Spring-Mass Transmission Line

```
In[32]:= Clear["Global`*"];
         Off[General::spell1];
```

■ Setup the initial conditions - all masses at rest with starting values xn0

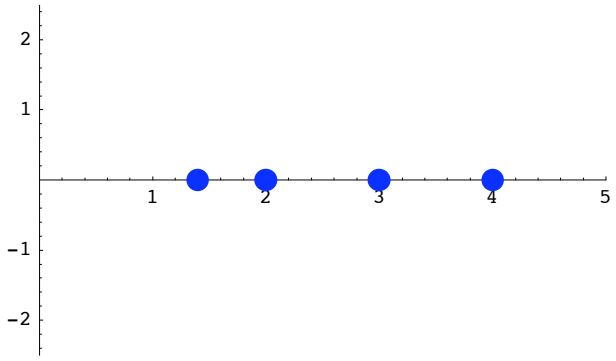
```
In[34]:= init = {x1[0] == x10, x2[0] == x20, x3[0] == x30, x4[0] == x40,
                 x1'[0] == 0, x2'[0] == 0, x3'[0] == 0, x4'[0] == 0};
```

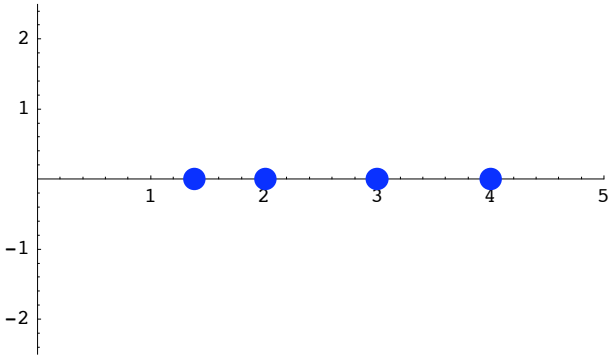
■ Define the coupled equations of motion and solve for xn[t]

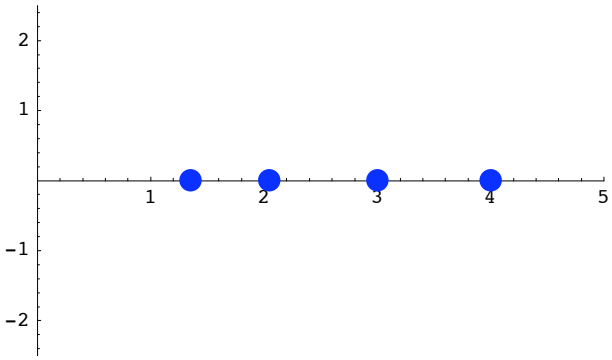
```
In[35]:= eqm = { x1''[t] == -ω^2 (x1[t] - x2[t]),
                 x2''[t] == -ω^2 (2 x2[t] - x1[t] - x3[t]),
                 x3''[t] == -ω^2 (2 x3[t] - x2[t] - x4[t]),
                 x4''[t] == -ω^2 (x4[t] - x3[t])};

In[36]:= eqm = Append[init, eqm];

In[37]:= dsol = DSolve[eqm, {x1[t], x2[t], x3[t], x4[t]}, t][[1]];
```

