

```

Exit[];

c = {1 - 3 n^2 x^2 + 2 n^3 x^3, 3 n^2 x^2 - 2 n^3 x^3, x - 2 n x^2 + n^2 x^3, -n x^2 + n^2 x^3}
{1 - 3 n^2 x^2 + 2 n^3 x^3, 3 n^2 x^2 - 2 n^3 x^3, x - 2 n x^2 + n^2 x^3, -n x^2 + n^2 x^3}

b = 1 / n;

Y[i_, h_] := {Y[i], Y[i+1], m[i], m[i+1]}.c /. x -> h;
{Y[i, 0], Y[i, 1/n], D[Y[i, x], x] /. x -> 0, D[Y[i, x], x] /. x -> 1/n}
{Y[i], Y[1+i], m[i], m[1+i]}

Simplify[(D[Y[1, x], {x, 2}] / 4 / n /. x -> 0) == 0]
2 m[1] + m[2] + 3 n y[1] == 3 n y[2]

Simplify[(D[Y[n, x], {x, 2}] / 4 / n /. x -> b) == 0]
m[n] + 2 m[1+n] + 3 n y[n] == 3 n y[1+n]

Simplify[(D[Y[i, x], {x, 2}] / 4 / n /. x -> b) == (D[Y[i+1, x], {x, 2}] / 4 / n /. x -> 0)]
m[i] + 4 m[1+i] + m[2+i] + 3 n y[i] == 3 n y[2+i]

M[n_] := SparseArray[{{1, 1} -> -2, (n+1) {1, 1} -> 2,
  {n+1, n} -> -2, {1, 2} -> 2, {i_, j_} /; (i == j+1 && i < n+1 && i > 1) -> -1,
  {i_, j_} /; (i == j-1 && i < n+1 && i > 1) -> 1}, (n+1) {1, 1}];

