Physics Laboratory Report

Lab number and Title:Lab 103: Translation Static Equilibrium--- Force Table

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Course & Section Number:PHYS111A-035 **Instructor's Name: Jianping Chen**

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1. INTRODUCTION

1.1 OBJECTIVES

1. Confirm that the condition for equilibrium is that the vector sum of forces is zero.
2. Experiment with the vector nature of force
3. Practice manipulating and addition of vectors.
4. Find unknown tensions and directions using principles of vector addition.

1.2 BACKGROUND

According to Newton's Law of motion, a particle that experiences zero net forces will either remain at rest or move with constant speed depending on its initial condition. Force is a vector quantity that has both magnitude and direction. We use the graphical and analytical method to add the force vectors. The

graphical method draws the vectors from head to tail. The resultant vector is the vector drawn from the beginning to end. The analytical method defined the resultant vector's components to be the sum of the x and y components of the vectors.

2. EXPERIMENTAL PROCEDURE

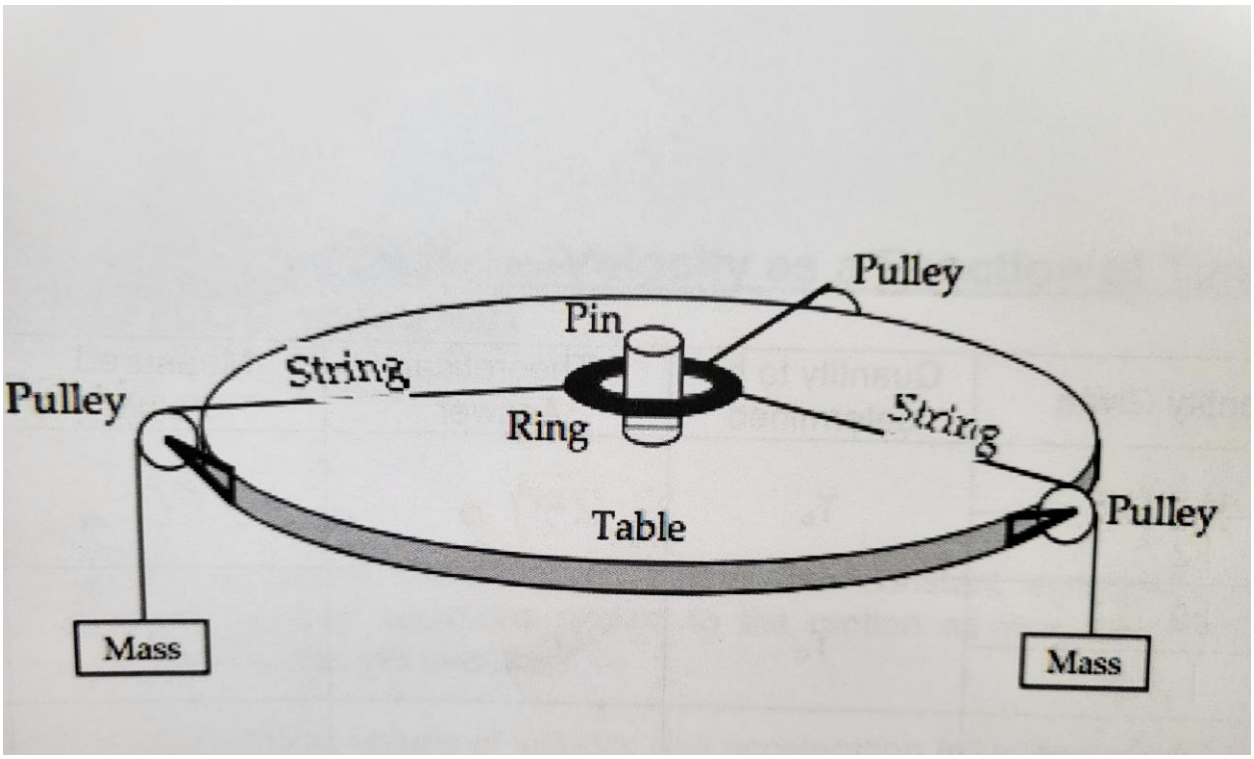


Figure 1

The experimental variables are the tensions T_a, T_b, T_c and the directions (angle) $\theta_a, \theta_b, \theta_c$.