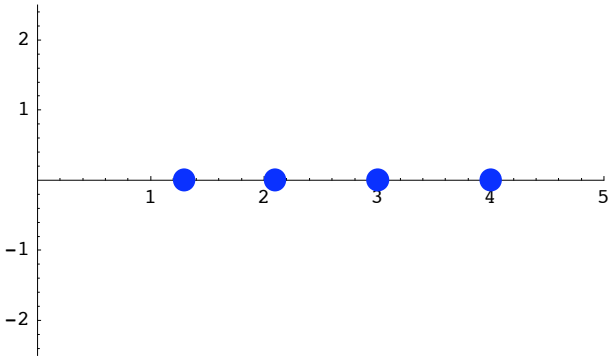
■ Make a movie of the masses

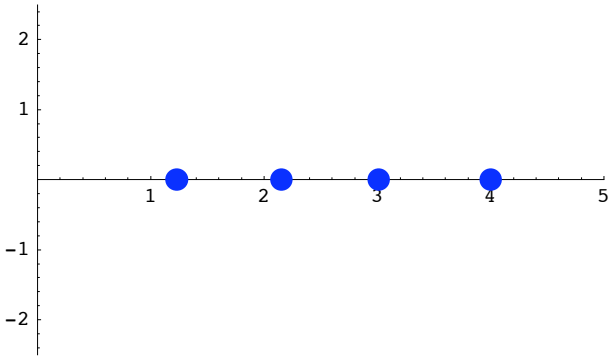
```
In[38]:= val = {ω → 1, x10 → .4, x20 → 0, x30 → 0, x40 → 0};

In[39]:= coord1[t_] = {1 + x1[t], 0} /. dsol /. val;
         coord2[t_] = {2 + x2[t], 0} /. dsol /. val;
         coord3[t_] = {3 + x3[t], 0} /. dsol /. val; coord4[t_] = {4 + x4[t], 0} /. dsol /. val;

In[42]:= Clear[coordplot];
         coordplot[t_] := ListPlot[{coord1[t], coord2[t], coord3[t], coord4[t]},
            PlotStyle → {PointSize[0.04], RGBColor[0, 0, 1]}, PlotRange → {{0, 5}, {-2.5, 2.5}}];

In[44]:= plotarray = Table[coordplot[tp], {tp, 0, 5, .25}];
```

