# Pendulum Project

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# 1 Abstract

# 2 Introduction & Theoretical Background

# 3 Materials & Methods

## 3.1 Language and Packages

Python 3.10.8, Numpy, Sympy, Scipy, Matplotlib.pyplot

## 3.2 Methodology

# 4 Results & Discussion

$$
\begin{aligned}
T_{rec} &= \frac{1}{2}mv^2\,, \\
&= \frac{1}{2}m\left(\dot{x}^2+\dot{y}^2\right)\,, && (1)\\
T_{rot} &= \frac{1}{2}i\dot{\theta}^2\,, && (2)\\
T &= \frac{1}{2}\left(m\dot{x}^2+m\dot{y}^2+i\dot{\theta}^2\right)\,. && (3)\\
x &= r\sin(\theta)\,, && (4)\\
y &= -r\cos(\theta)\,. && (5)\\
T &= \frac{1}{2}mr^2\dot{\theta}^2+\frac{1}{2}i\dot{\theta}^2\,, \\
&= \frac{1}{2}\left(mr^2\right)\dot{\theta}^2\,. && (6)\\
U &= mgr-mgr(\cos\theta)\,, \\
&= mgr(1-\cos\theta)\,. && (7)\\
L &= T-U\,, \\
&= \frac{1}{2}mr^2\dot{\theta}^2+\frac{1}{2}i\dot{\theta}^2-mgr(1-\cos\theta) && (8)
\end{aligned}
$$

# 5 Conclusion

# 6 References

# 7 Appendix