3. RESULTS

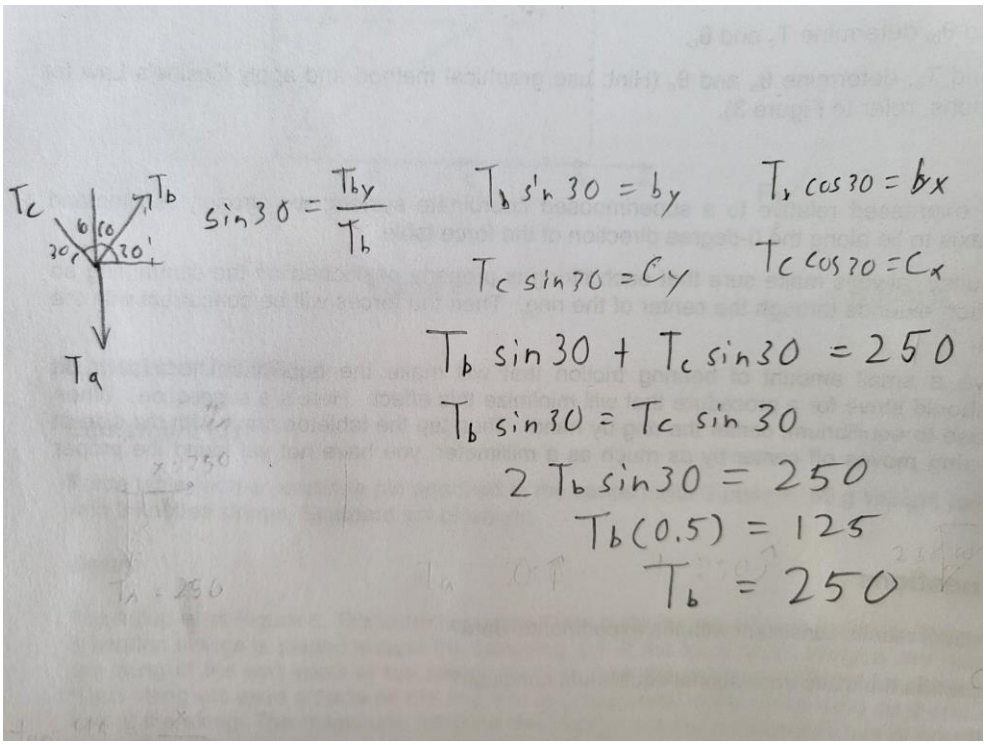
3.1 Experimental Data

Case	Quantity Given	Quantity to be Determined	Theoretical Answer	Measured Value	% diff
1	T_a=250g θ_a =120° $\theta_{b,}$ =120° θ_c =120°	T_b T_c	250g 250g	250g 250g	0 0
2	T_a=300g θ_a =150° T_b =300g θ_b =150°	T_c θ_c	519.61g 60°	520g 60°	0.075 0
3	T_a=500g θ_a =90° Tb=400g T_c=300g	$\theta_{b,}$ θ_c	126.87° 143.13°	126.5° 143.5°	0.2916 0.2585