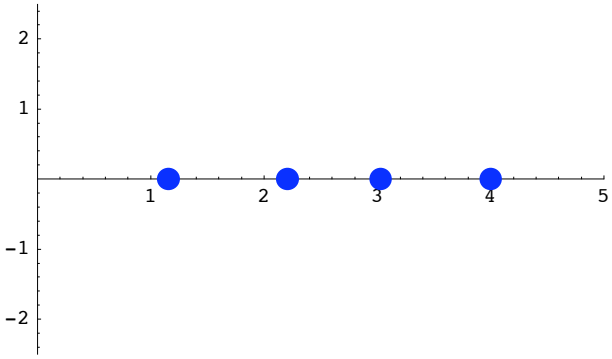


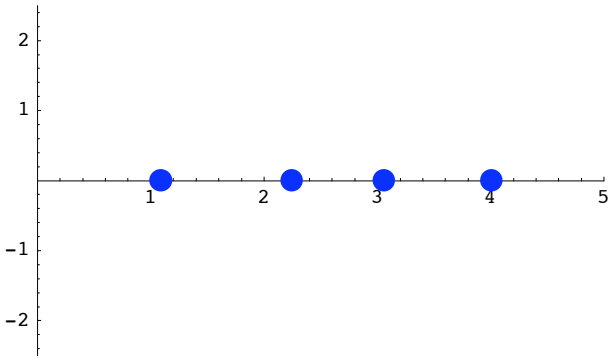

2
1
−1
−2
1
2
3
4
5

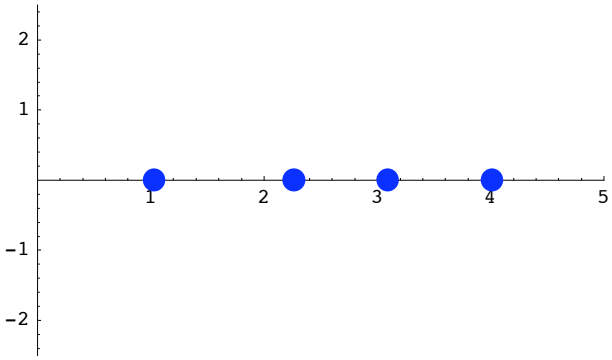

2
1
−1
−2
1
2
3
4
5

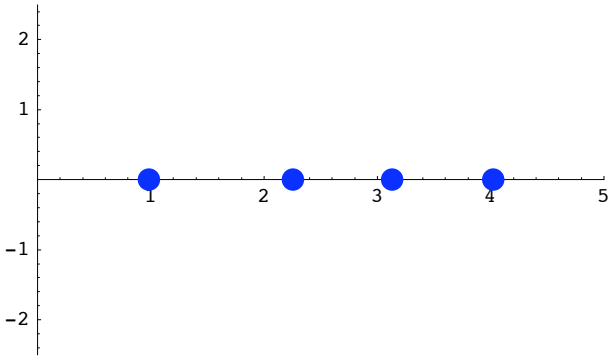

2
1
−1
−2
1
2
3
4
5

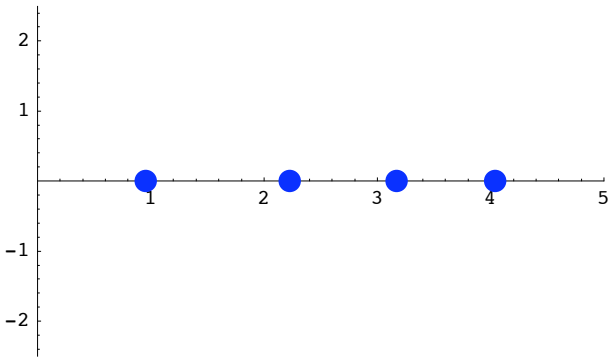

2
1
−1
−2
1
2
3
4
5

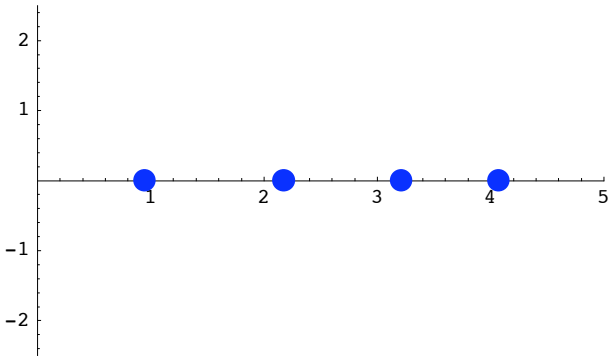

2
1
−1
−2
1
2
3
4
5

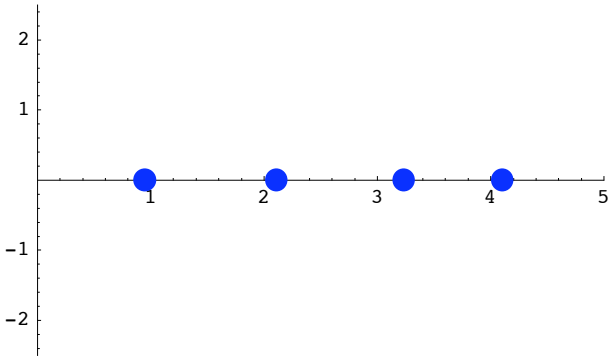

2
1
−1
−2
1
2
3
4
5

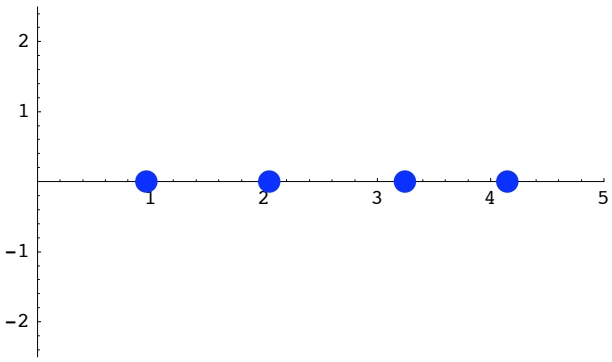

2
1
−1
−2
1
2
3
4
5

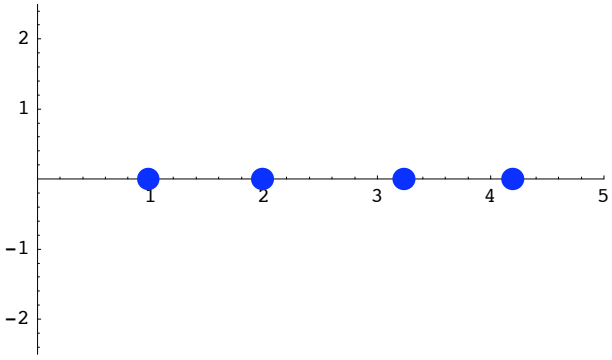

2
1
−1
−2
1
2
3
4
5

