity**	**Supplier Rating**
		Price for two trucks pairs, minimum order 12, delivered	*Manufacturer tested load capacity (Newtons) of an individual truck*	*Mass (grams) of a two- truck pair in grams*	*Finish style and color*	*Axle length end-to-end*	*Largest wheel diameter that will fit a truck*	*Hoover's Business Rating for reliability (5★ - top rating)*
	**Hawkwing**	$32.00	2100 ± 200 N	790g	Patterned	22cm	Up to 76mm	★★★★
	**Munich**	$44.00	2500 ± 200 N	850g	Gun Metal	23cm	Up to 80mm	★★★★★
	**Road Cruiser**	$27.00	2700 ± 300 N	1050g	Base silver	25cm	Up to 85mm	★★★★
	**Mega-T**	$20.00	N/A	825g	Anodized black	25cm	Up to 80mm	N/R