Madison Longboard
Lab B Worksheet

Your Name: (first and last)

_____

Your Partner's Name: (first and last)

_____

Your Pod: (circle)

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Your Lab Teammates: (first and last names)

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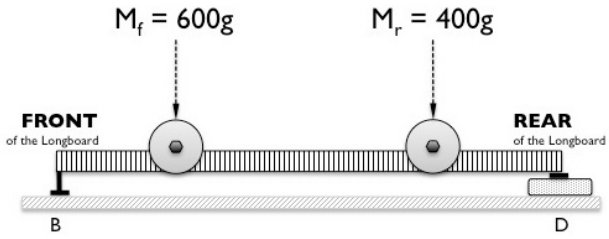
Part (1): Determine Forces on the Front and Rear of Test Fixture

		Front Truck Force		Rear Truck Force	
		g	**N**	**g**	**N**
Forward (10 cm/30 cm)	Test Rig (grams)				
Center (20 cm/20 cm)	Test Rig (grams)				
Rear (30 cm/10 cm)	Test Rig (grams)				

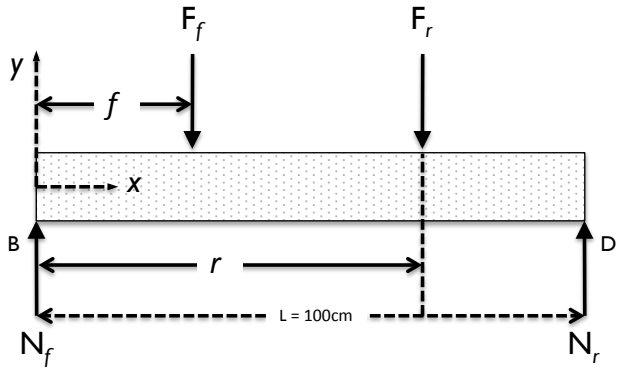
Reminder: 1 kilogram weighs 9.8 Newtons on Earth

Part (2): Writing the Force Equations

Test Rig – Physical Situation



Free Body Diagram



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

Write an expression/equation for N_f as a function of dimensions *f* and *r* (which are variables)	
$\sum M_{z@D} = 0 =$	$\rightarrow N_f =$ Equation #1
Write an expression/equation for N_r as a function of variables *f* and *r*:	
$\sum M_{z@B} = 0 =$	$\rightarrow N_r =$ Equation #2

Part (3): Values of Dimensions *f* and *r* (continued)

Stance:	**Normal Kick Style** – Dimensions for *f* and *r*		
		r_1=	**r_2=**
Front	f =10 cm	60 cm	80 cm
Center	f =20 cm	70 cm	90 cm
Rear	f =30 cm	80 cm	100 cm

Mongo Kick Style – Dimensions for *f* and *r*		
	f_1=	**f_2=**
r =70 cm	1 cm	19 cm
r =80 cm	11 cm	29 cm
r =90 cm	21 cm	39 cm

Choose values of *f* and *r* from table above; calculate ***maximum*** values of N_f and N_R using Equations #1 and #2. Base your calculations on ideal masses of 600g (.6kg) and 400g (.4kg). Remember, 60% of the weight is in the front.

	Normal Kick Style		
	N	**f =**	**r =**
$N_{F,max}$=			
$N_{R,max}$=			

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

Part (4): Experimental Verification of Calculations

Transfer the calculated maximum values for $N_{F,max}$ and $N_{R,max}$ into the gray boxes below. Perform the measurements using your test rig to confirm answers.

Normal Kick	N_{max} (above)	Test Rig (grams)	N_{meas} (N)	Diff (N_{max}-N_{meas})	**Mongo Kick**	N_{max} (above)	Test Rig (grams)	N_{meas} (N)	Diff (N_{max}-N_{meas})
$N_{F,max}$					$N_{F,max}$				
$N_{R,max}$					$N_{R,max}$				

Summary of Truck Forces

Convert the calculated maximum values for $N_{F,max}$ and $N_{R,max}$ 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} (above)	Scaled to a 100kg rider (N)	**Max F** w 3.0 ILF (N)	**Mongo Kick**	N_{max} (above)	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?

Part (5): Choosing a Truck

Discuss these questions with your lab partner. Write a brief description of the Madison Longboard **Value Proposition**, **Revenue Model** and **Cost Model**. Then make your decision about which truck vendor to use … and you must reach agreement with your partner. Show your selection by circling an "X" below, and then list what you consider the three reasons that make this the best choice.

What is the **Value Proposition** of Madison Longboard?	
Describe your **Revenue Model**? *(How will you price your product?)*	
Describe your **Cost Model**? *(What worries you about costs?)*	

It is possible that Sam and Adam could agree on the engineering calculations but disagree on the design of the longboard. Think about how Sam and Adam might design the longboard differently and the resulting **advantages** and **disadvantages** of each approach, then record your thoughts below:

What is likely to be the **important design decisions:**	What may be the **advantages** of this approach?	What may be the **disadvantages** of this approach?
… to **Sam**		
… to **Adam**		

Now, make your decision: *circle an "X" under a vendor name for each truck*

Vendor:	**Hawkwing**	**Munich**	**Road Cruiser**	**Mega-T**
Front Truck	X	X	X	X
Rear Truck	X	X	X	X

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