```
n = 20; h = 0.1;
a = 1; b = 1 + 2 / 10; c = 35 / 100; w = 1.5;
m =
  SparseArray[{Band[{1, 2}] → -a, Band[{2, 1}] → -b, Band[{1, 1}] → a + b + c}, {n, n}];
mm = IdentityMatrix[n] - h m;
p[t_] := ((1 + 0.8 Cos[2 π t / n]) / Sqrt[π]) ^ 3;
mm = SparseArray[{{i_, i_} → p[i + 0.5] ^ 3 + p[i - 0.5] ^ 3}, {n, n}]

Bpsor = PSORSplitting[mm, w];

q = RandomReal[{-1, 1}, n];
```

```
SparseArray[<20>, {20, 20}]
```

```
q = Table[(i - n / 2) ^ 2 - n, {i, n}] // N
```

```
{61., 44., 29., 16., 5., -4., -11., -16., -19.,
 -20., -19., -16., -11., -4., 5., 16., 29., 44., 61., 80.}
```

mm // MatrixForm // N

0.775	0.1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.12	0.775	0.1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.12	0.775	0.1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.12	0.775	0.1	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.12	0.775	0.1	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.12	0.775	0.1	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.12	0.775	0.1	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.12	0.775	0.1	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.12	0.775	0.1	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.12	0.775	0.1	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.12	0.775	0.1	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.12	0.775	0.1	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.12	0.775	0.1
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.12	0.775
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.12
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

```
{dkasd, sol} = LCPviaQP[q, mm]
```

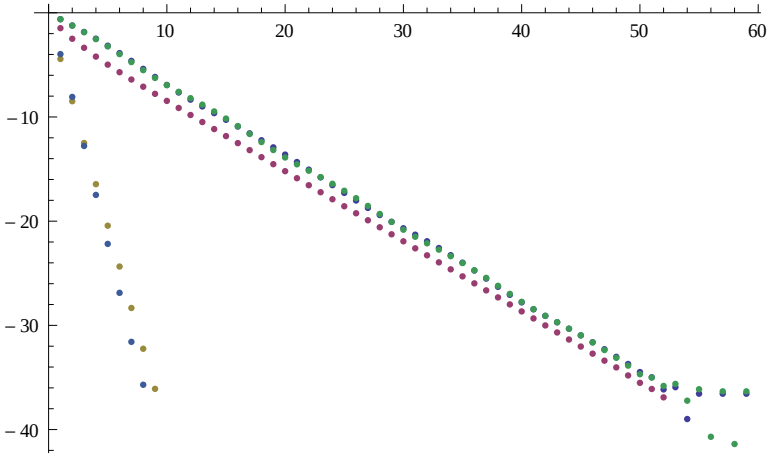
$$\{2.37454\times10^{-7},\ \{7.30685\times10^{-12},\ 8.02381\times10^{-12},\ 8.85577\times10^{-12},\ 9.82968\times10^{-12},\ 1.09812\times10^{-11},\ 1.23582\times10^{-11},\ 1.4027\times10^{-11},\ 1.60812\times10^{-11},\ 1.86573\times10^{-11},\ 2.19623\times10^{-11},\ 2.63247\times10^{-11},\ 3.22975\times10^{-11},\ 4.08873\times10^{-11},\ 5.41325\times10^{-11},\ 7.68682\times10^{-11},\ 1.23981\times10^{-10},\ 2.74418\times10^{-10},\ 8.24774\times10^{-8},\ 14.7727,\ 25.5113,\ 34.5598,\ 41.5477,\ 46.5335,\ 49.508,\ 50.4727,\ 49.4272,\ 46.3718,\ 41.3059,\ 34.2328,\ 25.1286,\ 14.1736,\ 1.94251\times10^{-8},\ 2.74544\times10^{-10},\ 1.23981\times10^{-10},\ 7.68682\times10^{-11},\ 5.41325\times10^{-11},\ 4.08873\times10^{-11},\ 3.22975\times10^{-11},\ 2.63247\times10^{-11},\ 2.19623\times10^{-11},\ 1.86573\times10^{-11},\ 1.60812\times10^{-11},\ 1.4027\times10^{-11},\ 1.23582\times10^{-11},\ 1.09812\times10^{-11},\ 9.82968\times10^{-12},\ 8.85577\times10^{-12},\ 8.02381\times10^{-12},\ 7.30685\times10^{-12},\ 6.68418\times10^{-12}\}\}$$

```
{l2, n2, m2, o2, p2} = Table[1, {i, 5}, {j, n}];

w2 = h / 2; {m1, m2, m3} = IterativeSplitting[60, IdentityMatrix[n] + w2 m, mm, q, m2];

{l1, l2, l3} = IterativeSplitting[60, Bpsor, mm, q, l2];

ListPlot[Log[{l3, m3, n3, o3, p3}]]
```




```
{n1, n2, n3} = IterativeSplitting[60, 0.5 (mm + Transpose[mm]), mm, q, n2];

{p1, p2, p3} = IterativeSplitting[60,
   Partition[Max /@ Transpose[{Flatten[mm], Flatten[Transpose[mm]]}], n], mm, q, p2];
```

```
{o1, o2, o3} = IterativeSplitting[60,
  PSORSplitting[0.5 (mm + Transpose[mm]), w], 0.5 (mm + Transpose[mm]), q, o2]
```

