

**Will Legg**

**04-05-2024**

**REFLECTION PROMPT:**

**Reflecting on this week in class, were you able to improve on what you said last week?**

**Why or why not?** As a group this week we made sure to pay special attention to our assumptions and our organization of our quadrants and solving process. I tried my best to contribute to all parts of our solving process from identifying what we were solving for up to the solving process. I felt I was able to stay involved and engaged as we worked through our problems and tried to ask questions of my groupmates to make sure we were all on the same page and to help everyone try to conceptualize what we needed to do.

**What went well this week?** This week I was able to lead our groups zoom call to build our program to represent our model of the merry-go-round and this really helped me gain an even better understanding of the concepts we covered in class on Tuesday by translating them to python. Making sure we built on our assumptions this week also helped me understand some of the short-comings of our model and how it could be improved and made to be more accurate as we gain more physics knowledge.

**What area(s) could you improve on for next week related to in class and how might you work to improve those next week? Be specific and include supporting examples from this week's class. What strategies might you try to improve next week?** Next week in class I will look to stay involved in all aspects of our groups process. As Richard recommended in class, I'll also be looking to treat our lab as if it were our group project that's due the following week. This would entail an evaluation of our model and assumptions in addition to our usual four quadrants and solving. Also making sure to include all relevant representations such as energy bar graphs & charts as well as force diagrams, if applicable.

PASTE IMAGES OF YOUR TUESDAY WHITEBOARDS HERE:

facts

- Merry go round - 300kg, 2.5m radius
- Need 1036J or 6500J
- 5 kg weight + 9
- Straps
- 4 scientist

assumptions

- jumping onto disk = maximally inelastic
- KE lost but momentum conserved
- Scientist + Florida = point mass
- neglect air resistance/friction
- avg scientist weight: 60 kg
- angular momentum conserved
- scientist jump on @ same time
- all taken at one force
- Florida mass: 95 kg
- linear momentum not conserved
- torque from axle = negligible
- system: Earth, axle, disk, scientist

Plan

1. find moment of inertia
2. solve for angular velocity
3. solve for angular momentum
4. solve velocity needed to jump on disk to generate 6500J

equation

$$I_{\text{disk}} = \frac{1}{2} M_{\text{disk}} R^2$$

$$I_{\text{people}} = m r^2$$

$$K.E_{\text{rot}} = I \omega^2 \cdot \frac{1}{2}$$

$$L_{\text{initial}} = L_{\text{final}}$$

$$L = \text{angular momentum}$$

$$= I \omega = m r \sin(\theta)$$

Representation

Angular momentum (rot.)

- Moment of inertia of merry-go-round.
- V of scientists

1. Find moment of Inertia

$$I_{\text{disk}} = \frac{M_{\text{disk}} R^2}{2}$$

$$I_{\text{disk}} = \frac{300 \cdot 2.5^2}{2}$$

$$I_{\text{disk}} = 937.5$$

$$I_{\text{people}} = \frac{M_1 R^2}{2} + \frac{M_2 R^2}{2} + \dots$$

$$I_{\text{people}} = \frac{60 \cdot 2.5^2}{2} + \frac{60 \cdot 2.5^2}{2} + \frac{2(60 \cdot 2.5^2)}{2}$$

$$I_{\text{people}} = 1500$$

$$I_{\text{total}} = 937.5 + 1500$$

$$I_{\text{tot}} = 2437.5$$

2. Solving for  $\omega$

$$K.E = \frac{1}{2} I \omega^2$$

$$\omega = \sqrt{\frac{2 K.E}{I}}$$

$$K.E = 6500, I = 2437.5$$

$$\omega = 2.3094 \frac{\text{rad}}{\text{sec}}$$

3. Solve for Angular momentum

$$L = I \omega$$

$$I = 2437.5, \omega = 2.3094$$

$$L = 2437.5 \cdot 2.3094$$

$$L = 5629.1625 \frac{\text{kg m}^2}{\text{s}}$$

4. Solving for V

$$L = m v r \sin \theta$$

$$\theta = 90^\circ, m = 240, r = 2.5, L = 5629.1625$$

$$V = \frac{L}{m r \sin \theta}$$

$$V = \frac{5629.1625}{240 \cdot 2.5 \cdot 1}$$

$$V = 9.3819 \text{ m/s}$$

5. solve for 1036 J

$$K.E = \frac{1}{2} I \omega^2$$

$$K.E = 1036 \text{ J}$$

$$\omega = 0.922$$

$$L = \omega I$$

$$L = 2247.33$$

$$L = m v r \sin \theta$$

$$V = 3.746 \text{ m/s}$$

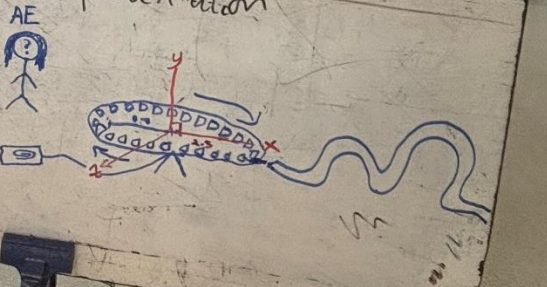
to destroy the satellite / K.E = 1036 J.

