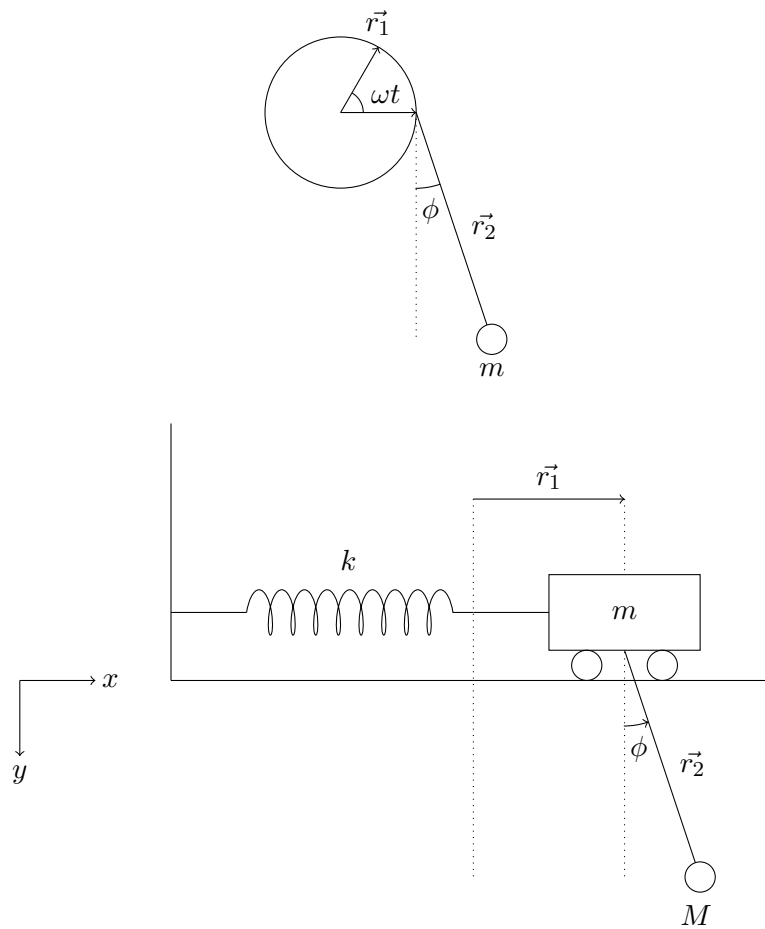# AMATH 271 Final Project:
Brachistochrone

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1. Example diagrams:

Example Python code:

```python
# Prints example twice
for i in [0, 1]:
  print("example")
#
#
#
```

So, using Python, we solve:

$$
\frac{d}{dt}
\begin{bmatrix} x \\ \phi \\ \dot{x} \\ \dot{\phi} \end{bmatrix}
=
\begin{bmatrix}
\dot{x} \\
\dot{\phi} \\
\dfrac{ML\dot{\phi}\sin(\phi) - kx + Mg\sin(\phi)\cos(\phi)}{(m+M) - M\cos^2(\phi)} \\
\dfrac{M^2L\dot{\phi}^2\cos(\phi)\sin(\phi) - Mkx\cos(\phi) + (m+M)Mg\sin(\phi)}{M^2L\cos^2(\phi) - (m+M)ML}
\end{bmatrix}
$$

Where $m = 1, M = 1, L = 1, g = 1$, and $k = 2$ are the given parameters.