```

# los:

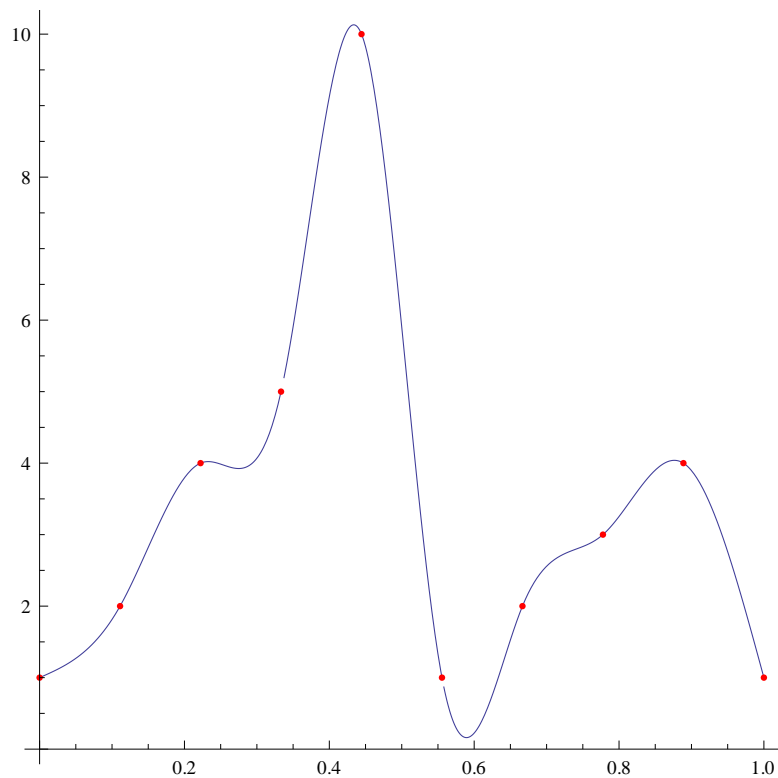
```

y = {1, 2, 4, 5, 10, 1, 2, 3, 4, 1}; m = M[Length[y] - 1].y; n = Length[y] - 1;

Y[x0_] := Module[{i, x = x0, y = y, m = m, c = c, n = n},
  i = Ceiling[x * n];
  x -= (i - 1) / n;
  {Y[[i]], Y[[i+1]], m[[i]], m[[i+1]]}.
  {1 - 3 n^2 x^2 + 2 n^3 x^3, 3 n^2 x^2 - 2 n^3 x^3, x - 2 n x^2 + n^2 x^3, -n x^2 + n^2 x^3}
]

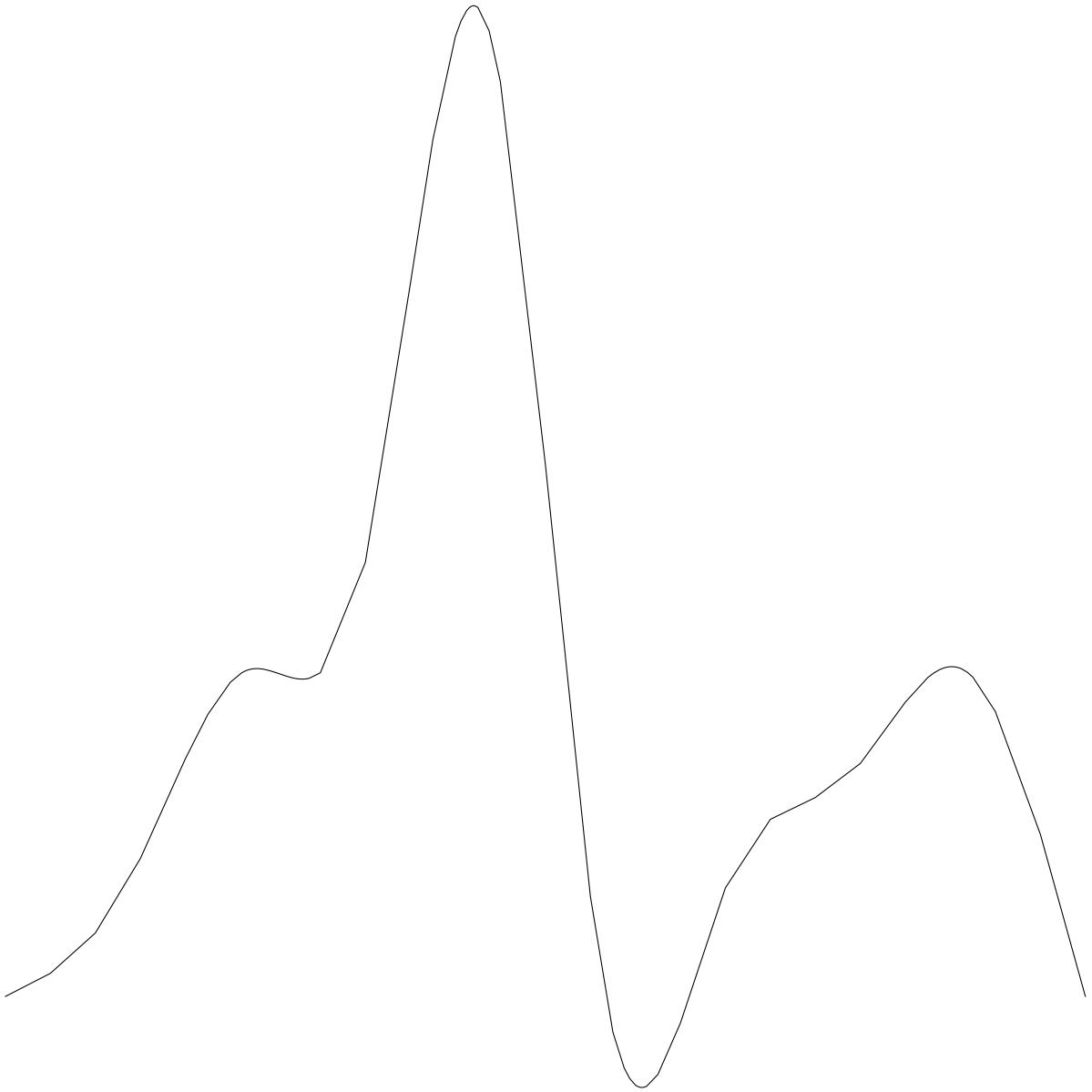
```

```
Show[Plot[Y[x], {x, 0, 1}, AspectRatio -> 1, PlotPoints -> 250],  
ListPlot[Table[{i / (Length[y] - 1), y[[i + 1]]}, {i, 0, Length[y] - 1}], PlotStyle -> Red]]
```



```
<< Splines`
```

```
Graphics[Spline[Table[{i / (Length[y] - 1), y[[i + 1]]}, {i, 0, Length[y] - 1}], Cubic],
  AspectRatio -> 1]
```



```
ys =.
```

```
nN = 30; y = Table[ys[i], {i, nN}]; m = n / 2 M[n].y; n = Length[y] - 1
```

```
29
```

```
d = (Y[#[[1]]] - #[[2]]) ^ 2 & /@ XY; d = Sum[d[[i]], {i, Length[d]}];
```

```
g = Solve[Table[D[d, ys[i]] == 0, {i, nN}], y][[1]];
```

```

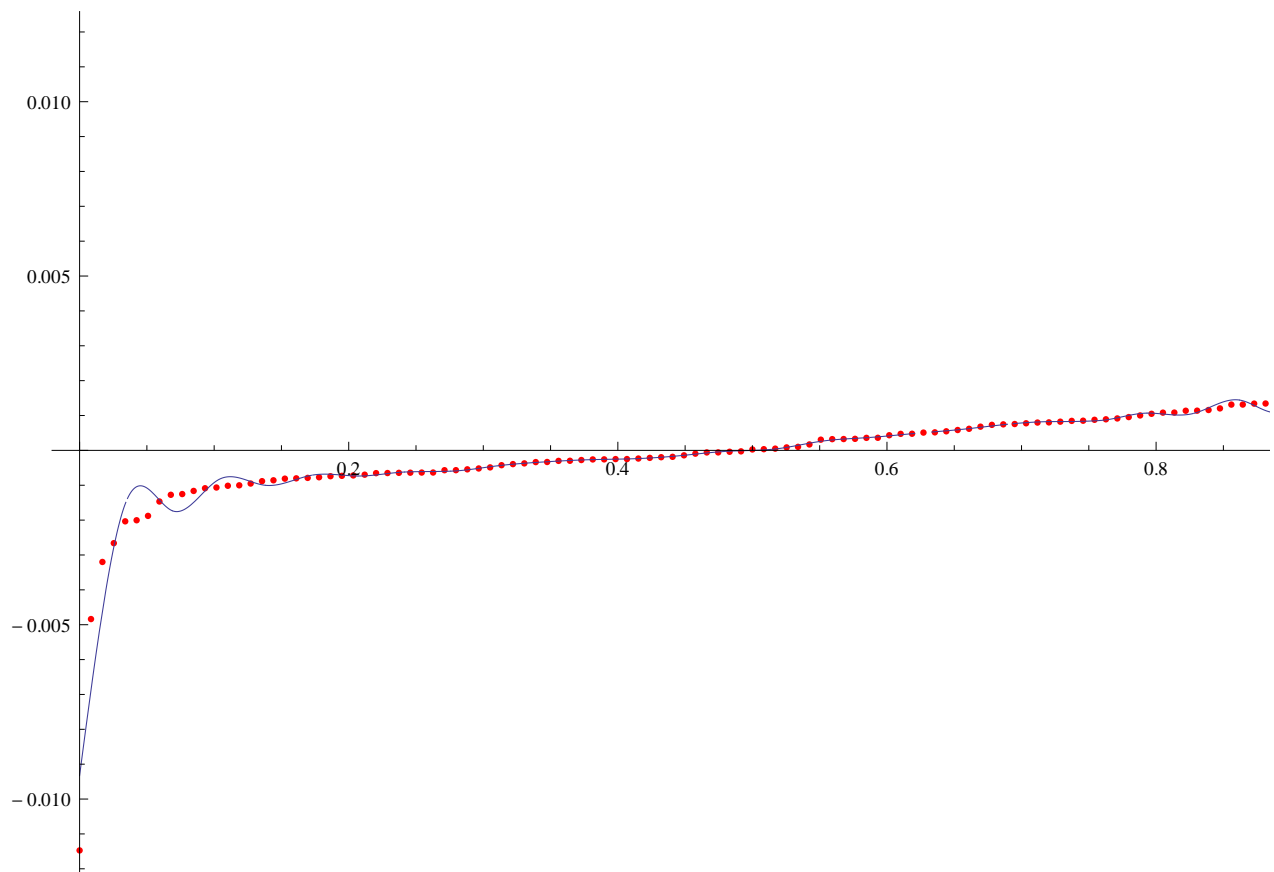
y = Table[ys[i], {i, nN}] /. g; m = n / 2 M[n].y; m
For[i = 1, i ≤ n, i++,
  delta = (y[[i + 1]] - y[[i]]) n;
  a = m[[i]] / delta; b = m[[i + 1]] / delta;
  If[2 a + b - 3 > 0 && a + 2 b - 3 > 0 && a - (2 a + b - 3) ^ 2 / 3 / (a + b - 2) < 0,
    t = 3 / Sqrt[a ^ 2 + b ^ 2]; m[[i]] = t a delta; m[[i + 1]] = t b delta;]
]; m
d /. g
Show[ListPlot[XY, PlotStyle → Red, PlotRange → All],
  Plot[Y[x], {x, 0, 1}, PlotRange → All]]

{0.293626, 0.0955448, -0.0151177, 0.0207445, -0.00424161, 0.00694523,
 -0.000383052, 0.00260123, 0.00205798, 0.00462628, 0.00240259, 0.00110667,
 0.00144907, 0.00379229, 0.00198213, 0.00442655, 0.00534018, 0.00261255,
 0.00343901, 0.00390998, 0.00389336, 0.00011677, 0.00506458, 0.000698872,
 0.00949056, -0.00609889, 0.0246598, -0.025783, 0.0701131, 0.283439}

{0.293626, 0.0955448, -0.0151177, 0.0207445, -0.00424161, 0.00694523,
 -0.000383052, 0.00171668, 0.00135816, 0.00462628, 0.00240259, 0.00110667,
 0.00144907, 0.00379229, 0.00198213, 0.00442655, 0.00534018, 0.00261255,
 0.00343901, 0.00390998, 0.00389336, 0.0000637241, 0.00276387, 0.000698872,
 0.00949056, -0.00609889, 0.0246598, -0.025783, 0.0701131, 0.283439}

0.0000460665