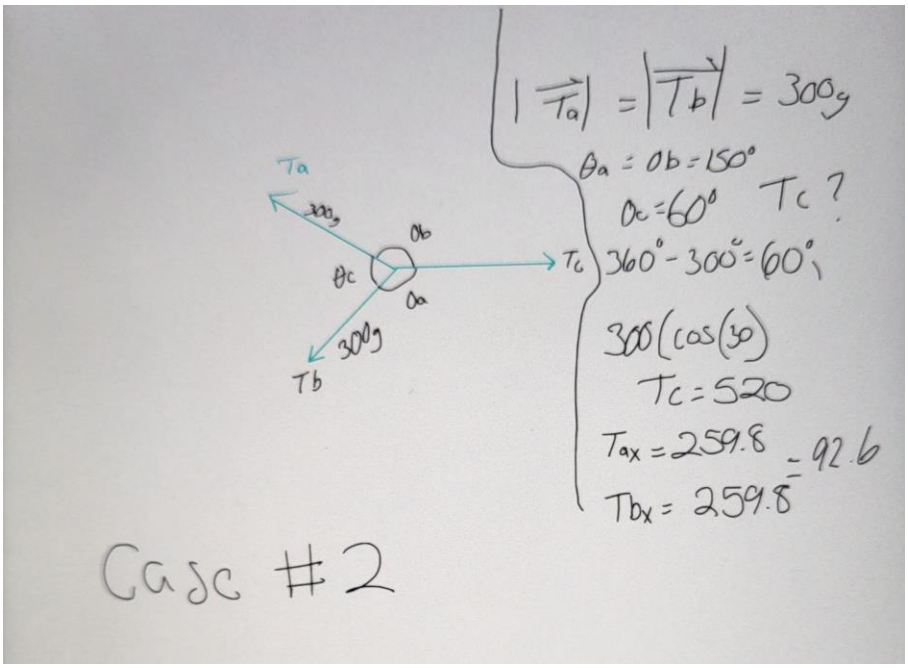
Table 1

3.2 Calculation

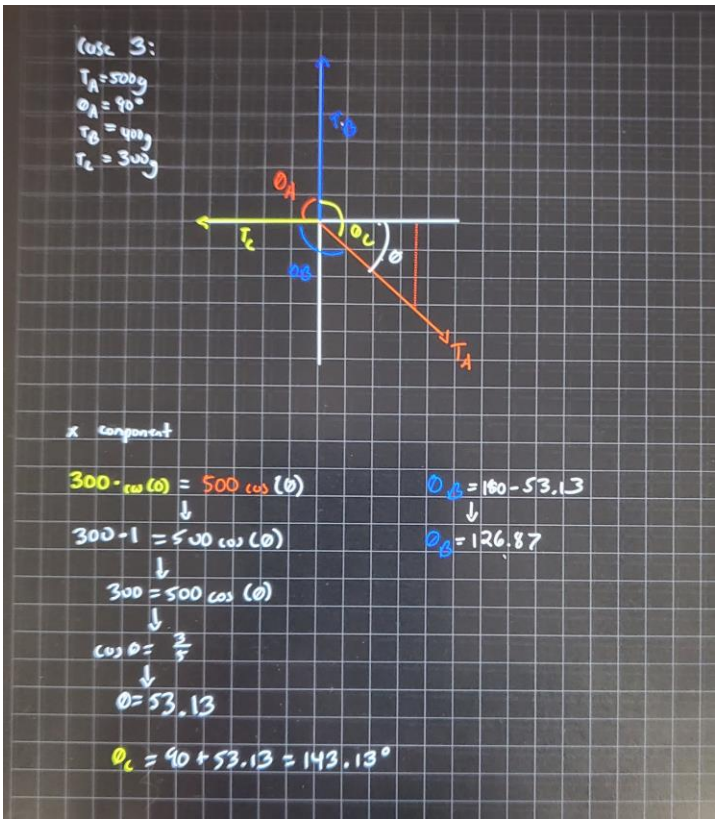
Case 1



Case 2



Case 3



4. ANALYSIS and DISCUSSION

The theoretical values were calculated by using the analytical method by breaking vectors into its components. The addition of the vectors should result in a net force of zero for equilibrium. We tested the theoretical values by setting up the experiment as shown in Figure 1 and observing whether the ring was in equilibrium. From Table 1, the measured % difference between theoretical and measured was within 0-0.2585%. The measured values were identical to our theoretical value. The errors could be due to personal error when reading the scales as well as systematic error of not being able to replicate 519.61g exactly. The results demonstrated the objectives of showing equilibrium happens when the net force of the vectors is zero.

5. CONCLUSIONS

The condition for static translational equilibrium that the vector sum of the forces must be zero holds true. If an object is in equilibrium and has some value unknown, we can use the analytical method of adding vectors to determine the unknown value. The experiment demonstrated the principles well and leaves me with no further questions. Some changes to data to easier numbers that result in whole numbers could reduce the amount of error in results.

6. RAW DATA

Data Table

Case	Quantity Given	Quantity to be determined	Theoretical Answer	Measured Value	% diff
1	T_a= 250 g	T_b	250 g	250 g	0
	Θ_a= 120°				
	Θ_b = 120°	T_c	250 g	250 g	0
	Θ_c= 120°				
2	T_a= 300 g	T_c	519.61	520 g	0.075
	Θ_a= 150°				
	T_b= 300 g	Θ_c	60°	60°	0
	Θ_b= 150°				
3	T_a= 500 g	Θ_b	126.87	126.5°	0.2916
	Θ_a= 90°				
	T_b = 400 g	Θ_c	143.13	143.5°	0.2585
	T_c = 300 g				