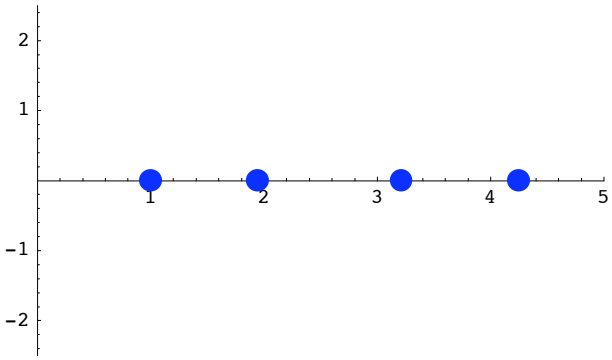

2
1
−1
−2
1
2
3
4
5

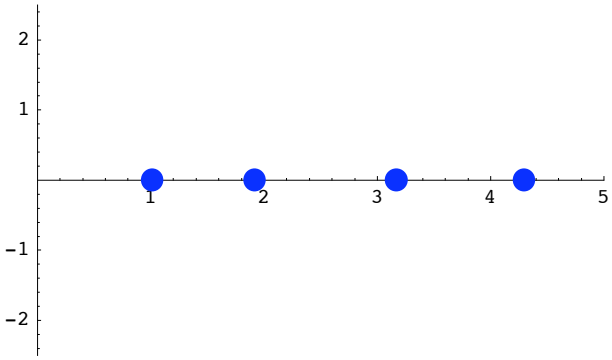

2
1
−1
−2
1
2
3
4
5

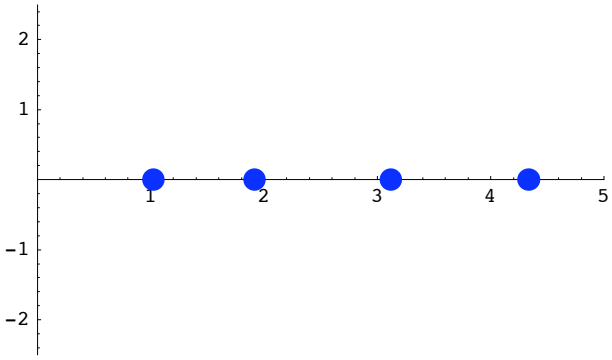

2
1
−1
−2
1
2
3
4
5

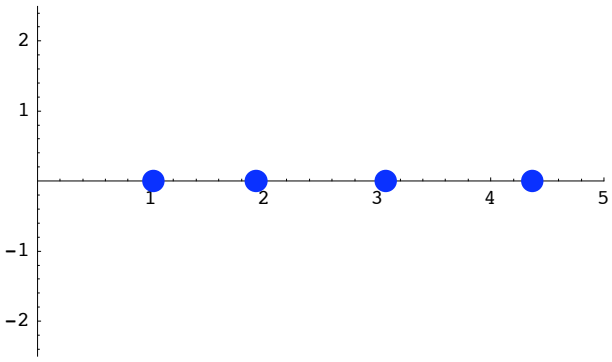

2
1
−1
−2
1
2
3
4
5

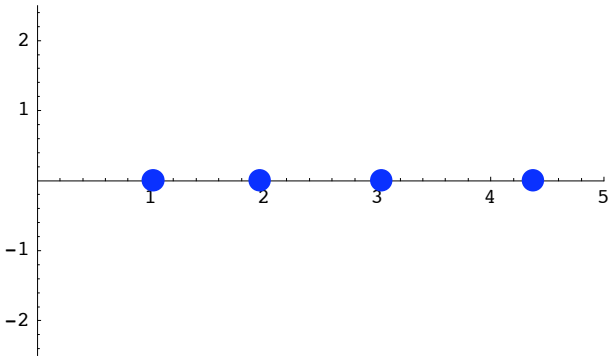

2
1
−1
−2
1
2
3
4
5

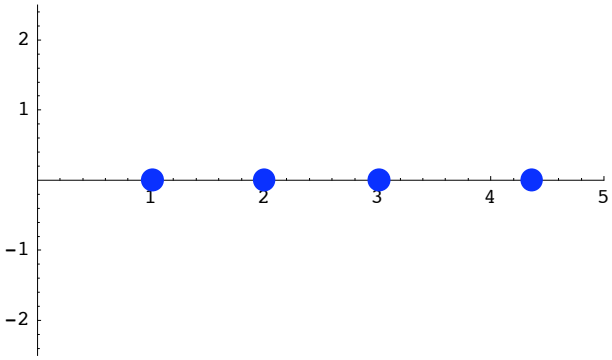

2
1
−1
−2
1
2
3
4
5

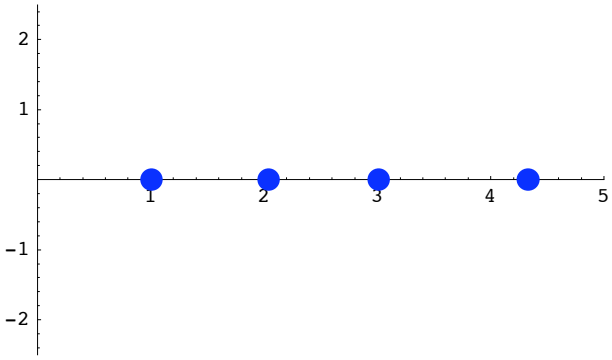

2
1
−1
−2
1
2
3
4
5


2
1
−1
−2
1
2
3
4
5


2
1
−1
−2
1
2
3
4
5


2
1
−1
−2
1
2
3
4
5


2
1
−1
−2
1
2
3
4
5


2
1
−1
−2
1
2
3
4
5