Task 3

Defines file path

```
addpath('classes');
```

Task description

Implementer varianten av Eulers metode gitt i likning (25) i avnsitt 4.1. Og test metoden på systemet som består av likningene (19) og (20).

Parameter initialization

```
X0 = eye(3);  % X-matrix
I = eye(3);   % Moment of intertia matrix
L = [1 0 0]'; % Torque vector

h = 0.1;  % Step size
n = 10000; % Number of iterations
```

Approximates the solution with Eulers method

```
eulersMethod = EulersMethod(h, n);
[t, W] = eulersMethod.solve(X0, I, L);
W = W{end}
```

```
W = 3×3
    1.0000         0         0
         0    0.5624   -0.8269
         0    0.8269    0.5624
```

The exact solution

```
X = @(x) [ 1    0           0
           0 cos(x) -sin(x)
           0 sin(x)  cos(x) ];

X = X(t(end))
```

```
X = 3×3
    1.0000         0         0
         0    0.5624   -0.8269
         0    0.8269    0.5624
```

Calculates the error

```
error = abs(X - W)
```

```
error = 3×3
10^-9 ×
         0         0         0
         0    0.1309    0.0897
         0    0.0897    0.1309
```

The above output shows that there is an absolute error of 1e-9 for the approximate solution.

Checks if energy is conserved

```
w0 = (X0 * I)^(-1) * L;
E0 = Energy.calculate(L, X0 * w0);

w1 = (W * I)^(-1) * L;
E1 = Energy.calculate(L, W * w1);

fprintf('Initial energy: %i \nFinal energy:   %i \nDifference:     %i', E0, E1, abs(E1
```

```
Initial energy: 5.000000e-01
Final energy:   5.000000e-01
Difference:     0
```