$$\{5.97351 \times 10^{-7}, \{2.91741 \times 10^{-8}, 0.413579, 6.60768 \times 10^{-9}, 7.93436 \times 10^{-8}, 2.99806 \times 10^{-8}, 7.69113 \times 10^{-9}, 7.82041 \times 10^{-9}, 0.865673, 6.19632 \times 10^{-9}, 0.740058, 1.10117, 1.53992 \times 10^{-8}, 2.78505 \times 10^{-8}, 0.050084, 0.0110573, 1.62927 \times 10^{-8}, 2.04862 \times 10^{-7}, 0.00945209, 9.16891 \times 10^{-9}, 8.25946 \times 10^{-9}\},$$
$$\{0.537155, 0.291289, 0.155033, 0.0798458, 0.0396006, 0.0189367, 0.00880275, 0.00405705, 0.0019175, 0.000959679, 0.000508292, 0.000275763, 0.000148212, 0.0000774052, 0.0000389723, 0.0000188966, 8.86867 \times 10^{-6}, 4.08771 \times 10^{-6}, 1.90413 \times 10^{-6}, 9.29567 \times 10^{-7}, 4.82791 \times 10^{-7}, 2.60647 \times 10^{-7}, 1.41047 \times 10^{-7}, 7.46093 \times 10^{-8}, 3.81279 \times 10^{-8}, 1.87595 \times 10^{-8}, 8.90846 \times 10^{-9}, 4.12479 \times 10^{-9}, 1.90511 \times 10^{-9}, 9.09546 \times 10^{-10}, 4.6138 \times 10^{-10}, 2.464 \times 10^{-10}, 1.3373 \times 10^{-10}, 7.15219 \times 10^{-11}, 3.70798 \times 10^{-11}, 1.85192 \times 10^{-11}, 8.91212 \times 10^{-12}, 4.15987 \times 10^{-12}, 1.91609 \times 10^{-12}, 8.98878 \times 10^{-13}, 4.44703 \times 10^{-13}, 2.33603 \times 10^{-13}, 1.26482 \times 10^{-13}, 6.82547 \times 10^{-14}, 3.58245 \times 10^{-14}, 1.81972 \times 10^{-14}, 8.78033 \times 10^{-15}, 4.15555 \times 10^{-15}, 1.96022 \times 10^{-15}, 8.60157 \times 10^{-16}, 6.25038 \times 10^{-16}, 2.79692 \times 10^{-16}, 3.39192 \times 10^{-16}, 6.7882 \times 10^{-17}, 2.03734 \times 10^{-16}, 2.12048 \times 10^{-18}, 1.66313 \times 10^{-16}, 1.05928 \times 10^{-18}, 1.66148 \times 10^{-16}, 0.\}\}$$

```
PSOR[50, 1 - h * (c + a + b), h b, h a, q, 1.5, mm]
```

```
0.
1.89326
-0.442622
0.290588
-0.103635
0.0490648
-0.0188201
0.00797326
-0.00310478
0.00129713
-0.00054775
0.000256142
-0.000128649
0.0000697261
-0.0000388906
0.0000217891
-0.0000119587
6.35395 × 10^-6
-3.2348 × 10^-6
1.56464 × 10^-6
```