Michael Hsouna, Nmm, ECE 124



- For the velocity we got in step 4 w/ 6500 J we deemed it impossible to run at  $\approx 9 \text{ m/s}$ , However when it was 1036 J we would only have to run  $\approx 3 \text{ m/s}$  which is much more realistic
- Our answer is not very accurate to the real world because of our assumptions. We assumed no friction or air resistance, but in reality the friction of the axle would take up energy.
- We also would not be able to have all 4 scientists run the same speed and jump on the merry-go-round at the same time and  $\theta = 90^\circ$  which would change the outcome
- We also assumed that angular momentum is conserved, but in reality it is not conserved and would be lost

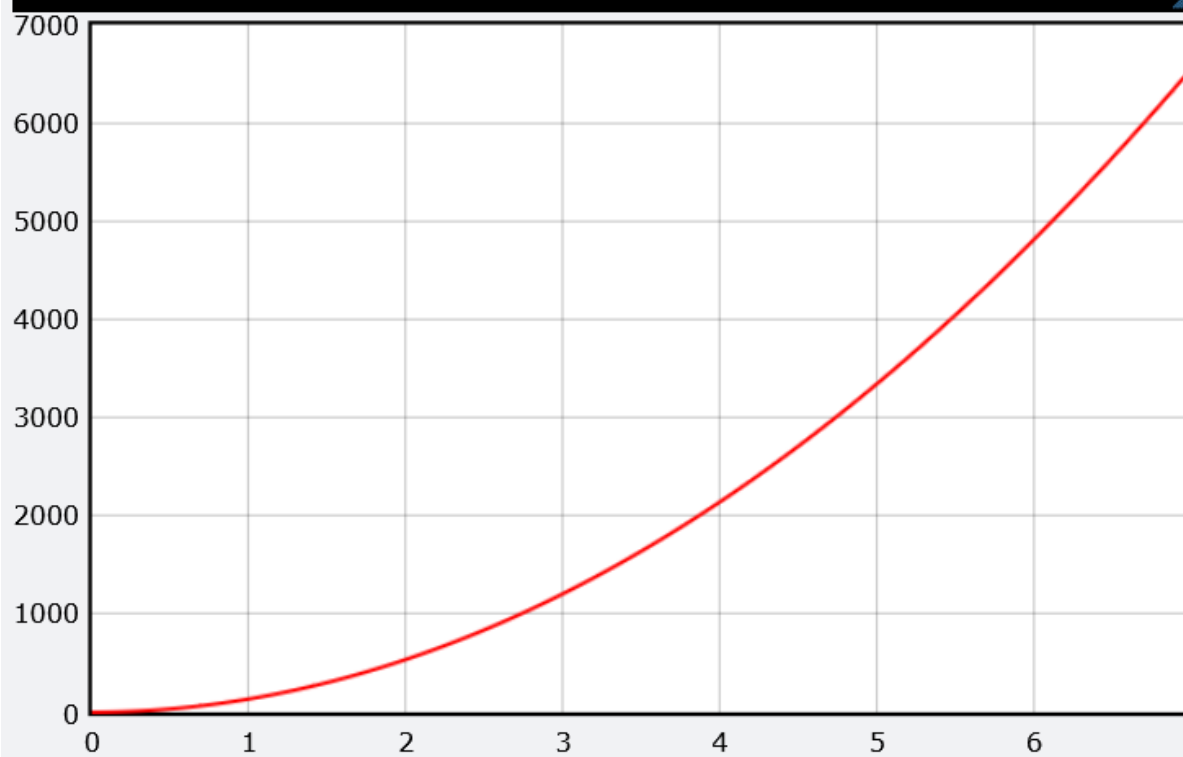
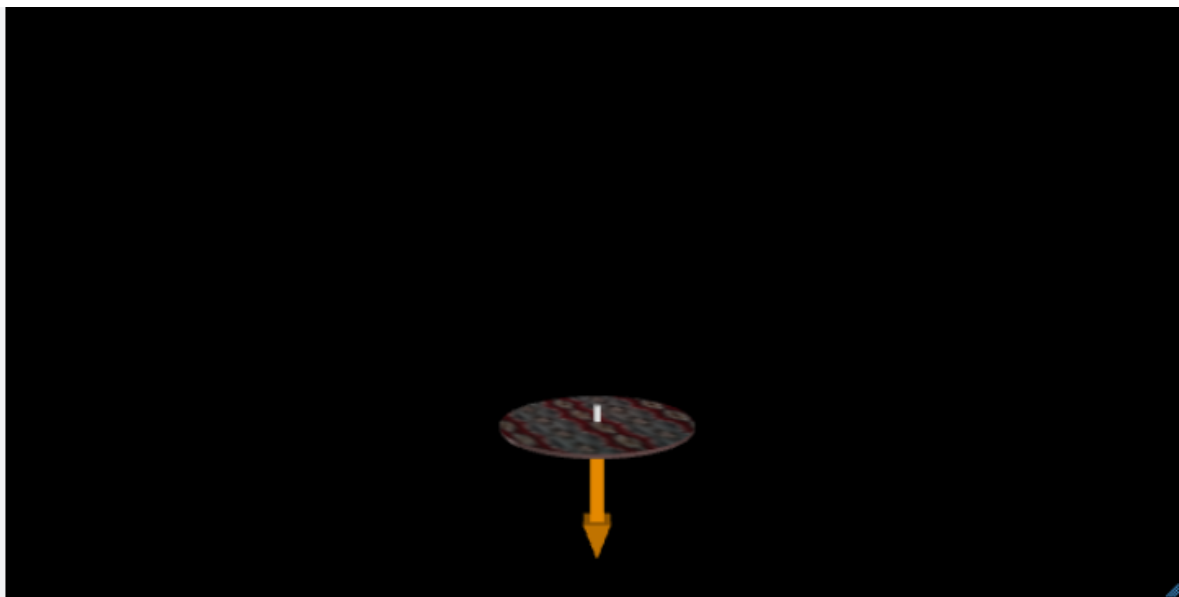
THURSDAY WB:

<p><b>Facts</b></p> <ul style="list-style-type: none"> <li>- cups: 2.5 m from center</li> <li>- hose force: 200 N</li> <li>- merry-go-round: 300 kg</li> </ul>	<p><b>plan</b></p> <ul style="list-style-type: none"> <li>• determine system, find I disk</li> <li>• find torque</li> <li>• determine angular acceleration</li> <li>• calculate time to reach desire <math>K \cdot E_{\text{rot}}</math></li> </ul>	<p><b>Lacking</b></p> <ul style="list-style-type: none"> <li>• Torque</li> <li>• angular acceleration</li> <li>• time to reach <math>K \cdot E</math> / speed</li> <li>• Moment of inertia</li> </ul>
<p><b>Assumptions</b></p> <ul style="list-style-type: none"> <li>- neglect air resistance/friction</li> <li>- force of hose applied to cups is constant</li> <li>- force applied directly to cup on radius of disk</li> <li>- force acts on cups @ <math>90^\circ</math> angle from center of disk, horizontal</li> <li>- cups don't obstruct hose</li> </ul>	<p><b>Equations</b></p> <p>Torque: <math>\tau = r \cdot F = L/t</math></p> <p>Static equilibrium: <math>\sum \tau = 0</math></p> <p><math>K \cdot E_{\text{rot}} = \frac{1}{2} I \cdot \omega^2</math></p> <p>angular momentum: <math>L = M V r \sin \theta =</math></p> <p>angular acceleration: <math>\alpha = \tau / I</math></p> <p><math>\omega = \alpha t - \text{time}</math></p>	<p><b>Representation</b></p> 

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1 Web VPython 3.2
2 # GlowScript 2.9 VPython
3
4 get_library('https://cdn.rawgit.com/PERLMSU/physutil/master/js/physutil.js')
5
6 #Objects
7 axle = cylinder(pos=vector(0,-5,0), axis=vector(0,0.5,0), radius=0.1, color=color.white)
8 platform = cylinder(pos=vector(0,-5,0), axis=vector(0,0.1,0), radius=2.5, texture=textures.rug)
9
10 #Parameters and Initial Conditions
11 disk_m = 300
12 I = (disk_m * platform.radius**2) / 2
13 L = 0
14 tau = 500
15 KE = 0
16
17
18 #Time and time step
19 t=0
20 tf=10
21 dt=0.01
22
23 #MotionMap/Graph
24 Larrow = arrow(color=color.orange)
25
26 EnergyGraph = PhysGraph(numPlots=1)
27 #Calculation Loop
28 while KE <= 6500:
29     rate(100)
30
31     taunet = tau
32     L += taunet * dt
33
34     platform.rotate(angle=(L/I)*dt, axis=vector(0,1,0), origin=axle.pos) #DO NOT MODIFY THIS LINE
35
36     omega = L/I
37     rotational_energy = 0.5*I*omega**2
38     EnergyGraph.plot(t,rotational_energy)
39     t = t + dt
40
41     Larrow.pos = axle.pos
42
43     # L scaled down by 1000
44     Larrow.axis = vector(0,-L / 1000,0)
45
46     KE = rotational_energy
47
48 print(KE + " " + t)

```



KE = 6514.68  
time = 6.9899999999999895