Bogdan Chwaliæski

Zestaw 6 zadanie 8 a

In[60]:=
```
doiteracji[wielomian_, {x_, x0_}] := Module[
  {
   P = Function[x, #][x0] & /@ NestList[D[#, x] &, wielomian, 2],
   g, h,
   n = Exponent[wielomian, x]
  },
  If[Abs[P[[1]]] < 10^-10,
   0,
   g = P[[2]] / P[[1]];
   h = g^2 - P[[3]] / P[[1]];
   Check[
    Sort[n / (g + # Sqrt[(n - 1) (n h - g^2)]) & /@ {-1, 1}, Abs[#1] < Abs[#2] &][[1]],
    0]
  ]
 ]

MetodaLaguerrea[wielomian_, {x_, x0_}, n_] :=
 FixedPointList[# - doiteracji[wielomian, {x, #}] &, x0, n]
```

In[54]:=
```
naszwielomian = z^10 + z^9 + 3 z^8 + 2 z^7 - z^6 - 3 z^5 - 11 z^4 - 8 z^3 - 12 z^2 - 4 z - 4;
```

Wszystkie miejsca wielomianu. Dla pomocy gdzie szukaæ

In[68]:=
```
N[Roots[naszwielomian == 0, z], 20]
```

Out[68]=
```
z == -0.50000000000000000000 - 0.86602540378443864676 i ||
 z == -0.50000000000000000000 + 0.86602540378443864676 i ||
 z == 1.4142135623730950488 i || z == -1.4142135623730950488 i ||
 z == 1.0000000000000000000 i || z == 1.0000000000000000000 i ||
 z == -1.0000000000000000000 i || z == -1.0000000000000000000 i ||
 z == 1.4142135623730950488 || z == -1.4142135623730950488
```

I na przykład:

In[62]:=
```
MetodaLaguerrea[naszwielomian, {z, -2.}, 100] // InputForm
```

Out[62]//InputForm=
```
{-2., -1.3524620387001527, -1.4143743864370295, -1.4142135623705387,
 -1.414213562373095, -1.414213562373095}
```

In[63]:=
```
MetodaLaguerrea[naszwielomian, {z, 2.}, 100] // InputForm
```

Out[63]//InputForm=
```
{2., 1.3726732425945072, 1.414241882510786, 1.4142135623730867,
 1.4142135623730867}
```

In[64]:=
```
MetodaLaguerrea[naszwielomian, {z, -1.}, 100] // InputForm
```

Out[64]//InputForm=
```
{-1., -0.5411008116644116, -0.4925292694941289 + 0.545120847457079*I,
 -0.43081010096077454 + 0.825597451630556*I,
 -0.5021117531526037 + 0.8652865474347139*I,
 -0.5000000392177305 + 0.8660254090558487*I,
 -0.5000000000000002 + 0.8660254037844387*I,
 -0.5000000000000002 + 0.8660254037844387*I}
```

In[65]:= **MetodaLaguerrea[naszwielomian, {z, 1.}, 100] // InputForm**

Out[65]//InputForm=

```
{1., 0.5931576462276323, 0.23924415191728932 + 1.0969655403069785*I,
 0.035293478542454876 + 1.029585964577908*I,
 0.010094368321727151 + 1.008265790108787*I,
 0.0028810852784211067 + 1.0023522887456844*I,
 0.0008228312528951341 + 1.0006714088393558*I,
 0.00023506514205975677 + 1.0001917779178613*I,
 0.00006715901230665527 + 1.0000547893893557*I,
 0.00001918808630350327 7 + 1.0000156537614082*I,
 5.4822994294074884*^-6 + 1.0000044724840893*I,
 1.566343384926203*^-6 + 1.0000012778340486*I,
 1.566343384926203*^-6 + 1.0000012778340486*I}
```

In[66]:= **MetodaLaguerrea[naszwielomian, {z, -4.}, 100] // InputForm**

Out[66]//InputForm=

```
{-4., -0.4520755727431762 + 1.2765023606742676*I,
 -0.007602281052297211 + 1.3711972899008555*I,
 -0.0001471259489606927 + 1.4139866358007*I,
 -5.120038738142853*^-11 + 1.4142135623803453*I,
 -4.1728528471395133*^-16 + 1.4142135623730954*I,
 -4.1728528471395133*^-16 + 1.4142135623730954*I}
```

In[67]:= **MetodaLaguerrea[naszwielomian, {z, 4.}, 100] // InputForm**

Out[67]//InputForm=

```
{4., -0.0032726591781875314 + 0.8687056889001215*I,
 -0.0001300203788962423 + 0.9618640431756569*I,
 0.00005092775125125 1754 + 0.9890487820138951*I,
 0.00002114354851850 3348 + 0.9968681614281103*I,
 6.5551704722588295*^-6 + 0.9991050053464753*I,
 1.91424529555708*^-6 + 0.9997442736564649*I,
 5.502873379812624*^-7 + 0.9999269342551796*I,
 1.5749857567113797*^-7 + 0.9999791239868402*I,
 4.502116442680087*^-8 + 0.9999940354164386*I,
 1.285004276640263*^-8 + 0.9999982958312676*I,
 1.285004276640263*^-8 + 0.9999982958312676*I}
```