```



**Y[0]**

0.01

**{#[[1]]} & /@ XY**

```
{ {0.}, {0.008475}, {0.016949}, {0.025424}, {0.033898}, {0.042373}, {0.050847},
  {0.059322}, {0.067797}, {0.076271}, {0.084746}, {0.09322}, {0.101695}, {0.110169},
  {0.118644}, {0.127119}, {0.135593}, {0.144068}, {0.152542}, {0.161017}, {0.169492},
  {0.177966}, {0.186441}, {0.194915}, {0.20339}, {0.211864}, {0.220339}, {0.228814},
  {0.237288}, {0.245763}, {0.254237}, {0.262712}, {0.271186}, {0.279661}, {0.288136},
  {0.29661}, {0.305085}, {0.313559}, {0.322034}, {0.330508}, {0.338983}, {0.347458},
  {0.355932}, {0.364407}, {0.372881}, {0.381356}, {0.389831}, {0.398305}, {0.40678},
  {0.415254}, {0.423729}, {0.432203}, {0.440678}, {0.449153}, {0.457627}, {0.466102},
  {0.474576}, {0.483051}, {0.491525}, {0.5}, {0.508475}, {0.516949}, {0.525424},
  {0.533898}, {0.542373}, {0.550847}, {0.559322}, {0.567797}, {0.576271}, {0.584746},
  {0.59322}, {0.601695}, {0.610169}, {0.618644}, {0.627119}, {0.635593}, {0.644068},
  {0.652542}, {0.661017}, {0.669492}, {0.677966}, {0.686441}, {0.694915}, {0.70339},
  {0.711864}, {0.720339}, {0.728814}, {0.737288}, {0.745763}, {0.754237}, {0.762712},
  {0.771186}, {0.779661}, {0.788136}, {0.79661}, {0.805085}, {0.813559}, {0.822034},
  {0.830508}, {0.838983}, {0.847458}, {0.855932}, {0.864407}, {0.872881}, {0.881356},
  {0.889831}, {0.898305}, {0.90678}, {0.915254}, {0.923729}, {0.932203}, {0.940678},
  {0.949153}, {0.957627}, {0.966102}, {0.974576}, {0.983051}, {0.991525}, {1.}}
```