-7.10119×10^{-7}

2.95945×10^{-7}

-1.07938×10^{-7}

2.97517×10^{-8}

-1.39163×10^{-9}

-6.30008×10^{-9}

6.54208×10^{-9}

-4.79998×10^{-9}

3.02993×10^{-9}

-1.74235×10^{-9}

9.34301×10^{-10}

-4.7197×10^{-10}

2.25288×10^{-10}

-1.01343×10^{-10}

4.25438×10^{-11}

-1.62937×10^{-11}

5.38454×10^{-12}

-1.26962×10^{-12}

-5.2×10^{-14}

3.374×10^{-13}

-3.0084×10^{-13}

2.0204×10^{-13}

-1.1908×10^{-13}

6.46874×10^{-14}

-3.31119×10^{-14}

1.61965×10^{-14}

-7.76413×10^{-15}

3.46323×10^{-15}

-1.66182×10^{-15}

6.73714×10^{-16}

```
{0.111243, 0, 0, 0.371967, 0.377199, 0.0784845, 0.400417, 0.326123,
 0.724123, 0, 0, 0.777822, 0.580169, 0.483187, 0, 0, 0, 0, 0.368379, 0.3108}
```

```
PSOR[20, c + a + b, -b, -a, q, 1.5, m]
```

```
0.
-2.92928
-6.62817
-7.47989
-7.38186
-6.9653
-6.33769
-5.49998
-4.73972
-4.02252
-3.37319
-2.81674
-2.35649
-1.96767
-1.63616
-1.35504
-1.11934
-0.9223
-0.759111
-0.624696
```

```
{0, 0.550834, 0.48521, 0.887649, 0.988473, 1.28318, 1.37025, 1.31259, 1.74905,
 2.44614, 3.48575, 4.49997, 5.31108, 6.16955, 6.7451, 6.78616, 6.19387, 6.39954,
 6.04113, 6.06078, 5.5483, 4.27354, 3.88595, 3.33878, 2.65614, 2.54623, 3.06752,
 3.01864, 3.31816, 3.026, 2.66094, 2.17163, 2.47579, 2.86646, 3.28667, 3.41963,
 3.26125, 2.96159, 3.08419, 3.08384, 2.7269, 2.44524, 2.00383, 1.44881, 0.619416,
 0.167657, 0, 0.0183176, 0.110801, 0, 0.149472, 0.486365, 0, 0, 0.391345, 0.824325,
 1.11101, 1.21267, 1.60859, 1.55192, 0.694075, 0.162233, 0, 0, 0.414726, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0.29732, 0.285154, 0.328335, 0.448801, 0, 0, 0.209186, 0.665995,
 0.901113, 0.310101, 0.286554, 0, 0.314101, 0, 0.26973, 0.899935, 0.721121, 0.683994,
 0.512522, 0.313707, 0.058356, 0.0532255, 0.247958, 0.407259, 0.570319, 0.564851}
```

```
0.
```

```
{0, 1.46472, 0, 0.832254, 0, 0.647477, 0.303931, 0, 0, 0, 0.797848, 1.04446, 0.502365,
 1.36891, 1.60091, 1.53552, 0, 1.79935, 0, 1.63296, 1.44341, 0, 0.543642, 0.256029, 0, 0,
 1.61007, 0, 1.58947, 0, 0.363073, 0, 0.195307, 0.331017, 0.964207, 0.726181, 0.362363, 0,
 0.586066, 0.853969, 0, 0.437288, 0.141379, 0.422988, 0, 0, 0, 0, 0.439977, 0, 0, 1.77088,
 0, 0, 0.108779, 0.505267, 0.459239, 0, 1.1849, 1.40371, 0, 0, 0, 0, 1.80606, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0.742871, 0, 0, 1.19187, 0, 0, 0, 0.67036, 1.62148, 0, 0.527662, 0, 1.36786,
 0, 0, 1.89688, 0, 0.311835, 0, 0.0628202, 0, 0, 0.167951, 0.0547961, 0.431767, 1.03494}
```

```
PSOR[20, c + a + b, -b, -a, q, 1.5, m]
```

```
0.
1.23013
1.19515
0.682974
0.26953
-0.00382681
0.0335667
0.0380308
0.0159514
-0.00734412
-0.0130506
-0.0057079
-0.00168116
-0.00277312
-0.0015404
-0.00137243
-0.00158738
-0.00111387
-0.000606693
-0.000479434
{0, 0, 0, 0.123453, 0.617872, 0.455816, 0.237601, 0.141532, 0.137842, 0.212096, 0.98556,
 1.25635, 0.893842, 0.13417, 0.112065, 0.784634, 1.26488, 1.16838, 0.74741, 0.51277,
 0.832283, 0.646684, 0, 0, 0.250851, 0.659512, 0.619077, 0.0757747, 0, 0, 0.246678, 0, 0,
 0.00947508, 0, 0.188731, 0.218844, 0.467843, 0.419133, 0.562179, 0.107881, 0, 0.0641934,
 0, 0, 0.305372, 0.108252, 0, 0.396547, 0, 0.373653, 0.236325, 0, 0.033317, 0.708558,
 0.68753, 0.856295, 0.793316, 0.482755, 0.379358, 0, 0, 0, 0, 0.433626, 0.739381, 0.72445,
 0.00754416, 0, 0.107626, 0, 0.0294638, 0.443512, 0.661378, 0.425362, 0.795899, 0.494215,
 0, 0, 0.0298536, 0.472824, 0.685428, 1.73732, 2.22892, 2.38324, 2.00748, 0.832586,
 0.135096, 0, 0, 0.202402, 0, 0, 0.314123, 0.0309494, 0, 0, 0, 0.181871, 0.261394}
```

```
{a2, sol} = LCPviaQP[q, m]
```

$$\left\{1.22252 \times 10^{-7},\ \{1.08524 \times 10^{-9},\ 7.4811 \times 10^{-11},\ 1.26843 \times 10^{-10},\ 0.123658,\ 0.618264,\ 0.456362,\ 0.23827,\ 0.142292,\ 0.138663,\ 0.212949,\ 0.986421,\ 1.25719,\ 0.894653,\ 0.134928,\ 0.112756,\ 0.785246,\ 1.26541,\ 1.16881,\ 0.747753,\ 0.51302,\ 0.832444,\ 0.646761,\ 2.66915 \times 10^{-8},\ 2.17313 \times 10^{-10},\ 0.25085,\ 0.659512,\ 0.619077,\ 0.0757749,\ 1.45476 \times 10^{-10},\ 9.96267 \times 10^{-11},\ 0.246678,\ 1.47928 \times 10^{-10},\ 1.20015 \times 10^{-10},\ 0.00947635,\ 1.19559 \times 10^{-9},\ 0.188731,\ 0.218844,\ 0.467843,\ 0.419133,\ 0.562179,\ 0.107881,\ 1.2575 \times 10^{-10},\ 0.0641935,\ 1.21484 \times 10^{-10},\ 2.18736 \times 10^{-10},\ 0.305372,\ 0.108252,\ 3.00441 \times 10^{-9},\ 0.396546,\ 2.57704 \times 10^{-8},\ 0.373653,\ 0.236325,\ 2.65114 \times 10^{-10},\ 0.0333169,\ 0.708557,\ 0.687531,\ 0.856295,\ 0.793316,\ 0.482755,\ 0.379358,\ 1.50042 \times 10^{-10},\ 1.14746 \times 10^{-10},\ 8.83588 \times 10^{-11},\ 2.18654 \times 10^{-10},\ 0.433627,\ 0.739384,\ 0.724455,\ 0.00755182,\ 1.16283 \times 10^{-10},\ 0.107627,\ 1.74463 \times 10^{-10},\ 0.0294636,\ 0.443512,\ 0.661378,\ 0.425362,\ 0.795898,\ 0.494215,\ 2.09901 \times 10^{-10},\ 1.66911 \times 10^{-10},\ 0.0298578,\ 0.47283,\ 0.685433,\ 1.73732,\ 2.22892,\ 2.38324,\ 2.00748,\ 0.832586,\ 0.135096,\ 2.79104 \times 10^{-10},\ 3.46461 \times 10^{-10},\ 0.202402,\ 4.3851 \times 10^{-10},\ 3.76023 \times 10^{-10},\ 0.314123,\ 0.0309494,\ 1.47313 \times 10^{-10},\ 8.34707 \times 10^{-11},\ 1.07204 \times 10^{-10},\ 0.181871,\ 0.261393\}\right\}$$

```
sol.(m.sol - q)
```

```
4.4611
```