Energy Derivations

**Euler Method:**

Using the Euler Method, the following will be reached:

The differential equation in question is:

 Using these equations, then the derivations follow:

Which gives the following:

Now for the theta:

Which gives:

 To find the energy, the following will be used:

The first thing that will be done is change the kinetic energy from linear to rotational:

Now the second change:

The following trigonometry with the small angle approximation will give:

To find the Energy after a time interval, the following will be done:

Now comes the long algebra where the definitons of and :

Ignoring the term since it is not significant:

**Euler-Cromer method:**

Using the same equation for the energy but changing the time steps to that of the Euler-Cromer:

Doing the following algebraic step and substituting it back into the eqution:

By ingnoring the and sice they are not significant: