```
ClearAll["Global`*"]
```

```
Residue[ DDa2[9, x], {x, 0}]
```

```
1
```

```
Limit[DDa2[100, z] - 1 / z, {z → 0}]
```

$$\left\{\frac{428}{15}\right\}$$

```
Expand[DDa[9, x] / x]
```

$$\frac{16}{3}+\frac{1}{x}+\frac{5\,x}{2}+\frac{x^2}{6}$$

$$\mathbf{\frac{16}{3}+\frac{1}{x}+\frac{5\,x}{2}+\frac{x^2}{6}}$$

```
f2[x_] := 16/3 + 1/x + 5 x/2 + x^2/6
```

```
f2[3]
```

$$\frac{44}{3}$$

```
DDa2[9, 3]
```

$$\frac{44}{3}$$

```
K[n_] := If[n == 1, 0, FullSimplify[MangoldtLambda[n] / Log[n]]]
P[n_, k_] := P[n, k] = Sum[ K[j] P[Floor[n / j], k - 1], {j, 2, n}]; P[n_, 0] := 1
D2[n_, k_] := D2[n, k] = Sum[D2[Floor[n / j], k - 1], {j, 2, n}]; D2[n_, 0] := 1
DD[n_, z_] := Sum[FactorialPower[z, a] / a! D2[n, a], {a, 0, Log[2, n]}]
P[n_, k_, s_] := P[n, k, s] = Sum[ j^-s K[j] P[Floor[n / j], k - 1, s], {j, 2, n}];
P[n_, 0, s_] := 1
DDa[n_, z_] := Sum[ z^k / k! P[n, k], {k, 0, Log[2, n]}]
DDa[n_, z_, s_] := Sum[ z^k / k! P[n, k, s], {k, 0, Log[2, n]}]
DDa2[n_, z_] := Sum[ z^k / k! P[n, k] / z, {k, 0, Log[2, n]}]
Dhyp[n_, k_, a_] := Dhyp[n, k, a] =
  Sum[Binomial[k, j] Dhyp[Floor[n / (m^(k - j))], j, m + 1], {m, a, n^(1 / k)}, {j, 0, k - 1}]
Dhyp[n_, 1, a_] := Floor[n] - a + 1; Dhyp[n_, 0, a_] := 1
bins[ z_, a_] := Product[ (z - k), {k, 0, a - 1}] / a!
DDD[n_, z_] := Expand[Sum[bins[z, a] Dhyp[n, a, 2], {a, 0, Log[2, n]}]]
lin[n_] := Sum[ (-1)^(k + 1) / k Dhyp[n, k, 2], {k, 1, Log[2, n]}]
```

```
Roots[ 1 + 9 x/2 + 3 x^2/2 == 0, x]
```

$$x == \frac{1}{6}\left(-9-\sqrt{57}\right) \;||\; x == \frac{1}{6}\left(-9+\sqrt{57}\right)$$

```
FullSimplify[(-7/2 + Sqrt[41]/2) - (-5/2 + Sqrt[17]/2)]
```

```
Table[{n, Expand[Roots[ Expand[DDa[n, x]] == 0, x]]}, {n, 2, 16}] // TableForm
```

2 $x == -1$

3 $x == -\frac{1}{2}$

4 $x == -\frac{5}{2}-\frac{\sqrt{17}}{2} \;||\; x == -\frac{5}{2}+\frac{\sqrt{17}}{2}$

5 $x == -\frac{7}{2}-\frac{\sqrt{41}}{2} \;||\; x == -\frac{7}{2}+\frac{\sqrt{41}}{2}$

6 $x == -\frac{1}{3} \;||\; x == -2$

7 $x == -\frac{3}{2}-\frac{\sqrt{\frac{19}{3}}}{2} \;||\; x == -\frac{3}{2}+\frac{\sqrt{\frac{19}{3}}}{2}$

8 $x == -\frac{9}{2}-\frac{\sqrt{73}}{2} \;||\; x == -\frac{9}{2}+\frac{\sqrt{73}}{2} \;||\; x == -3$

9 $x == -5+\frac{43}{3^{1/3}\left(-432+i\sqrt{51\,897}\right)^{1/3}}+\frac{\left(-432+i\sqrt{51\,897}\right)^{1/3}}{3^{2/3}} \;||\; x == -5-\frac{43}{2\times 3^{1/3}\left(-432+i\sqrt{51\,897}\right)^{1/3}}+\frac{43\,i\,3^{1/6}}{2\left(-432+i\sqrt{51\,897}\right)^{1/3}}$

10 $x == -7+\frac{115}{3^{1/3}\left(-2106+i\sqrt{127\,389}\right)^{1/3}}+\frac{\left(-2106+i\sqrt{127\,389}\right)^{1/3}}{3^{2/3}} \;||\; x == -7-\frac{115}{2\times 3^{1/3}\left(-2106+i\sqrt{127\,389}\right)^{1/3}}+\frac{115\,i\,3^{1/}}{2\left(-2106+i\sqrt{127}\right.}$

11 $x == -7+\frac{109}{3^{1/3}\left(-1917+i\sqrt{210\,198}\right)^{1/3}}+\frac{\left(-1917+i\sqrt{210\,198}\right)^{1/3}}{3^{2/3}} \;||\; x == -7-\frac{109}{2\times 3^{1/3}\left(-1917+i\sqrt{210\,198}\right)^{1/3}}+\frac{109\,i\,3^{1/}}{2\left(-1917+i\sqrt{210}\right.}$

12 $x == -\frac{3}{2}-\frac{\sqrt{7}}{2} \;||\; x == -\frac{3}{2}+\frac{\sqrt{7}}{2} \;||\; x == -3$

13 $x == -2+\frac{1}{6}\left(486-6\sqrt{6513}\right)^{1/3}+\frac{\left(81+\sqrt{6513}\right)^{1/3}}{6^{2/3}} \;||\; x == -2-\frac{1}{12}\left(486-6\sqrt{6513}\right)^{1/3}-\frac{i\left(486-6\sqrt{6513}\right)^{1/3}}{4\sqrt{3}}+$

14 $x == -\frac{5}{2}+\frac{31}{2\times 3^{1/3}\left(-189+2\,i\sqrt{13\,413}\right)^{1/3}}+\frac{\left(-189+2\,i\sqrt{13\,413}\right)^{1/3}}{2\times 3^{2/3}} \;||\; x == -\frac{5}{2}-\frac{31}{4\times 3^{1/3}\left(-189+2\,i\sqrt{13\,413}\right)^{1/3}}+\frac{31\,i\,3}{4\left(-189+2\,i\sqrt{}\right.}$

15 $x == -3+\frac{\left(-405+i\sqrt{32\,583}\right)^{1/3}}{6^{2/3}}+\frac{16\times 2^{2/3}}{\left(3\left(-405+i\sqrt{32\,583}\right)\right)^{1/3}} \;||\; x == -3+\frac{8\,i\,2^{2/3}\,3^{1/6}}{\left(-405+i\sqrt{32\,583}\right)^{1/3}}-\frac{i\left(-405+i\sqrt{32\,583}\right)^{1/3}}{2\times 2^{2/3}\,3^{1/6}}-\frac{\left(-40\right.}{}$

16 $x == -\frac{11}{2}-\frac{53}{2\sqrt{3\left(53+\left(1\,401\,155-18\sqrt{314\,550\,701}\right)^{1/3}+\left(1\,401\,155+18\sqrt{314\,550\,701}\right)^{1/3}\right)}}-\frac{\left(1\,401\,155-18\sqrt{314}\right.}{2\sqrt{3\left(53+\left(1\,401\,155-18\sqrt{314\,550\,701}\right)^{1/3}\right.}}$

```
DD[12, -3]
```

0

```
Table[{n, N[Expand[Roots[ Expand[DDa[n, x]] == 0, x]]]}, {n, 2, 32}] // TableForm
```

```
2   x == -1.
3   x == -0.5
4   x == -4.56155 || x == -0.438447
5   x == -6.70156 || x == -0.298438
6   x == -0.333333 || x == -2.
7   x == -2.75831 || x == -0.241694
8   x == -8.772 || x == -0.227998 || x == -3.
9   x == -0.207381 - 1.33227 × 10^-15 i || x == -2.31959 + 1.77636 × 10^-15 i || x == -12.473 - 2.22045 × 1
10  x == -0.218507 + 2.66454 × 10^-15 i || x == -1.41809 - 1.77636 × 10^-15 i || x == -19.3634 + 0. i
11  x == -0.174602 + 0. i || x == -1.80686 + 1.77636 × 10^-15 i || x == -19.0185 - 1.33227 × 10^-15 i
12  x == -2.82288 || x == -0.177124 || x == -3.
13  x == -0.14802 || x == -2.92599 + 1.25394 i || x == -2.92599 - 1.25394 i
14  x == -0.151746 + 4.44089 × 10^-16 i || x == -1.773 - 2.22045 × 10^-16 i || x == -5.57525 - 2.22045 × 10
15  x == -0.155907 - 8.88178 × 10^-16 i || x == -1.27033 + 6.66134 × 10^-16 i || x == -7.57377 + 2.22045 × 
16  x == -10.2913 - 4.44128 i || x == -10.2913 + 4.44128 i || x == -1.2665 || x == -0.150831
17  x == -10.1642 - 4.18445 i || x == -10.1642 + 4.18445 i || x == -1.54283 || x == -0.128751
18  x == -1.72599 - 6.34634 × 10^-16 i || x == -0.129805 + 4.78239 × 10^-16 i || x == -28.368 - 3.01529 × 1
19  x == -0.113483 - 2.66454 × 10^-15 i || x == -28.4047 - 4.44089 × 10^-16 i || x == -2.4818 + 3.55271 × 1
20  x == -2.01579 - 0.978644 i || x == -2.01579 + 0.978644 i || x == -41.8542 || x == -0.114201
21  x == -0.115891 + 0. i || x == -41.209 + 1.77636 × 10^-15 i || x == -1.67512 - 1.77636 × 10^-15 i || x == 
22  x == -1.22037 - 9.42146 × 10^-16 i || x == -0.117694 + 6.68801 × 10^-16 i || x == -40.5402 - 9.65607 × 
23  x == -1.47239 - 4.9035 × 10^-16 i || x == -0.10394 + 1.58688 × 10^-16 i || x == -40.557 + 8.48301 × 10^-1
24  x == -5.00304 - 2.42184 i || x == -5.00304 + 2.42184 i || x == -1.48963 || x == -0.104295
25  x == -5.03548 - 2.91604 i || x == -5.03548 + 2.91604 i || x == -1.4299 || x == -0.0991419
26  x == -5.16558 - 3.78035 i || x == -5.16558 + 3.78035 i || x == -1.16859 || x == -0.100246
27  x == -5.56913 - 3.37906 i || x == -5.56913 + 3.37906 i || x == -1.16462 || x == -0.0971295
28  x == -1.1831 - 2.4326 × 10^-16 i || x == -0.097597 + 1.6585 × 10^-16 i || x == -8.79004 - 1.59755 × 10^-1
29  x == -1.39219 - 1.17138 × 10^-16 i || x == -0.0880418 + 5.31228 × 10^-17 i || x == -8.93869 + 7.64789 × 
30  x == -1.66598 - 0.772391 i || x == -1.66598 + 0.772391 i || x == -16.1801 || x == -0.0879758
31  x == -1.65844 - 0.969339 i || x == -1.65844 + 0.969339 i || x == -16.2028 || x == -0.0802821
32  x == -0.0791241 || x == -15.809 - 12.8148 i || x == -15.809 + 12.8148 i || x == -1.65148 - 0.96678
```

```
{-1 / -0.08028210516043632`, LogIntegral[31.]}
```

```
{12.4561, 13.3152}
```

```
{-1 / -0.10429530346233817`, LogIntegral[24.]}
```

```
{9.58816, 11.2003}
```

```
N[Expand[Roots[ Expand[DDa[100, x]] == 0, x]]]
```

```
x == -0.933809 || x == -0.0372047 || x == -11.1997 - 12.3982 i ||
 x == -11.1997 + 12.3982 i || x == -2.67195 - 1.86184 i || x == -2.67195 + 1.86184 i
```

```
(-0.9338092178222002)^-1 + (-0.03720467504094746)^-1 +
 (-11.199685576035792` - 12.398224487807216` i)^-1 +
 (-11.199685576035792` + 12.398224487807216` i)^-1 +
 (-2.6719503346754907` - 1.8618449055430246` i)^-1 +
 (-2.6719503346754907` + 1.8618449055430246` i)^-1
```

```
-28.5333 - 1.38778 × 10^-17 i
```

```
DD[100, -0.03720467504094746`]
```

```
9.56179579958416`*^-15
```

```
N[Expand[Roots[ Expand[DDa[7, x]] == 0, x]]]
```

```
x == -2.75831 || x == -0.241694
```

```
ff[z_] := (z + 2.7583057392117913)
  (z + 0.24169426078820844) / (2.7583057392117913 * 0.24169426078820844)
```

```
ff[3]
```

```
28.
```

```
DD[7, 3]
```

```
28
```

```
Expand[3 / 2 (z + 2.7583057392117913) (z + 0.24169426078820844)]
```

$$1. + 4.5\, z + \frac{3\, z^2}{2}$$

```
ff[0]
```

```
1.
```

```
List[N[Expand[Roots[ Expand[DDa[93, x]] == 0, x]]]]
```

```
{x == -119.654 || x == -15.028 || x == -0.0385352 ||
  x == -2.63978 - 1.84996 i || x == -2.63978 + 1.84996 i || x == -1.}
```

```
Expand[(-9/2 - Sqrt[73]/2) (-9/2 + Sqrt[73]/2) (-3)]
```

```
-6
```

```
Expand[(-7/2 - Sqrt[41]/2) (-7/2 + Sqrt[41]/2)]
```

```
2
```

```
Limit[ ((z + 2.7583057392117913)
     (z + 0.24169426078820844) / (2.7583057392117913 * 0.24169426078820844) - 1) / z, z → 0]
```

```
4.5
```

```
Limit[ ((z + 2.7583057392117913)
    (z + 0.24169426078820844) / (2.7583057392117913 * 0.24169426078820844) / z - 1 / z), z → 0]
```

```
4.5
```

```
Limit[ ((z + 2.7583057392117913)
    (z + 0.24169426078820844) / (2.7583057392117913 * 0.24169426078820844 z) - 1 / z), z → 0]
```

```
4.5
```

```
Limit[
 ((0.6666666666666667` + 3.` z + z^2) / (2.7583057392117913 * 0.24169426078820844 z) - 1 / z),
 z → 0]
```

4.5

```
Limit[ ((0.6666666666666667` / z + 3. + z) / (0.6666666666666667`) - 1 / z), z → 0]
```

4.5

```
Limit[ ((1 / z + 3. / 0.6666666666666667` + z / 0.6666666666666667`) - 1 / z), z → 0]
```

4.5

```
Limit[ ((3. / 0.6666666666666667` + z / 0.6666666666666667`)), z → 0]
```

4.5

```
Limit[ ((3. / 0.6666666666666667`)), z → 0]
```

4.5

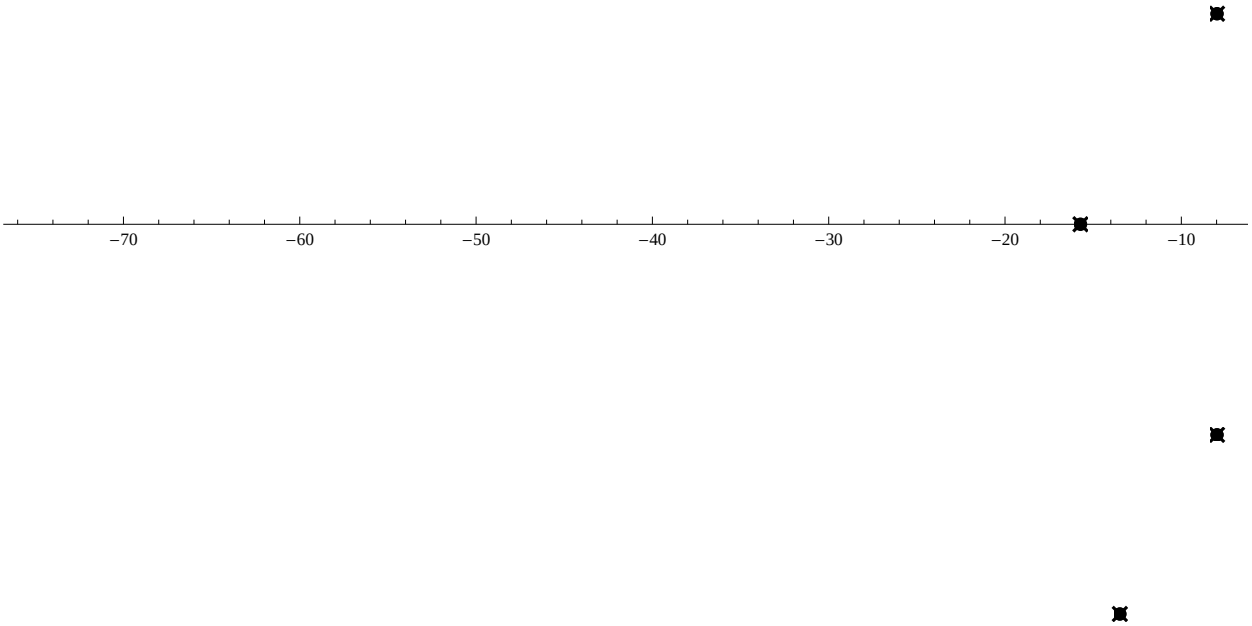
$$\text{Expand}\left[\text{FullSimplify}\left[\left(z-\left(-\frac{3}{2}-\frac{\sqrt{\frac{19}{3}}}{2}\right)\right)\left(z-\left(-\frac{3}{2}+\frac{\sqrt{\frac{19}{3}}}{2}\right)\right)\Big/\left(\left(\left(-\frac{3}{2}-\frac{\sqrt{\frac{19}{3}}}{2}\right)\right)\left(\left(-\frac{3}{2}+\frac{\sqrt{\frac{19}{3}}}{2}\right)\right)\right)\right]\right]$$

$$1+\frac{9\,z}{2}+\frac{3\,z^2}{2}$$

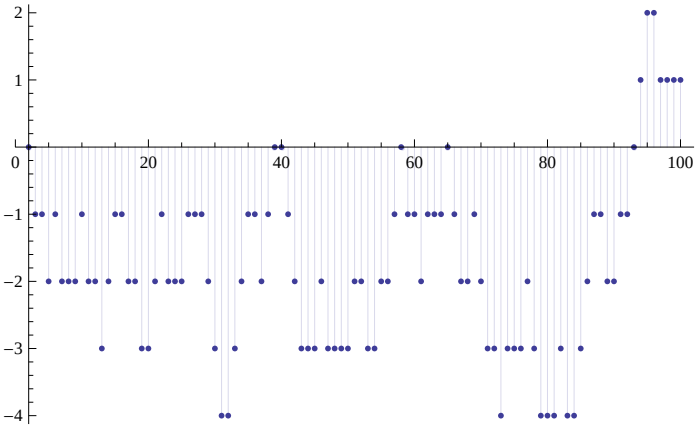
$$\text{Limit}\left[\left(\left(1+\frac{9\,z}{2}+\frac{3\,z^2}{2}\right)-1\right)\Big/ z,\ z\to 0\right]$$

$$\frac{9}{2}$$

```
RootLocusPlot[1 / Expand[DDa[117 337, x]], {k, 0, 1}, FeedbackType → None]
```


−70
−60
−50
−40
−30
−20
−10

```
DiscretePlot[ DD[n, -1], {n, 2, 100}]
```




```
Table[{n, Expand[Roots[ Expand[DDa[n, x, s]] == 0, x]]}, {n, 2, 7}] // TableForm
```

2 $2^s + x == 0$

3 $\frac{6^s}{2^s+3^s} + x == 0$

4 $1 + 2^{1+s} + 2^{1+2\,s}\,3^{-s} + 2\,x == 3^{-s}\sqrt{-2^{3+2\,s}\,9^s + \left(2^{1+2\,s} + 3^s\,\left(1 + 2^{1+s}\right)\right)^2}$ || $1 + 2^{1+s} + 2^{1+2\,s}\,3^{-s} + 3^{-s}\sqrt{-2^{3+2\,s}$

5 $15^{-s}\sqrt{-2^{3+2\,s}\,225^s + \left(2^{1+2\,s}\,3^s + 5^s\,\left(2^{1+2\,s} + 3^s\,\left(1 + 2^{1+s}\right)\right)\right)^2} == 1 + 2^{1+s} + 2^{1+2\,s}\,3^{-s} + 2^{1+2\,s}\,5^{-s} + 2\,x$ || 15^{-}

6 $x == -\frac{5^{-s}\left(15^s+2^{1+s}\,15^s+2^{1+2\,s}\,\left(3^s+5^s\right)+\sqrt{-2^{3+2\,s}\,75^s\,\left(2^{1+s}+3^s\right)+\left(2^{1+2\,s}\,3^s+5^s\,\left(2^{1+2\,s}+3^s\,\left(1+2^{1+s}\right)\right)\right)^2}\right)}{2\,\left(2^{1+s}+3^s\right)}$ || $\frac{5^{-s}\left(15^s+2^{1+s}\,15^s+2^{1+2\,s}\,\left(3^s+5^s\right)-\sqrt{\right.}}{}$

7 $\frac{35^{-s}\left(2^{1+2\,s}\,\left(15^s+21^s+35^s\right)+\sqrt{-2^{3+2\,s}\,3675^s\,\left(2^{1+s}+3^s\right)+\left(105^s\,\left(1+2^{1+s}\right)+2^{1+2\,s}\,\left(15^s+21^s+35^s\right)\right)^2}+105^s\,\left(1+2\,x\right)+2^{1+s}\,35^s\,\left(3^s+2\,x\right)\right)}{2^{1+s}+3^s} == 0$ || $\frac{35^{-s}}{}$

```
Table[{n, Expand[Roots[ Expand[DDa[n, x, s]] == 0, x]]}, {n, 2, 7}] // TableForm
```

2 $x == -2^s$

3 $x == -\frac{6^s}{2^s+3^s}$

4 $x == -\frac{1}{2} - 2^s - 2^{2\,s}\,3^{-s} - \frac{1}{2}\,3^{-s}\sqrt{-2^{3+2\,s}\,3^{2\,s} + \left(2^{1+2\,s} + 3^s + 2^{1+s}\,3^s\right)^2}$ || $x == -\frac{1}{2} - 2^s - 2^{2\,s}\,3^{-s} + \frac{1}{2}\,3^{-s}\sqrt{-2^3}$

5 $x == -\frac{1}{2} - 2^s - 2^{2\,s}\,3^{-s} - 2^{2\,s}\,5^{-s} - \frac{1}{2}\,15^{-s}\sqrt{-2^{3+2\,s}\,15^{2\,s} + \left(2^{1+2\,s}\,3^s + 2^{1+2\,s}\,5^s + 15^s + 2^{1+s}\,15^s\right)^2}$ || $x == -\frac{1}{2}$

6 $x == -\frac{2^{2\,s}\,3^s}{2^{1+s}\,5^s+15^s} - \frac{2^{2\,s}\,5^s}{2^{1+s}\,5^s+15^s} - \frac{15^s}{2\,\left(2^{1+s}\,5^s+15^s\right)} - \frac{30^s}{2^{1+s}\,5^s+15^s} - \frac{\sqrt{-2^{3+2\,s}\,15^s\,\left(2^{1+s}\,5^s+15^s\right)+\left(2^{1+2\,s}\,3^s+2^{1+2\,s}\,5^s+15^s+2^{1+s}\,15^s\right)^2}}{2\,\left(2^{1+s}\,5^s+15^s\right)}$ || x

7 $x == -\frac{2^{2\,s}\,15^s}{2^{1+s}\,35^s+105^s} - \frac{2^{2\,s}\,21^s}{2^{1+s}\,35^s+105^s} - \frac{2^{2\,s}\,35^s}{2^{1+s}\,35^s+105^s} - \frac{105^s}{2\,\left(2^{1+s}\,35^s+105^s\right)} - \frac{210^s}{2^{1+s}\,35^s+105^s} - \frac{\sqrt{-2^{3+2\,s}\,105^s\,\left(2^{1+s}\,35^s+105^s\right)+\left(2^{1+2\,s}\,15^s+\right.}}{2\,\left(2^{1+s}\,35^s+\right.}$

```
Roots[ Expand[DDa[9, x]] == 0, x]
```

$$x == -5 + \frac{\left(-432 + i\sqrt{51897}\right)^{1/3}}{3^{2/3}} + \frac{43}{\left(3\left(-432 + i\sqrt{51897}\right)\right)^{1/3}} \;||$$

$$x == -5 - \frac{\left(1 + i\sqrt{3}\right)\left(-432 + i\sqrt{51897}\right)^{1/3}}{2 \times 3^{2/3}} - \frac{43\left(1 - i\sqrt{3}\right)}{2\left(3\left(-432 + i\sqrt{51897}\right)\right)^{1/3}} \;||$$

$$x == -5 - \frac{\left(1 - i\sqrt{3}\right)\left(-432 + i\sqrt{51897}\right)^{1/3}}{2 \times 3^{2/3}} - \frac{43\left(1 + i\sqrt{3}\right)}{2\left(3\left(-432 + i\sqrt{51897}\right)\right)^{1/3}}$$

```
FullSimplify[ (-432 + i Sqrt[51897])^(1/3)/3^(2/3) + 43/(3 (-432 + i Sqrt[51897]))^(1/3) ]
```

```
Table[{n, N[Expand[Roots[ Expand[DDa[n, x]] == 0, x]]]}, {n, 2, 210}] // TableForm
```

```
2    x == -1.
3    x == -0.5
4    x == -4.56155 || x == -0.438447
5    x == -6.70156 || x == -0.298438
6    x == -0.333333 || x == -2.
7    x == -2.75831 || x == -0.241694
8    x == -8.772 || x == -0.227998 || x == -3.
9    x == -0.207381 - 1.33227*10^-15 i || x == -2.31959 + 1.77636*10^-15 i || x == -12.473 - 2.22045*1
10   x == -0.218507 + 2.66454*10^-15 i || x == -1.41809 - 1.77636*10^-15 i || x == -19.3634 + 0. i
11   x == -0.174602 + 0. i || x == -1.80686 + 1.77636*10^-15 i || x == -19.0185 - 1.33227*10^-15 i
12   x == -2.82288 || x == -0.177124 || x == -3.
13   x == -0.14802 || x == -2.92599 + 1.25394 i || x == -2.92599 - 1.25394 i
14   x == -0.151746 + 4.44089*10^-16 i || x == -1.773 - 2.22045*10^-16 i || x == -5.57525 - 2.22045*10
15   x == -0.155907 - 8.88178*10^-16 i || x == -1.27033 + 6.66134*10^-16 i || x == -7.57377 + 2.22045*
16   x == -10.2913 - 4.44128 i || x == -10.2913 + 4.44128 i || x == -1.2665 || x == -0.150831
17   x == -10.1642 - 4.18445 i || x == -10.1642 + 4.18445 i || x == -1.54283 || x == -0.128751
18   x == -1.72599 - 6.34634*10^-16 i || x == -0.129805 + 4.78239*10^-16 i || x == -28.368 - 3.01529*1
19   x == -0.113483 - 2.66454*10^-15 i || x == -28.4047 - 4.44089*10^-16 i || x == -2.4818 + 3.55271*1
20   x == -2.01579 - 0.978644 i || x == -2.01579 + 0.978644 i || x == -41.8542 || x == -0.114201
21   x == -0.115891 + 0. i || x == -41.209 + 1.77636*10^-15 i || x == -1.67512 - 1.77636*10^-15 i || x ==
22   x == -1.22037 - 9.42146*10^-16 i || x == -0.117694 + 6.68801*10^-16 i || x == -40.5402 - 9.65607*
23   x == -1.47239 - 4.9035*10^-16 i || x == -0.10394 + 1.58688*10^-16 i || x == -40.557 + 8.48301*10^
24   x == -5.00304 - 2.42184 i || x == -5.00304 + 2.42184 i || x == -1.48963 || x == -0.104295
25   x == -5.03548 - 2.91604 i || x == -5.03548 + 2.91604 i || x == -1.4299 || x == -0.0991419
26   x == -5.16558 - 3.78035 i || x == -5.16558 + 3.78035 i || x == -1.16859 || x == -0.100246
27   x == -5.56913 - 3.37906 i || x == -5.56913 + 3.37906 i || x == -1.16462 || x == -0.0971295
28   x == -1.1831 - 2.4326*10^-16 i || x == -0.097597 + 1.6585*10^-16 i || x == -8.79004 - 1.59755*10^
29   x == -1.39219 - 1.17138*10^-16 i || x == -0.0880418 + 5.31228*10^-17 i || x == -8.93869 + 7.64789
30   x == -1.66598 - 0.772391 i || x == -1.66598 + 0.772391 i || x == -16.1801 || x == -0.0879758
31   x == -1.65844 - 0.969339 i || x == -1.65844 + 0.969339 i || x == -16.2028 || x == -0.0802821
32   x == -0.0791241 || x == -15.809 - 12.8148 i || x == -15.809 + 12.8148 i || x == -1.65148 - 0.96678
33   x == -0.0796674 || x == -15.6172 - 12.6277 i || x == -15.6172 + 12.6277 i || x == -1.84299 - 0.581
34   x == -2.65999 || x == -1.43379 || x == -0.0802267 || x == -15.413 - 12.435 i || x == -15.413 + 12.4
35   x == -3.3736 || x == -1.1566 || x == -0.0808029 || x == -15.1945 - 12.2366 i || x == -15.1945 + 12
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```
36  x == -54.9842 || x == -1.15543 || x == -0.0809268 || x == -4.38973 - 2.01759 i || x == -4.38973 + 2
37  x == -54.9833 || x == -1.33294 || x == -0.0743078 || x == -4.30472 - 1.8719 i || x == -4.30472 + 1
38  x == -55.0311 || x == -1.13358 || x == -0.0747616 || x == -4.38028 - 2.55799 i || x == -4.38028 + 2
39  x == -4.42303 - 3.06569 i || x == -4.42303 + 3.06569 i || x == -55.0787 || x == -0.0752272 || x ==
40  x == -3.46801 - 2.94174 i || x == -3.46801 + 2.94174 i || x == -76.9886 || x == -0.0753676 || x ==
41  x == -76.9883 || x == -1.11969 || x == -0.0695918 || x == -3.41119 - 2.89258 i || x == -3.41119 + 2
42  x == -1.37009 - 2.23309 × 10^-15 i || x == -0.0695662 + 1.86455 × 10^-15 i || x == -75.2124 - 2.58364
43  x == -75.2121 || x == -5.23778 || x == -2.80883 || x == -1.6766 || x == -0.0646831
44  x == -74.3 || x == -6.92271 || x == -0.0648202 || x == -1.85624 - 0.391869 i || x == -1.85624 + 0.3
45  x == -73.3616 || x == -8.25697 || x == -0.0649585 || x == -1.65826 - 0.547607 i || x == -1.65826 +
46  x == -73.3879 || x == -7.88397 || x == -2.25106 || x == -1.41185 || x == -0.0652585
47  x == -73.3875 || x == -7.93385 || x == -0.0609491 || x == -1.80885 - 0.330992 i || x == -1.80885 +
48  x == -0.0610036 || x == -7.73504 - 6.00055 i || x == -7.73504 + 6.00055 i || x == -1.8178 - 0.3413
49  x == -7.65226 - 5.93046 i || x == -7.65226 + 5.93046 i || x == -1.80297 || x == -0.059176 || x == -
50  x == -0.0592813 || x == -7.84124 - 6.87275 i || x == -7.84124 + 6.87275 i || x == -1.71245 - 0.413
51  x == -2.39716 || x == -1.33615 || x == -0.0595076 || x == -7.68692 - 6.77071 i || x == -7.68692 + 6
52  x == -7.85005 - 7.58953 i || x == -7.85005 + 7.58953 i || x == -1.40695 || x == -0.0596153 || x ==
53  x == -0.056011 || x == -7.8636 - 7.58663 i || x == -7.8636 + 7.58663 i || x == -1.69173 - 0.358851
54  x == -0.0560689 || x == -9.5262 - 5.1975 i || x == -9.5262 + 5.1975 i || x == -1.69576 - 0.391668
55  x == -2.38273 || x == -1.32237 || x == -0.0562598 || x == -9.36932 - 5.00404 i || x == -9.36932 + 5
56  x == -2.44887 - 4.4718 × 10^-16 i || x == -0.0563187 + 2.95274 × 10^-16 i || x == -14.4877 - 5.12833 ×
57  x == -14.7362 || x == -6.7522 || x == -3.16449 || x == -1.12395 || x == -0.0565132
58  x == -4.18966 - 6.71377 × 10^-16 i || x == -0.0567105 + 1.8823 × 10^-16 i || x == -14.9604 - 4.38981 ×
59  x == -14.946 || x == -5.89368 || x == -3.83085 || x == -1.10936 || x == -0.0534256
60  x == -29.4075 || x == -1.10216 || x == -0.0534214 || x == -2.63511 - 2.14639 i || x == -2.63511 + 2
61  x == -29.4066 || x == -1.21414 || x == -0.0505217 || x == -2.58106 - 2.10375 i || x == -2.58106 + 2
62  x == -29.4354 || x == -1.09234 || x == -0.0506605 || x == -2.62749 - 2.31828 i || x == -2.62749 + 2
63  x == -29.0198 || x == -1.09747 || x == -0.050727 || x == -2.83265 - 2.087 i || x == -2.83265 + 2.08
64  x == -1.0972 || x == -0.0503203 || x == -22.1014 - 23.8156 i || x == -22.1014 + 23.8156 i || x == -
65  x == -0.050458 || x == -22.1175 - 23.8118 i || x == -22.1175 + 23.8118 i || x == -2.85728 - 2.3121
66  x == -1.10965 || x == -0.050451 || x == -21.6567 - 23.5126 i || x == -21.6567 + 23.5126 i || x == -
67  x == -1.2378 || x == -0.0478587 || x == -21.6565 - 23.5131 i || x == -21.6565 + 23.5131 i || x == -
68  x == -1.26133 || x == -0.0479146 || x == -21.4219 - 23.3619 i || x == -21.4219 + 23.3619 i || x ==
69  x == -1.10418 || x == -0.048033 || x == -21.4393 - 23.3567 i || x == -21.4393 + 23.3567 i || x == -
70  x == -5.75909 || x == -1.34218 || x == -0.0480273 || x == -20.9254 - 23.062 i || x == -20.9254 + 23
71  x == -5.81506 || x == -0.0456799 || x == -20.9251 - 23.0626 i || x == -20.9251 + 23.0626 i || x ==
72  x == -95.1136 || x == -0.0456949 || x == -6.27159 - 4.4454 i || x == -6.27159 + 4.4454 i || x == -1
73  x == -95.1136 || x == -0.0435771 || x == -6.29361 - 4.44749 i || x == -6.29361 + 4.44749 i || x ==
74  x == -95.1126 || x == -1.5288 || x == -0.0436652 || x == -6.15748 - 4.33415 i || x == -6.15748 + 4
75  x == -95.1592 || x == -0.0437076 || x == -6.26004 - 4.89393 i || x == -6.26004 + 4.89393 i || x ==
76  x == -95.2057 || x == -0.0437502 || x == -6.33186 - 5.377 i || x == -6.33186 + 5.377 i || x == -1.5
77  x == -95.2047 || x == -1.28804 || x == -0.0438398 || x == -6.23172 - 5.3038 i || x == -6.23172 + 5
78  x == -95.2984 || x == -0.0438358 || x == -6.42438 - 6.20052 i || x == -6.42438 + 6.20052 i || x ==
79  x == -95.2984 || x == -0.0418819 || x == -6.43456 - 6.19912 i || x == -6.43456 + 6.19912 i || x ==
80  x == -127.657 || x == -0.0419 || x == -5.25753 - 5.64872 i || x == -5.25753 + 5.64872 i || x == -1.
81  x == -127.408 || x == -0.0414732 || x == -5.38253 - 5.60845 i || x == -5.38253 + 5.60845 i || x ==
82  x == -127.407 || x == -0.0415492 || x == -5.30543 - 5.56581 i || x == -5.30543 + 5.56581 i || x ==
83  x == -127.407 || x == -0.0397954 || x == -5.31649 - 5.56221 i || x == -5.31649 + 5.56221 i || x ==
84  x == -124.2 || x == -0.0397941 || x == -6.77929 - 2.36483 i || x == -6.77929 + 2.36483 i || x == -1
85  x == -124.2 || x == -1.50744 || x == -0.039861 || x == -6.62651 - 2.08037 i || x == -6.62651 + 2.08
86  x == -124.199 || x == -2.69014 || x == -1.22318 || x == -0.0399284 || x == -6.42375 - 1.69075 i ||
87  x == -124.199 || x == -3.5047 || x == -1.09087 || x == -0.0399962 || x == -6.08281 - 0.954423 i ||
88  x == -123.105 || x == -9.50564 || x == -1.09236 || x == -0.0400176 || x == -3.62829 - 0.954346 i |
89  x == -123.105 || x == -9.48409 || x == -1.20047 || x == -0.0383865 || x == -3.58582 - 0.724003 i |
90  x == -119.625 || x == -15.2613 || x == -1.18525 || x == -0.0383853 || x == -2.44511 - 1.64011 i ||
91  x == -119.624 || x == -15.3059 || x == -1.07993 || x == -0.0384454 || x == -2.47569 - 1.82821 i ||
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92   x == -119.654 || x == -14.9805 || x == -1.08374 || x == -0.0384745 || x == -2.62141 - 1.66181 i ||
93   x == -119.654 || x == -15.028 || x == -0.0385352 || x == -2.63978 - 1.84996 i || x == -2.63978 + 1
94   x == -119.653 || x == -15.0747 || x == -0.933817 || x == -0.0385962 || x == -2.6497 - 2.01352 i ||
95   x == -119.653 || x == -15.1209 || x == -0.879194 || x == -0.0386577 || x == -2.65418 - 2.15966 i |
96   x == -0.878819 || x == -0.0386691 || x == -11.2338 - 11.2829 i || x == -11.2338 + 11.2829 i || x ==
97   x == -0.937604 || x == -0.0371394 || x == -11.2331 - 11.2843 i || x == -11.2331 + 11.2843 i || x ==
98   x == -0.935788 || x == -0.0371657 || x == -11.0739 - 11.1912 i || x == -11.0739 + 11.1912 i || x ==
99   x == -0.933874 || x == -0.037192 || x == -10.9064 - 11.0996 i || x == -10.9064 + 11.0996 i || x ==
100  x == -0.933809 || x == -0.0372047 || x == -11.1997 - 12.3982 i || x == -11.1997 + 12.3982 i || x ==
101  x == -0.0357907 || x == -11.1993 - 12.3993 i || x == -11.1993 + 12.3993 i || x == -2.63994 - 1.823
102  x == -1.0852 || x == -0.035789 || x == -10.8987 - 12.2681 i || x == -10.8987 + 12.2681 i || x == -2
103  x == -1.18423 || x == -0.0344844 || x == -10.8984 - 12.2693 i || x == -10.8984 + 12.2693 i || x ==
104  x == -1.1875 || x == -0.0344981 || x == -11.0439 - 13.0382 i || x == -11.0439 + 13.0382 i || x == -
105  x == -3.84481 || x == -1.7029 || x == -1.60874 || x == -0.0344966 || x == -10.7617 - 12.9331 i || x
106  x == -3.2499 || x == -2.65774 || x == -1.21754 || x == -0.03454 || x == -10.7773 - 12.9237 i || x =
107  x == -3.49678 || x == -2.23614 || x == -1.39379 || x == -0.033326 || x == -10.7771 - 12.9247 i || x
108  x == -4.20334 || x == -2.21237 || x == -1.39128 || x == -0.033332 || x == -14.7227 - 4.66395 i || x
109  x == -4.33157 || x == -0.0322038 || x == -14.7181 - 4.66169 i || x == -14.7181 + 4.66169 i || x ==
110  x == -6.48589 || x == -0.0322027 || x == -13.9542 - 3.19111 i || x == -13.9542 + 3.19111 i || x ==
111  x == -6.08992 || x == -0.0322378 || x == -14.056 - 3.31724 i || x == -14.056 + 3.31724 i || x == -1
112  x == -24.6692 || x == -0.0322461 || x == -6.90985 - 1.90994 i || x == -6.90985 + 1.90994 i || x ==
113  x == -24.6698 || x == -0.031191 || x == -6.93437 - 1.94792 i || x == -6.93437 + 1.94792 i || x == -
114  x == -25.0218 || x == -0.0311901 || x == -6.94579 - 3.46883 i || x == -6.94579 + 3.46883 i || x ==
115  x == -25.0082 || x == -0.0312219 || x == -6.88146 - 3.33492 i || x == -6.88146 + 3.33492 i || x ==
116  x == -25.1684 || x == -0.0312374 || x == -6.84598 - 3.81203 i || x == -6.84598 + 3.81203 i || x ==
117  x == -25.3232 || x == -0.0312529 || x == -6.80727 - 4.22044 i || x == -6.80727 + 4.22044 i || x ==
118  x == -25.3107 || x == -0.031285 || x == -6.75168 - 4.1257 i || x == -6.75168 + 4.1257 i || x == -1.
119  x == -25.2981 || x == -0.0313172 || x == -6.69151 - 4.02628 i || x == -6.69151 + 4.02628 i || x ==
120  x == -48.1479 || x == -0.0313169 || x == -3.82693 - 4.13159 i || x == -3.82693 + 4.13159 i || x ==
121  x == -48.1473 || x == -0.0308252 || x == -3.8001 - 4.1158 i || x == -3.8001 + 4.1158 i || x == -1.4
122  x == -48.1461 || x == -1.85335 || x == -1.21796 || x == -0.0308561 || x == -3.73299 - 4.09106 i ||
123  x == -48.145 || x == -2.12797 || x == -1.0844 || x == -0.030887 || x == -3.66302 - 4.06902 i || x =
124  x == -48.172 || x == -1.08892 || x == -0.0309021 || x == -3.71123 - 4.23717 i || x == -3.71123 + 4
125  x == -48.1806 || x == -1.0876 || x == -0.0305854 || x == -3.70775 - 4.28266 i || x == -3.70775 + 4
126  x == -46.8377 || x == -2.32471 || x == -1.08288 || x == -0.0305849 || x == -4.21921 - 3.27422 i ||
127  x == -46.8377 || x == -2.18177 || x == -1.18467 || x == -0.0296322 || x == -4.24025 - 3.27002 i ||
128  x == -2.18166 || x == -1.18435 || x == -0.0295103 || x == -29.0652 - 38.1714 i || x == -29.0652 + 3
129  x == -2.50665 || x == -1.07591 || x == -0.0295373 || x == -29.0651 - 38.1721 i || x == -29.0651 + 3
130  x == -1.84763 || x == -1.21598 || x == -0.0295365 || x == -29.0948 - 38.1571 i || x == -29.0948 + 3
131  x == -0.0286489 || x == -29.0948 - 38.1571 i || x == -29.0948 + 38.1571 i || x == -4.37323 - 3.737
132  x == -1.35361 || x == -0.0286486 || x == -28.3695 - 37.8081 i || x == -28.3695 + 37.8081 i || x ==
133  x == -2.49801 || x == -1.17412 || x == -0.0286733 || x == -28.3694 - 37.8089 i || x == -28.3694 + 3
134  x == -3.07632 || x == -1.07292 || x == -0.028698 || x == -28.3693 - 37.8096 i || x == -28.3693 + 37
135  x == -1.07388 || x == -0.028706 || x == -28.1278 - 37.6917 i || x == -28.1278 + 37.6917 i || x == -
136  x == -6.69309 || x == -1.07487 || x == -0.0287139 || x == -27.8813 - 37.5758 i || x == -27.8813 + 3
137  x == -6.65433 || x == -1.16264 || x == -0.0278747 || x == -27.8813 - 37.5758 i || x == -27.8813 + 3
138  x == -1.72503 || x == -1.42647 || x == -0.0278741 || x == -27.9125 - 37.5567 i || x == -27.9125 + 3
139  x == -0.0270847 || x == -27.9124 - 37.5567 i || x == -27.9124 + 37.5567 i || x == -5.52578 - 1.851
140  x == -9.21052 || x == -2.89781 || x == -1.64281 || x == -0.0270844 || x == -27.1109 - 37.242 i || x
141  x == -9.28788 || x == -1.28764 || x == -0.0271052 || x == -27.1109 - 37.2428 i || x == -27.1109 + 3
142  x == -9.3619 || x == -1.15506 || x == -0.027126 || x == -27.1109 - 37.2437 i || x == -27.1109 + 37
143  x == -9.43294 || x == -1.06685 || x == -0.027147 || x == -27.1108 - 37.2445 i || x == -27.1108 + 37
144  x == -151.703 || x == -1.06684 || x == -0.0271494 || x == -8.4411 - 7.65509 i || x == -8.4411 + 7.6
145  x == -151.703 || x == -0.0271704 || x == -8.46702 - 7.64799 i || x == -8.46702 + 7.64799 i || x ==
146  x == -151.703 || x == -0.945996 || x == -0.0271914 || x == -8.49296 - 7.64127 i || x == -8.49296 +
147  x == -151.703 || x == -0.944638 || x == -0.0272017 || x == -8.36707 - 7.56722 i || x == -8.36707 +
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148  x == -151.702 || x == -0.943218 || x == -0.027212 || x == -8.23314 - 7.49498 i || x == -8.23314 + 7
149  x == -151.702 || x == -0.0264573 || x == -8.23185 - 7.49733 i || x == -8.23185 + 7.49733 i || x ==
150  x == -151.828 || x == -0.0264571 || x == -8.66147 - 8.91413 i || x == -8.66147 + 8.91413 i || x ==
151  x == -151.828 || x == -1.06045 || x == -0.025745 || x == -8.66086 - 8.91542 i || x == -8.66086 + 8
152  x == -151.87 || x == -1.06109 || x == -0.0257507 || x == -8.70023 - 9.28898 i || x == -8.70023 + 9
153  x == -151.869 || x == -1.06325 || x == -0.0257594 || x == -8.61605 - 9.24125 i || x == -8.61605 + 9
154  x == -151.867 || x == -1.16065 || x == -0.0257589 || x == -8.42351 - 9.15566 i || x == -8.42351 + 9
155  x == -151.868 || x == -1.06812 || x == -0.0257768 || x == -8.43922 - 9.14843 i || x == -8.43922 + 9
156  x == -151.994 || x == -1.06542 || x == -0.0257766 || x == -8.71743 - 10.27 i || x == -8.71743 + 10
157  x == -151.994 || x == -1.13911 || x == -0.0251009 || x == -8.71718 - 10.2709 i || x == -8.71718 + 1
158  x == -151.994 || x == -1.0612 || x == -0.0251174 || x == -8.72834 - 10.2658 i || x == -8.72834 + 10
159  x == -151.994 || x == -0.025134 || x == -8.73953 - 10.2608 i || x == -8.73953 + 10.2608 i || x == -
160  x == -196.807 || x == -0.0251371 || x == -7.33592 - 9.28377 i || x == -7.33592 + 9.28377 i || x ==
161  x == -196.807 || x == -0.949446 || x == -0.0251537 || x == -7.34738 - 9.27642 i || x == -7.34738 +
162  x == -195.654 || x == -0.949234 || x == -0.0251577 || x == -7.94506 - 8.87922 i || x == -7.94506 +
163  x == -195.654 || x == -0.0245136 || x == -7.9447 - 8.88038 i || x == -7.9447 + 8.88038 i || x == -2
164  x == -195.654 || x == -0.0245211 || x == -7.87157 - 8.84298 i || x == -7.87157 + 8.84298 i || x ==
165  x == -195.653 || x == -1.0642 || x == -0.0245207 || x == -7.7054 - 8.77815 i || x == -7.7054 + 8.77
166  x == -195.653 || x == -0.0245361 || x == -7.71904 - 8.7707 i || x == -7.71904 + 8.7707 i || x == -2
167  x == -195.653 || x == -1.06011 || x == -0.0239238 || x == -7.71874 - 8.772 i || x == -7.71874 + 8.7
168  x == -190.809 || x == -1.05945 || x == -0.0239236 || x == -9.99803 - 4.64917 i || x == -9.99803 + 4
169  x == -190.809 || x == -1.05765 || x == -0.0236361 || x == -10.0149 - 4.65844 i || x == -10.0149 + 4
170  x == -190.809 || x == -1.14235 || x == -0.0236358 || x == -9.68506 - 4.26027 i || x == -9.68506 + 4
171  x == -190.808 || x == -1.14955 || x == -0.0236425 || x == -9.50415 - 4.03762 i || x == -9.50415 + 4
172  x == -190.808 || x == -4.10213 || x == -2.33971 || x == -1.1578 || x == -0.0236492 || x == -9.2845
173  x == -190.808 || x == -4.22018 || x == -2.12422 || x == -1.27201 || x == -0.0230811 || x == -9.276
174  x == -190.807 || x == -6.53357 || x == -0.0230808 || x == -8.37236 - 3.09005 i || x == -8.37236 + 3
175  x == -190.806 || x == -8.39447 || x == -0.023087 || x == -7.48652 - 3.02772 i || x == -7.48652 + 3
176  x == -189.571 || x == -12.4248 || x == -0.0230901 || x == -6.09039 - 2.69806 i || x == -6.09039 + 2
177  x == -189.571 || x == -12.362 || x == -0.0231029 || x == -6.05239 - 2.5223 i || x == -6.05239 + 2.5
178  x == -189.571 || x == -12.2961 || x == -1.92559 || x == -1.17195 || x == -0.0231158 || x == -6.005
179  x == -189.571 || x == -12.3016 || x == -1.73091 || x == -1.32279 || x == -0.0225728 || x == -6.025
180  x == -181.561 || x == -25.7964 || x == -1.64123 || x == -1.33409 || x == -0.0225728 || x == -3.322
181  x == -181.561 || x == -25.7965 || x == -0.0220557 || x == -3.33482 - 3.27141 i || x == -3.33482 + 3
182  x == -181.56 || x == -25.8667 || x == -0.0220554 || x == -3.42675 - 3.53013 i || x == -3.42675 + 3
183  x == -181.56 || x == -25.864 || x == -0.0220666 || x == -3.37934 - 3.5068 i || x == -3.37934 + 3.5
184  x == -181.591 || x == -25.5937 || x == -0.0220702 || x == -3.50366 - 3.43117 i || x == -3.50366 + 3
185  x == -181.591 || x == -25.5909 || x == -1.47035 || x == -1.42021 || x == -0.0220813 || x == -3.452
186  x == -181.59 || x == -25.6629 || x == -0.0220811 || x == -3.53177 - 3.65572 i || x == -3.53177 + 3
187  x == -181.59 || x == -25.6601 || x == -0.0220923 || x == -3.48842 - 3.63279 i || x == -3.48842 + 3
188  x == -181.589 || x == -25.6944 || x == -0.0220978 || x == -3.50118 - 3.73883 i || x == -3.50118 + 3
189  x == -181.62 || x == -25.4213 || x == -0.0221014 || x == -3.62651 - 3.66971 i || x == -3.62651 + 3
190  x == -181.619 || x == -25.4945 || x == -0.0221011 || x == -3.67968 - 3.90009 i || x == -3.67968 + 3
191  x == -181.619 || x == -25.4946 || x == -0.021605 || x == -3.68724 - 3.89815 i || x == -3.68724 + 3
192  x == -0.0216067 || x == -15.165 - 18.2884 i || x == -15.165 + 18.2884 i || x == -3.70452 - 3.97526
193  x == -0.021133 || x == -15.165 - 18.2884 i || x == -15.165 + 18.2884 i || x == -3.71221 - 3.97326
194  x == -0.0211428 || x == -15.1647 - 18.29 i || x == -15.1647 + 18.29 i || x == -3.6752 - 3.95015 i |
195  x == -0.0211426 || x == -15.1999 - 18.2708 i || x == -15.1999 + 18.2708 i || x == -3.71528 - 4.174
196  x == -0.0211449 || x == -14.9925 - 18.1742 i || x == -14.9925 + 18.1742 i || x == -3.9216 - 4.0317
197  x == -0.0206915 || x == -14.9924 - 18.1742 i || x == -14.9924 + 18.1742 i || x == -3.92895 - 4.036
198  x == -0.0206914 || x == -14.5355 - 18.0034 i || x == -14.5355 + 18.0034 i || x == -4.36636 - 3.547
199  x == -0.0202577 || x == -14.5354 - 18.0034 i || x == -14.5354 + 18.0034 i || x == -4.37571 - 3.548
200  x == -0.020259 || x == -14.9136 - 19.6281 i || x == -14.9136 + 19.6281 i || x == -3.99629 - 3.4511
201  x == -0.0202676 || x == -14.9135 - 19.6295 i || x == -14.9135 + 19.6295 i || x == -3.95661 - 3.426
202  x == -0.0202762 || x == -14.9135 - 19.6309 i || x == -14.9135 + 19.6309 i || x == -3.91493 - 3.389
203  x == -0.0202849 || x == -14.9134 - 19.6323 i || x == -14.9134 + 19.6323 i || x == -3.87107 - 3.359
```

```
204   x == -0.0202848 || x == -14.5156 - 19.5042 i || x == -14.5156 + 19.5042 i || x == -4.22436 - 2.756
205   x == -0.0202934 || x == -14.5157 - 19.5057 i || x == -14.5157 + 19.5057 i || x == -4.16513 - 2.698
206   x == -1.70658 || x == -1.29194 || x == -0.0203021 || x == -14.5158 - 19.5072 i || x == -14.5158 + 1
207   x == -1.56629 || x == -1.34155 || x == -0.0203064 || x == -14.5297 - 19.4966 i || x == -14.5297 + 1
208   x == -1.55773 || x == -1.3487 || x == -0.0203084 || x == -14.6571 - 20.2321 i || x == -14.6571 + 20
209   x == -1.88159 || x == -1.15282 || x == -0.0203171 || x == -14.6572 - 20.2334 i || x == -14.6572 + 2
210   x == -6.71284 || x == -1.05502 || x == -0.0203171 || x == -13.8507 - 20.0715 i || x == -13.8507 + 2
```

$$\text{FullSimplify}\left[-3+\frac{\left(-405+i\sqrt{32583}\right)^{1/3}}{6^{2/3}}+\frac{16\times 2^{2/3}}{\left(3\left(-405+i\sqrt{32583}\right)\right)^{1/3}}\right]$$

$$\text{Root}\left[3+22\,\#1+18\,\#1^2+2\,\#1^3\ \&,\ 3\right]$$

```
N[Expand[Roots[ Expand[DDa[10 000, x]] == 0, x]]]
```

```
x == -1005.17 || x == -12.5619 || x == -0.000803511 || x == -25.9197 - 61.2147 i ||
 x == -25.9197 + 61.2147 i || x == -9.95084 - 13.237 i || x == -9.95084 + 13.237 i ||
 x == -4.34989 - 4.84639 i || x == -4.34989 + 4.84639 i || x == -2.23696 - 1.84432 i ||
 x == -2.23696 + 1.84432 i || x == -1.17804 - 0.181571 i || x == -1.17804 + 0.181571 i
```

```
-1 / -0.0008035114443394241`
```

```
1244.537345478771`
```

```
N[P[10 000, 1]]
```

```
1247.1
```

```
N[Expand[Roots[ Expand[DDa[30 000, x]] == 0, x]]]
```

```
x == -354.04 || x == -10.0771 || x == -0.964132 || x == -0.000305817 || x == -26.0425 - 60.5324 i ||
 x == -26.0425 + 60.5324 i || x == -9.43491 - 16.2343 i || x == -9.43491 + 16.2343 i ||
 x == -5.07174 - 5.86069 i || x == -5.07174 + 5.86069 i || x == -3.07235 - 2.56054 i ||
 x == -3.07235 + 2.56054 i || x == -1.80433 - 0.707176 i || x == -1.80433 + 0.707176 i
```

```
N[P[30 000, 1]]
```

```
3272.65
```

```
-1 / -0.0003058170781135937`
```

```
3269.93
```

```
N[Expand[Roots[ Expand[DDa[10, x]] == 9, x]]]
```

```
x == 0.920094 + 1.77636 × 10^-15 i || x == -19.2035 - 1.33227 × 10^-15 i || x == -2.71662 + 0. i
```

```
DDa[100, -11.199718313735843` + 12.398284753324173` i]
```

```
1. - 2.91038 × 10^-11 i
```

$$\text{FullSimplify}\left[\left\{1\Big/\left(-\frac{5}{2}-\frac{\sqrt{17}}{2}\right),\ 1\Big/\left(-\frac{5}{2}+\frac{\sqrt{17}}{2}\right)\right\}\right]$$

$$\left\{\frac{1}{4}\left(-5+\sqrt{17}\right),\ \frac{1}{4}\left(-5-\sqrt{17}\right)\right\}$$

$$\text{Simplify}\left[\left\{1\Big/\left(-5+\frac{43}{3^{1/3}\left(-432+i\sqrt{51\,897}\right)^{1/3}}+\frac{\left(-432+i\sqrt{51\,897}\right)^{1/3}}{3^{2/3}}\right),\right.\right.$$

$$1\Big/\left(-5-\frac{43}{2\times 3^{1/3}\left(-432+i\sqrt{51\,897}\right)^{1/3}}+\frac{43\,i\,3^{1/6}}{2\left(-432+i\sqrt{51\,897}\right)^{1/3}}-\frac{\left(-432+i\sqrt{51\,897}\right)^{1/3}}{2\times 3^{2/3}}-\right.$$

$$\left.\frac{i\left(-432+i\sqrt{51\,897}\right)^{1/3}}{2\times 3^{1/6}}\right),\ 1\Big/\left(-5-\frac{43}{2\times 3^{1/3}\left(-432+i\sqrt{51\,897}\right)^{1/3}}-\right.$$

$$\left.\left.\frac{43\,i\,3^{1/6}}{2\left(-432+i\sqrt{51\,897}\right)^{1/3}}-\frac{\left(-432+i\sqrt{51\,897}\right)^{1/3}}{2\times 3^{2/3}}+\frac{i\left(-432+i\sqrt{51\,897}\right)^{1/3}}{2\times 3^{1/6}}\right)\right\}\right]$$

$$\left\{\frac{1}{-5+\frac{\left(-432+i\sqrt{51\,897}\right)^{1/3}}{3^{2/3}}+\frac{43}{\left(3\,i\left(432\,i+\sqrt{51\,897}\right)\right)^{1/3}}},\ \left(6\,i\left(-432+i\sqrt{51\,897}\right)^{1/3}\right)\Big/\right.$$

$$\left(-43\,i\,3^{1/6}\left(-3\,i+\sqrt{3}\right)-30\,i\left(-432+i\sqrt{51\,897}\right)^{1/3}+3^{1/3}\left(-i+\sqrt{3}\right)\left(-432+i\sqrt{51\,897}\right)^{2/3}\right),$$

$$-\left(6\,i\left(-432+i\sqrt{51\,897}\right)^{1/3}\right)\Big/$$

$$\left.\left(43\,i\,3^{1/6}\left(3\,i+\sqrt{3}\right)+30\,i\left(-432+i\sqrt{51\,897}\right)^{1/3}+3^{1/3}\left(i+\sqrt{3}\right)\left(-432+i\sqrt{51\,897}\right)^{2/3}\right)\right\}$$

$$\text{FullSimplify}\left[\left(-5+\frac{\left(-432+i\sqrt{51\,897}\right)^{1/3}}{3^{2/3}}+\frac{43}{\left(3\,i\left(432\,i+\sqrt{51\,897}\right)\right)^{1/3}}\right)\right]$$

$$\text{Root}\left[6+32\,\#1+15\,\#1^2+\#1^3\ \&,\ 3\right]$$

```
N[Roots[ Expand[DDa[30 000, x]] == 0, x]]
```

```
x == -354.04 || x == -10.0771 || x == -0.964132 || x == -0.000305817 || x == -26.0425 - 60.5324 i ||
  x == -26.0425 + 60.5324 i || x == -9.43491 - 16.2343 i || x == -9.43491 + 16.2343 i ||
  x == -5.07174 - 5.86069 i || x == -5.07174 + 5.86069 i || x == -3.07235 - 2.56054 i ||
  x == -3.07235 + 2.56054 i || x == -1.80433 - 0.707176 i || x == -1.80433 + 0.707176 i
```

```
NRoots[ DDa[210, x] == 0, x]
```

```
x == -13.8507 - 20.0715 i || x == -13.8507 + 20.0715 i || x == -6.71284 ||
  x == -2.38022 - 1.30259 i || x == -2.38022 + 1.30259 i || x == -1.05502 || x == -0.0203171
```

```
List @@ NRoots[ DDa[210, x] == 0, x][[All, 2]]
```

```
Table[{n, NRoots[ DDa[n, x] == 0, x]}, {n, 2, 210}] // TableForm
```

```
2     x == -1.
3     x == -0.5
4     x == -4.56155 || x == -0.438447
5     x == -6.70156 || x == -0.298438
6     x == -2. || x == -0.333333
7     x == -2.75831 || x == -0.241694
8     x == -8.772 || x == -3. || x == -0.227998
9     x == -12.473 || x == -2.31959 || x == -0.207381
10    x == -19.3634 || x == -1.41809 || x == -0.218507
```

```
11  x == -19.0185 || x == -1.80686 || x == -0.174602
12  x == -3. || x == -2.82288 || x == -0.177124
13  x == -2.92599 - 1.25394 i || x == -2.92599 + 1.25394 i || x == -0.14802
14  x == -5.57525 || x == -1.773 || x == -0.151746
15  x == -7.57377 || x == -1.27033 || x == -0.155907
16  x == -10.2913 - 4.44128 i || x == -10.2913 + 4.44128 i || x == -1.2665 || x == -0.150831
17  x == -10.1642 - 4.18445 i || x == -10.1642 + 4.18445 i || x == -1.54283 || x == -0.128751
18  x == -28.368 || x == -3.77618 || x == -1.72599 || x == -0.129805
19  x == -28.4047 || x == -3. || x == -2.4818 || x == -0.113483
20  x == -41.8542 || x == -2.01579 - 0.978644 i || x == -2.01579 + 0.978644 i || x == -0.114201
21  x == -41.209 || x == -3. || x == -1.67512 || x == -0.115891
22  x == -40.5402 || x == -4.12173 || x == -1.22037 || x == -0.117694
23  x == -40.557 || x == -3.86667 || x == -1.47239 || x == -0.10394
24  x == -5.00304 - 2.42184 i || x == -5.00304 + 2.42184 i || x == -1.48963 || x == -0.104295
25  x == -5.03548 - 2.91604 i || x == -5.03548 + 2.91604 i || x == -1.4299 || x == -0.0991419
26  x == -5.16558 - 3.78035 i || x == -5.16558 + 3.78035 i || x == -1.16859 || x == -0.100246
27  x == -5.56913 - 3.37906 i || x == -5.56913 + 3.37906 i || x == -1.16462 || x == -0.0971295
28  x == -8.79004 || x == -4.72927 || x == -1.1831 || x == -0.097597
29  x == -8.93869 || x == -4.38108 || x == -1.39219 || x == -0.0880418
30  x == -16.1801 || x == -1.66598 - 0.772391 i || x == -1.66598 + 0.772391 i || x == -0.0879758
31  x == -16.2028 || x == -1.65844 - 0.969339 i || x == -1.65844 + 0.969339 i || x == -0.0802821
32  x == -15.809 - 12.8148 i || x == -15.809 + 12.8148 i || x == -1.65148 - 0.966781 i || x == -1.6514
33  x == -15.6172 - 12.6277 i || x == -15.6172 + 12.6277 i || x == -1.84299 - 0.58114 i || x == -1.842
34  x == -15.413 - 12.435 i || x == -15.413 + 12.435 i || x == -2.65999 || x == -1.43379 || x == -0.080
35  x == -15.1945 - 12.2366 i || x == -15.1945 + 12.2366 i || x == -3.3736 || x == -1.1566 || x == -0.0
36  x == -54.9842 || x == -4.38973 - 2.01759 i || x == -4.38973 + 2.01759 i || x == -1.15543 || x == -0
37  x == -54.9833 || x == -4.30472 - 1.8719 i || x == -4.30472 + 1.8719 i || x == -1.33294 || x == -0.0
38  x == -55.0311 || x == -4.38028 - 2.55799 i || x == -4.38028 + 2.55799 i || x == -1.13358 || x == -0
39  x == -55.0787 || x == -4.42303 - 3.06569 i || x == -4.42303 + 3.06569 i || x == -1. || x == -0.0752
40  x == -76.9886 || x == -3.46801 - 2.94174 i || x == -3.46801 + 2.94174 i || x == -1. || x == -0.0753
41  x == -76.9883 || x == -3.41119 - 2.89258 i || x == -3.41119 + 2.89258 i || x == -1.11969 || x == -0
42  x == -75.2124 || x == -5. || x == -3.34792 || x == -1.37009 || x == -0.0695662
43  x == -75.2121 || x == -5.23778 || x == -2.80883 || x == -1.6766 || x == -0.0646831
44  x == -74.3 || x == -6.92271 || x == -1.85624 - 0.391869 i || x == -1.85624 + 0.391869 i || x == -0.
45  x == -73.3616 || x == -8.25697 || x == -1.65826 - 0.547607 i || x == -1.65826 + 0.547607 i || x ==
46  x == -73.3879 || x == -7.88397 || x == -2.25106 || x == -1.41185 || x == -0.0652585
47  x == -73.3875 || x == -7.93385 || x == -1.80885 - 0.330992 i || x == -1.80885 + 0.330992 i || x ==
48  x == -7.73504 - 6.00055 i || x == -7.73504 + 6.00055 i || x == -1.8178 - 0.341339 i || x == -1.817
49  x == -7.65226 - 5.93046 i || x == -7.65226 + 5.93046 i || x == -2. || x == -1.80297 || x == -0.0591
50  x == -7.84124 - 6.87275 i || x == -7.84124 + 6.87275 i || x == -1.71245 - 0.413114 i || x == -1.71
51  x == -7.68692 - 6.77071 i || x == -7.68692 + 6.77071 i || x == -2.39716 || x == -1.33615 || x == -0
52  x == -7.85005 - 7.58953 i || x == -7.85005 + 7.58953 i || x == -2. || x == -1.40695 || x == -0.0596
53  x == -7.8636 - 7.58663 i || x == -7.8636 + 7.58663 i || x == -1.69173 - 0.358851 i || x == -1.6917
54  x == -9.5262 - 5.1975 i || x == -9.5262 + 5.1975 i || x == -1.69576 - 0.391668 i || x == -1.69576 +
55  x == -9.36932 - 5.00404 i || x == -9.36932 + 5.00404 i || x == -2.38273 || x == -1.32237 || x == -0
56  x == -14.4877 || x == -7.50714 || x == -2.44887 || x == -1.33333 || x == -0.0563187
57  x == -14.7362 || x == -6.7522 || x == -3.16449 || x == -1.12395 || x == -0.0565132
58  x == -14.9604 || x == -5.62659 || x == -4.18966 || x == -1. || x == -0.0567105
59  x == -14.946 || x == -5.89368 || x == -3.83085 || x == -1.10936 || x == -0.0534256
60  x == -29.4075 || x == -2.63511 - 2.14639 i || x == -2.63511 + 2.14639 i || x == -1.10216 || x == -0
61  x == -29.4066 || x == -2.58106 - 2.10375 i || x == -2.58106 + 2.10375 i || x == -1.21414 || x == -0
62  x == -29.4354 || x == -2.62749 - 2.31828 i || x == -2.62749 + 2.31828 i || x == -1.09234 || x == -0
63  x == -29.0198 || x == -2.83265 - 2.087 i || x == -2.83265 + 2.087 i || x == -1.09747 || x == -0.050
64  x == -22.1014 - 23.8156 i || x == -22.1014 + 23.8156 i || x == -2.82482 - 2.09132 i || x == -2.824
65  x == -22.1175 - 23.8118 i || x == -22.1175 + 23.8118 i || x == -2.85728 - 2.31217 i || x == -2.857
66  x == -21.6567 - 23.5126 i || x == -21.6567 + 23.5126 i || x == -3.26321 - 1.39191 i || x == -3.263
```

```
67   x == -21.6565 - 23.5131 i || x == -21.6565 + 23.5131 i || x == -3.20069 - 1.28435 i || x == -3.200
68   x == -21.4219 - 23.3619 i || x == -21.4219 + 23.3619 i || x == -3.4235 - 0.370953 i || x == -3.423
69   x == -21.4393 - 23.3567 i || x == -21.4393 + 23.3567 i || x == -3.48455 - 1.16761 i || x == -3.484
70   x == -20.9254 - 23.062 i || x == -20.9254 + 23.062 i || x == -5.75909 || x == -2. || x == -1.34218 |
71   x == -20.9251 - 23.0626 i || x == -20.9251 + 23.0626 i || x == -5.81506 || x == -1.64453 - 0.30105
72   x == -95.1136 || x == -6.27159 - 4.4454 i || x == -6.27159 + 4.4454 i || x == -1.64878 - 0.291287
73   x == -95.1136 || x == -6.29361 - 4.44749 i || x == -6.29361 + 4.44749 i || x == -1.62782 - 0.52457
74   x == -95.1126 || x == -6.15748 - 4.33415 i || x == -6.15748 + 4.33415 i || x == -2. || x == -1.5288
75   x == -95.1592 || x == -6.26004 - 4.89393 i || x == -6.26004 + 4.89393 i || x == -1.63852 - 0.23878
76   x == -95.2057 || x == -6.33186 - 5.377 i || x == -6.33186 + 5.377 i || x == -1.54343 - 0.350486 i |
77   x == -95.2047 || x == -6.23172 - 5.3038 i || x == -6.23172 + 5.3038 i || x == -2. || x == -1.28804 |
78   x == -95.2984 || x == -6.42438 - 6.20052 i || x == -6.42438 + 6.20052 i || x == -1.40451 - 0.43513
79   x == -95.2984 || x == -6.43456 - 6.19912 i || x == -6.43456 + 6.19912 i || x == -1.39531 - 0.55924
80   x == -127.657 || x == -5.25753 - 5.64872 i || x == -5.25753 + 5.64872 i || x == -1.39306 - 0.56554
81   x == -127.408 || x == -5.38253 - 5.60845 i || x == -5.38253 + 5.60845 i || x == -1.3929 - 0.561078
82   x == -127.407 || x == -5.30543 - 5.56581 i || x == -5.30543 + 5.56581 i || x == -1.47015 - 0.37284
83   x == -127.407 || x == -5.31649 - 5.56221 i || x == -5.31649 + 5.56221 i || x == -1.45997 - 0.51681
84   x == -124.2 || x == -6.77929 - 2.36483 i || x == -6.77929 + 2.36483 i || x == -1.60076 - 0.513274
85   x == -124.2 || x == -6.62651 - 2.08037 i || x == -6.62651 + 2.08037 i || x == -2. || x == -1.50744 |
86   x == -124.199 || x == -6.42375 - 1.69075 i || x == -6.42375 + 1.69075 i || x == -2.69014 || x == -1
87   x == -124.199 || x == -6.08281 - 0.954423 i || x == -6.08281 + 0.954423 i || x == -3.5047 || x == -
88   x == -123.105 || x == -9.50564 || x == -3.62829 - 0.954346 i || x == -3.62829 + 0.954346 i || x ==
89   x == -123.105 || x == -9.48409 || x == -3.58582 - 0.724003 i || x == -3.58582 + 0.724003 i || x ==
90   x == -119.625 || x == -15.2613 || x == -2.44511 - 1.64011 i || x == -2.44511 + 1.64011 i || x == -1
91   x == -119.624 || x == -15.3059 || x == -2.47569 - 1.82821 i || x == -2.47569 + 1.82821 i || x == -1
92   x == -119.654 || x == -14.9805 || x == -2.62141 - 1.66181 i || x == -2.62141 + 1.66181 i || x == -1
93   x == -119.654 || x == -15.028 || x == -2.63978 - 1.84996 i || x == -2.63978 + 1.84996 i || x == -1.
94   x == -119.653 || x == -15.0747 || x == -2.6497 - 2.01352 i || x == -2.6497 + 2.01352 i || x == -0.9
95   x == -119.653 || x == -15.1209 || x == -2.65418 - 2.15966 i || x == -2.65418 + 2.15966 i || x == -0
96   x == -11.2338 - 11.2829 i || x == -11.2338 + 11.2829 i || x == -2.66463 - 2.19985 i || x == -2.664
97   x == -11.2331 - 11.2843 i || x == -11.2331 + 11.2843 i || x == -2.63671 - 2.16774 i || x == -2.636
98   x == -11.0739 - 11.1912 i || x == -11.0739 + 11.1912 i || x == -2.79673 - 2.02719 i || x == -2.796
99   x == -10.9064 - 11.0996 i || x == -10.9064 + 11.0996 i || x == -2.96526 - 1.85389 i || x == -2.965
100  x == -11.1997 - 12.3982 i || x == -11.1997 + 12.3982 i || x == -2.67195 - 1.86184 i || x == -2.671
101  x == -11.1993 - 12.3993 i || x == -11.1993 + 12.3993 i || x == -2.63994 - 1.82348 i || x == -2.639
102  x == -10.8987 - 12.2681 i || x == -10.8987 + 12.2681 i || x == -2.89793 - 1.19859 i || x == -2.897
103  x == -10.8984 - 12.2693 i || x == -10.8984 + 12.2693 i || x == -2.84939 - 1.11054 i || x == -2.849
104  x == -11.0439 - 13.0382 i || x == -11.0439 + 13.0382 i || x == -2.70226 - 1.13906 i || x == -2.702
105  x == -10.7617 - 12.9331 i || x == -10.7617 + 12.9331 i || x == -3.84481 || x == -1.7029 || x == -1.
106  x == -10.7773 - 12.9237 i || x == -10.7773 + 12.9237 i || x == -3.2499 || x == -2.65774 || x == -1.
107  x == -10.7771 - 12.9247 i || x == -10.7771 + 12.9247 i || x == -3.49678 || x == -2.23614 || x == -1
108  x == -14.7227 - 4.66395 i || x == -14.7227 + 4.66395 i || x == -4.20334 || x == -2.21237 || x == -1
109  x == -14.7181 - 4.66169 i || x == -14.7181 + 4.66169 i || x == -4.33157 || x == -1.74284 - 0.23675
110  x == -13.9542 - 3.19111 i || x == -13.9542 + 3.19111 i || x == -6.48589 || x == -1.42959 - 0.59971
111  x == -14.056 - 3.31724 i || x == -14.056 + 3.31724 i || x == -6.08992 || x == -1.52579 - 0.428758
112  x == -24.6692 || x == -6.90985 - 1.90994 i || x == -6.90985 + 1.90994 i || x == -1.52512 - 0.43575
113  x == -24.6698 || x == -6.93437 - 1.94792 i || x == -6.93437 + 1.94792 i || x == -1.50083 - 0.56925
114  x == -25.0218 || x == -6.94579 - 3.46883 i || x == -6.94579 + 3.46883 i || x == -1.31344 - 0.67925
115  x == -25.0082 || x == -6.88146 - 3.33492 i || x == -6.88146 + 3.33492 i || x == -1.38452 - 0.57951
116  x == -25.1684 || x == -6.84598 - 3.81203 i || x == -6.84598 + 3.81203 i || x == -1.33992 - 0.57916
117  x == -25.3232 || x == -6.80727 - 4.22044 i || x == -6.80727 + 4.22044 i || x == -1.30121 - 0.57687
118  x == -25.3107 || x == -6.75168 - 4.1257 i || x == -6.75168 + 4.1257 i || x == -1.36305 - 0.465703
119  x == -25.2981 || x == -6.69151 - 4.02628 i || x == -6.69151 + 4.02628 i || x == -1.42951 - 0.29197
120  x == -48.1479 || x == -3.82693 - 4.13159 i || x == -3.82693 + 4.13159 i || x == -1.44063 - 0.27466
121  x == -48.1473 || x == -3.8001 - 4.1158 i || x == -3.8001 + 4.1158 i || x == -1.46799 - 0.231301 i |
122  x == -48.1461 || x == -3.73299 - 4.09106 i || x == -3.73299 + 4.09106 i || x == -1.85335 || x == -1
```

```
123  x == -48.145 || x == -3.66302 - 4.06902 i || x == -3.66302 + 4.06902 i || x == -2.12797 || x == -1.
124  x == -48.172 || x == -3.71123 - 4.23717 i || x == -3.71123 + 4.23717 i || x == -2. || x == -1.08892
125  x == -48.1806 || x == -3.70775 - 4.28266 i || x == -3.70775 + 4.28266 i || x == -2. || x == -1.0876
126  x == -46.8377 || x == -4.21921 - 3.27422 i || x == -4.21921 + 3.27422 i || x == -2.32471 || x == -1
127  x == -46.8377 || x == -4.24025 - 3.27002 i || x == -4.24025 + 3.27002 i || x == -2.18177 || x == -1
128  x == -29.0652 - 38.1714 i || x == -29.0652 + 38.1714 i || x == -4.23701 - 3.28072 i || x == -4.237
129  x == -29.0651 - 38.1721 i || x == -29.0651 + 38.1721 i || x == -4.12884 - 3.23082 i || x == -4.128
130  x == -29.0948 - 38.1571 i || x == -29.0948 + 38.1571 i || x == -4.35862 - 3.74018 i || x == -4.358
131  x == -29.0948 - 38.1571 i || x == -29.0948 + 38.1571 i || x == -4.37323 - 3.73742 i || x == -4.373
132  x == -28.3695 - 37.8081 i || x == -28.3695 + 37.8081 i || x == -4.93935 - 2.16505 i || x == -4.939
133  x == -28.3694 - 37.8089 i || x == -28.3694 + 37.8089 i || x == -4.78017 - 1.99307 i || x == -4.780
134  x == -28.3693 - 37.8096 i || x == -28.3693 + 37.8096 i || x == -4.5417 - 1.78502 i || x == -4.5417
135  x == -28.1278 - 37.6917 i || x == -28.1278 + 37.6917 i || x == -5. || x == -3.82087 - 0.429496 i ||
136  x == -27.8813 - 37.5758 i || x == -27.8813 + 37.5758 i || x == -6.69309 || x == -3.22033 - 0.87962
137  x == -27.8813 - 37.5758 i || x == -27.8813 + 37.5758 i || x == -6.65433 || x == -3.19625 - 0.67741
138  x == -27.9125 - 37.5567 i || x == -27.9125 + 37.5567 i || x == -5.49786 - 1.82542 i || x == -5.497
139  x == -27.9124 - 37.5567 i || x == -27.9124 + 37.5567 i || x == -5.52578 - 1.85106 i || x == -5.525
140  x == -27.1109 - 37.242 i || x == -27.1109 + 37.242 i || x == -9.21052 || x == -2.89781 || x == -2. |
141  x == -27.1109 - 37.2428 i || x == -27.1109 + 37.2428 i || x == -9.28788 || x == -2.58782 - 0.79374
142  x == -27.1109 - 37.2437 i || x == -27.1109 + 37.2437 i || x == -9.3619 || x == -2.6171 - 1.11695 i
143  x == -27.1108 - 37.2445 i || x == -27.1108 + 37.2445 i || x == -9.43294 || x == -2.62569 - 1.34128
144  x == -151.703 || x == -8.4411 - 7.65509 i || x == -8.4411 + 7.65509 i || x == -2.66022 - 1.32538 i
145  x == -151.703 || x == -8.46702 - 7.64799 i || x == -8.46702 + 7.64799 i || x == -2.6677 - 1.50866
146  x == -151.703 || x == -8.49296 - 7.64127 i || x == -8.49296 + 7.64127 i || x == -2.66875 - 1.66533
147  x == -151.703 || x == -8.36707 - 7.56722 i || x == -8.36707 + 7.56722 i || x == -2.79572 - 1.53065
148  x == -151.702 || x == -8.23314 - 7.49498 i || x == -8.23314 + 7.49498 i || x == -2.93078 - 1.36113
149  x == -151.702 || x == -8.23185 - 7.49733 i || x == -8.23185 + 7.49733 i || x == -2.90405 - 1.30209
150  x == -151.828 || x == -8.66147 - 8.91413 i || x == -8.66147 + 8.91413 i || x == -2.41109 - 1.51937
151  x == -151.828 || x == -8.66086 - 8.91542 i || x == -8.66086 + 8.91542 i || x == -2.38183 - 1.48222
152  x == -151.87 || x == -8.70023 - 9.28898 i || x == -8.70023 + 9.28898 i || x == -2.32135 - 1.45244
153  x == -151.869 || x == -8.61605 - 9.24125 i || x == -8.61605 + 9.24125 i || x == -2.40486 - 1.34422
154  x == -151.867 || x == -8.42351 - 9.15566 i || x == -8.42351 + 9.15566 i || x == -2.54953 - 0.81943
155  x == -151.868 || x == -8.43922 - 9.14843 i || x == -8.43922 + 9.14843 i || x == -2.58008 - 1.06021
156  x == -151.994 || x == -8.71743 - 10.27 i || x == -8.71743 + 10.27 i || x == -2.24016 - 1.2788 i || x
157  x == -151.994 || x == -8.71718 - 10.2709 i || x == -8.71718 + 10.2709 i || x == -2.20391 - 1.23818
158  x == -151.994 || x == -8.72834 - 10.2658 i || x == -8.72834 + 10.2658 i || x == -2.23169 - 1.36787
159  x == -151.994 || x == -8.73953 - 10.2608 i || x == -8.73953 + 10.2608 i || x == -2.25109 - 1.48153
160  x == -196.807 || x == -7.33592 - 9.28377 i || x == -7.33592 + 9.28377 i || x == -2.2479 - 1.49119
161  x == -196.807 || x == -7.34738 - 9.27642 i || x == -7.34738 + 9.27642 i || x == -2.26171 - 1.59437
162  x == -195.654 || x == -7.94506 - 8.87922 i || x == -7.94506 + 8.87922 i || x == -2.24054 - 1.6057
163  x == -195.654 || x == -7.9447 - 8.88038 i || x == -7.9447 + 8.88038 i || x == -2.21584 - 1.57841 i
164  x == -195.654 || x == -7.87157 - 8.84298 i || x == -7.87157 + 8.84298 i || x == -2.28915 - 1.50163
165  x == -195.653 || x == -7.7054 - 8.77815 i || x == -7.7054 + 8.77815 i || x == -2.4236 - 1.16699 i |
166  x == -195.653 || x == -7.71904 - 8.7707 i || x == -7.71904 + 8.7707 i || x == -2.44204 - 1.31428 i
167  x == -195.653 || x == -7.71874 - 8.772 i || x == -7.71874 + 8.772 i || x == -2.41259 - 1.27235 i ||
168  x == -190.809 || x == -9.99803 - 4.64917 i || x == -9.99803 + 4.64917 i || x == -2.55562 - 1.42854
169  x == -190.809 || x == -10.0149 - 4.65844 i || x == -10.0149 + 4.65844 i || x == -2.53977 - 1.48671
170  x == -190.809 || x == -9.68506 - 4.26027 i || x == -9.68506 + 4.26027 i || x == -2.82769 - 0.86179
171  x == -190.808 || x == -9.50415 - 4.03762 i || x == -9.50415 + 4.03762 i || x == -3.00521 - 0.28829
172  x == -190.808 || x == -9.28452 - 3.78271 i || x == -9.28452 + 3.78271 i || x == -4.10213 || x == -2
173  x == -190.808 || x == -9.27641 - 3.78252 i || x == -9.27641 + 3.78252 i || x == -4.22018 || x == -2
174  x == -190.807 || x == -8.37236 - 3.09005 i || x == -8.37236 + 3.09005 i || x == -6.53357 || x == -1
175  x == -190.806 || x == -8.39447 || x == -7.48652 - 3.02772 i || x == -7.48652 + 3.02772 i || x == -1
176  x == -189.571 || x == -12.4248 || x == -6.09039 - 2.69806 i || x == -6.09039 + 2.69806 i || x == -1
177  x == -189.571 || x == -12.362 || x == -6.05239 - 2.5223 i || x == -6.05239 + 2.5223 i || x == -1.46
178  x == -189.571 || x == -12.2961 || x == -6.0059 - 2.31902 i || x == -6.0059 + 2.31902 i || x == -1.9
```

```
179   x == -189.571 || x == -12.3016 || x == -6.02535 - 2.34765 i || x == -6.02535 + 2.34765 i || x == -1
180   x == -181.561 || x == -25.7964 || x == -3.32228 - 3.27645 i || x == -3.32228 + 3.27645 i || x == -1
181   x == -181.561 || x == -25.7965 || x == -3.33482 - 3.27141 i || x == -3.33482 + 3.27141 i || x == -1
182   x == -181.56 || x == -25.8667 || x == -3.42675 - 3.53013 i || x == -3.42675 + 3.53013 i || x == -1.
183   x == -181.56 || x == -25.864 || x == -3.37934 - 3.5068 i || x == -3.37934 + 3.5068 i || x == -1.397
184   x == -181.591 || x == -25.5937 || x == -3.50366 - 3.43117 i || x == -3.50366 + 3.43117 i || x == -1
185   x == -181.591 || x == -25.5909 || x == -3.45274 - 3.40579 i || x == -3.45274 + 3.40579 i || x == -1
186   x == -181.59 || x == -25.6629 || x == -3.53177 - 3.65572 i || x == -3.53177 + 3.65572 i || x == -1.
187   x == -181.59 || x == -25.6601 || x == -3.48842 - 3.63279 i || x == -3.48842 + 3.63279 i || x == -1.
188   x == -181.589 || x == -25.6944 || x == -3.50118 - 3.73883 i || x == -3.50118 + 3.73883 i || x == -1
189   x == -181.62 || x == -25.4213 || x == -3.62651 - 3.66971 i || x == -3.62651 + 3.66971 i || x == -1.
190   x == -181.619 || x == -25.4945 || x == -3.67968 - 3.90009 i || x == -3.67968 + 3.90009 i || x == -1
191   x == -181.619 || x == -25.4946 || x == -3.68724 - 3.89815 i || x == -3.68724 + 3.89815 i || x == -1
192   x == -15.165 - 18.2884 i || x == -15.165 + 18.2884 i || x == -3.70452 - 3.97526 i || x == -3.70452
193   x == -15.165 - 18.2884 i || x == -15.165 + 18.2884 i || x == -3.71221 - 3.97326 i || x == -3.71221
194   x == -15.1647 - 18.29 i || x == -15.1647 + 18.29 i || x == -3.6752 - 3.95015 i || x == -3.6752 + 3.9
195   x == -15.1999 - 18.2708 i || x == -15.1999 + 18.2708 i || x == -3.71528 - 4.17405 i || x == -3.715
196   x == -14.9925 - 18.1742 i || x == -14.9925 + 18.1742 i || x == -3.9216 - 4.03172 i || x == -3.9216
197   x == -14.9924 - 18.1742 i || x == -14.9924 + 18.1742 i || x == -3.92895 - 4.03045 i || x == -3.928
198   x == -14.5355 - 18.0034 i || x == -14.5355 + 18.0034 i || x == -4.36636 - 3.54781 i || x == -4.366
199   x == -14.5354 - 18.0034 i || x == -14.5354 + 18.0034 i || x == -4.37571 - 3.54848 i || x == -4.375
200   x == -14.9136 - 19.6281 i || x == -14.9136 + 19.6281 i || x == -3.99629 - 3.45114 i || x == -3.996
201   x == -14.9135 - 19.6295 i || x == -14.9135 + 19.6295 i || x == -3.95661 - 3.42042 i || x == -3.956
202   x == -14.9135 - 19.6309 i || x == -14.9135 + 19.6309 i || x == -3.91493 - 3.38971 i || x == -3.914
203   x == -14.9134 - 19.6323 i || x == -14.9134 + 19.6323 i || x == -3.87107 - 3.35916 i || x == -3.871
204   x == -14.5156 - 19.5042 i || x == -14.5156 + 19.5042 i || x == -4.22436 - 2.75075 i || x == -4.224
205   x == -14.5157 - 19.5057 i || x == -14.5157 + 19.5057 i || x == -4.16513 - 2.69851 i || x == -4.165
206   x == -14.5158 - 19.5072 i || x == -14.5158 + 19.5072 i || x == -4.09982 - 2.6451 i || x == -4.0998
207   x == -14.5297 - 19.4966 i || x == -14.5297 + 19.4966 i || x == -4.13119 - 2.8118 i || x == -4.1311
208   x == -14.6571 - 20.2321 i || x == -14.6571 + 20.2321 i || x == -4.00448 - 2.76056 i || x == -4.004
209   x == -14.6572 - 20.2334 i || x == -14.6572 + 20.2334 i || x == -3.94041 - 2.7155 i || x == -3.9404
210   x == -13.8507 - 20.0715 i || x == -13.8507 + 20.0715 i || x == -6.71284 || x == -2.38022 - 1.30259
```

```
1 / List @@ NRoots[ DDa[210, x] == 0, x][[All, 2]]
```

```
{-0.0232899 + 0.0337502 i, -0.0232899 - 0.0337502 i, -0.148968,
 -0.323304 + 0.17693 i, -0.323304 - 0.17693 i, -0.947847, -49.2195}
```

```
v := List @@ NRoots[ DDa[210, x] == 0, x][[All, 2]]
```

```
Length[v]
```

```
7
```

```
Sum[ -1 / k, {k, v}]
```

```
51.0095 + 0. i
```

```
N[P[210, 1]]
```

```
51.0095
```

```
Product[1 - 1 / k, {k, v}]
```

```
210. - 3.55271 × 10^-15 i
```

```
List @@ NRoots[ DDa[22 777, x] == 0, x][[All, 2]]
```

```
{-1358.67, -124.165, -20.1733 - 42.7808 i, -20.1733 + 42.7808 i, -8.01356 - 9.76041 i,
 -8.01356 + 9.76041 i, -5.2413 - 6.02945 i, -5.2413 + 6.02945 i, -3.79645,
 -2.48472 - 1.8831 i, -2.48472 + 1.8831 i, -1.45141, -1.08745, -0.000389627}
```

```
N[LogIntegral[2111]]
```

```
329.361
```

```
N[P[2111, 1]]
```

```
328.72
```

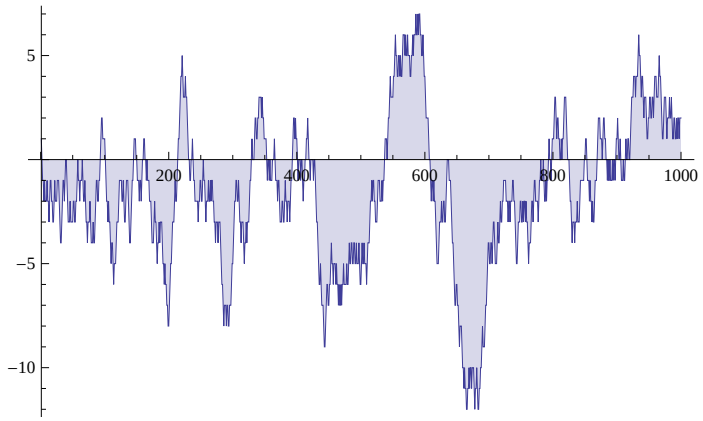
```
(1 + 1 / List @@ NRoots[ DDa[22 777, x] == 0, x][[All, 2]])
```

```
{0.999264, 0.991946, 0.990983 + 0.0191228 i, 0.990983 - 0.0191228 i, 0.949753 + 0.0612004 i,
 0.949753 - 0.0612004 i, 0.917881 + 0.0944677 i, 0.917881 - 0.0944677 i, 0.736596,
 0.744368 + 0.193737 i, 0.744368 - 0.193737 i, 0.311016, 0.0804181, -2565.56}
```

```
List @@ NRoots[ DDa[22 777, x] == 0, x][[All, 2]]
```

```
{-1358.67, -124.165, -20.1733 - 42.7808 i, -20.1733 + 42.7808 i, -8.01356 - 9.76041 i,
 -8.01356 + 9.76041 i, -5.2413 - 6.02945 i, -5.2413 + 6.02945 i, -3.79645,
 -2.48472 - 1.8831 i, -2.48472 + 1.8831 i, -1.45141, -1.08745, -0.000389627}
```

```
DiscretePlot[ DDa[n, -1], {n, 1, 1000}]
```



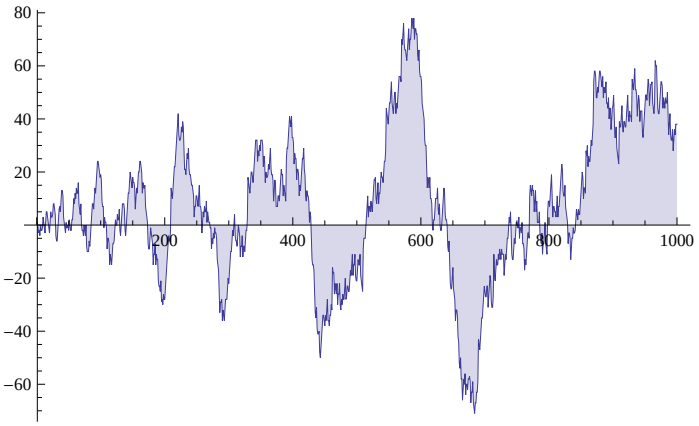

```
(1 + 1 / List @@ NRoots[ DDa[221, x] == 0, x][[All, 2]])
```

```
{0.968083, 0.929078 + 0.0404926 i, 0.929078 - 0.0404926 i,
 0.734395 + 0.230064 i, 0.734395 - 0.230064 i, -0.205371, -49.0992}
```

```
(List @@ NRoots[ DDa[221, x] == 0, x][[All, 2]])
```

```
{-31.331, -10.6336 - 6.07118 i, -10.6336 + 6.07118 i,
 -2.15108 - 1.86324 i, -2.15108 + 1.86324 i, -0.82962, -0.0199604}
```

```
DiscretePlot[ DDa[n, -2], {n, 1, 1000}]
```




```
(1 - 1 / List @@ NRoots[ DDa[221, x] == 0, x][[All, 2]])
```

```
{1.03192, 1.07092 - 0.0404926 i, 1.07092 + 0.0404926 i,
 1.2656 - 0.230064 i, 1.2656 + 0.230064 i, 2.20537, 51.0992}
```

```
(List @@ NRoots[ DDa[117 337, x] == 0, x][[All, 2]])
```

```
{-538.728, -31.0949 - 83.461 i, -31.0949 + 83.461 i, -15.7211,
 -13.4864 - 22.1035 i, -13.4864 + 22.1035 i, -7.97607 - 11.9414 i, -7.97607 + 11.9414 i,
 -3.61902 - 5.17153 i, -3.61902 + 5.17153 i, -2.58457 - 2.27341 i, -2.58457 + 2.27341 i,
 -1.65895 - 0.738425 i, -1.65895 + 0.738425 i, -0.946108, -0.0000899707}
```

```
(-1 / List @@ NRoots[ DDa[117 337, x] == 0, x][[All, 2]])
```

```
{0.00185622, 0.00391987 - 0.0105212 i, 0.00391987 + 0.0105212 i, 0.0636086,
 0.0201155 - 0.0329682 i, 0.0201155 + 0.0329682 i, 0.0386785 - 0.0579076 i,
 0.0386785 + 0.0579076 i, 0.0908342 - 0.129801 i, 0.0908342 + 0.129801 i, 0.218137 - 0.191875 i,
 0.218137 + 0.191875 i, 0.503111 - 0.223943 i, 0.503111 + 0.223943 i, 1.05696, 11114.7}
```

```
(1 - 1 / List @@ NRoots[ DDa[117 337, x] == 0, x][[All, 2]])
```

```
{1.00186, 1.00392 - 0.0105212 i, 1.00392 + 0.0105212 i, 1.06361,
 1.02012 - 0.0329682 i, 1.02012 + 0.0329682 i, 1.03868 - 0.0579076 i,
 1.03868 + 0.0579076 i, 1.09083 - 0.129801 i, 1.09083 + 0.129801 i, 1.21814 - 0.191875 i,
 1.21814 + 0.191875 i, 1.50311 - 0.223943 i, 1.50311 + 0.223943 i, 2.05696, 11115.7}
```

```
(1 + 1 / List @@ NRoots[ DDa[117 337, x] == 0, x][[All, 2]])
```

```
{0.998144, 0.99608 + 0.0105212 i, 0.99608 - 0.0105212 i, 0.936391, 0.979884 + 0.0329682 i,
 0.979884 - 0.0329682 i, 0.961322 + 0.0579076 i, 0.961322 - 0.0579076 i,
 0.909166 + 0.129801 i, 0.909166 - 0.129801 i, 0.781863 + 0.191875 i, 0.781863 - 0.191875 i,
 0.496889 + 0.223943 i, 0.496889 - 0.223943 i, -0.0569616, -11113.7}
```

```
(1 - 2 / List @@ NRoots[ DDa[117 337, x] == 0, x][[All, 2]])
```

```
{1.00371, 1.00784 - 0.0210424 i, 1.00784 + 0.0210424 i, 1.12722,
 1.04023 - 0.0659365 i, 1.04023 + 0.0659365 i, 1.07736 - 0.115815 i,
 1.07736 + 0.115815 i, 1.18167 - 0.259602 i, 1.18167 + 0.259602 i, 1.43627 - 0.38375 i,
 1.43627 + 0.38375 i, 2.00622 - 0.447885 i, 2.00622 + 0.447885 i, 3.11392, 22230.5}
```

```
(1 + 1 / List @@ NRoots[ DDD[530 617 337, x] == 0, x][[All, 2]])
```

$$\{0.999687, 0.998591, 0.987255, 0.998376 + 0.00544341\,i, 0.998376 - 0.00544341\,i,\ 0.998094 + 0.00809593\,i, 0.998094 - 0.00809593\,i, 0.985423 + 0.0236715\,i,\ 0.985423 - 0.0236715\,i, 0.942226 + 0.0475071\,i, 0.942226 - 0.0475071\,i, 0.993499 + 0.0260563\,i,\ 0.993499 - 0.0260563\,i, 0.883949, 0.979123 + 0.0508231\,i, 0.979123 - 0.0508231\,i,\ 0.955838 + 0.0802674\,i, 0.955838 - 0.0802674\,i, 0.90885 + 0.121061\,i, 0.90885 - 0.121061\,i,\ 0.829949 + 0.144261\,i, 0.829949 - 0.144261\,i, 0.722644 + 0.159157\,i, 0.722644 - 0.159157\,i,\ 0.508028 + 0.103477\,i, 0.508028 - 0.103477\,i, -0.0042037, -2.78828 \times 10^{7}\}$$

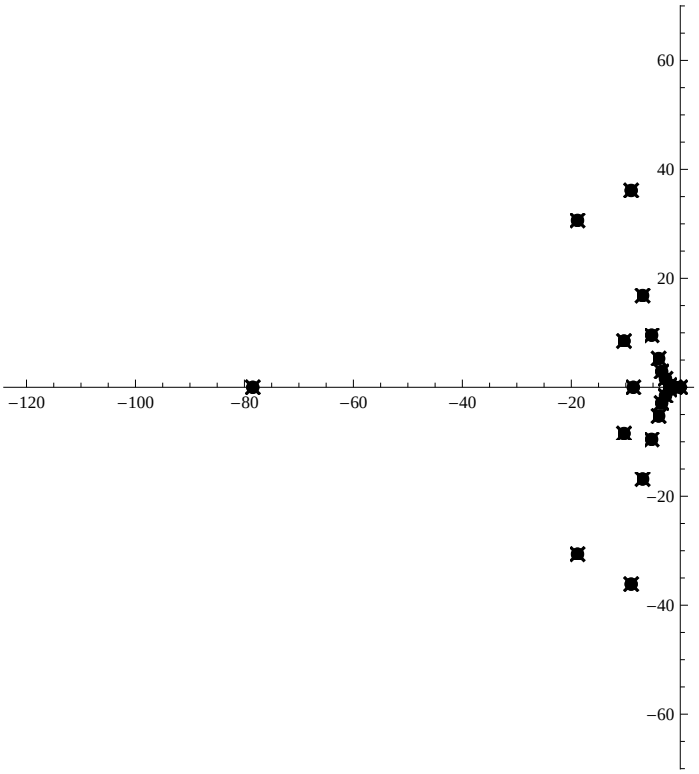
```
N[lin[ 530 617 337]]
```

$$2.78828 \times 10^{7}$$

```
N[LogIntegral[530 617 337]]
```

$$2.78831 \times 10^{7}$$

```
RootLocusPlot[1 / Expand[DDD[530 617 337, x]], {k, 0, 1}, FeedbackType → None]
```




```
3.036429505056579`*^6
```

```
3.036426152187806`*^6
```

$$3.03643 \times 10^{6}$$

```
3.036368981104197`*^6
```

```
{8.^5, 11.^7, 13.^9};
NumberForm[2.78828270840755`*^7, ExponentFunction → (If[-10 < # < 10, Null, #] &)]
```

27882827.

```
NumberForm[2.7882830574696146`*^7, ExponentFunction → (If[-10 < # < 10, Null, #] &)]
```

27882831.

```
NumberForm[2.7883111397742484`*^7, ExponentFunction → (If[-10 < # < 10, Null, #] &)]
```

```
27883111.
```

```
NumberForm[2.7883111397742484`*^7 - 2.7882830574696146`*^7,
 ExponentFunction → (If[-10 < # < 10, Null, #] &)]
```

```
280.823
```

```
Floor[Log[2, n]]
```

```
15
```

```
Table[ {n, (lin[n] + 1 / List @@ NRoots[ DDD[n, x] == 0, x][[All, 2]])[[Floor[Log[2, n]]]]},
  {n, 2 312 002, 2 312 100}] // TableForm
```

```
2 312 002    3.13588
2 312 003    3.13588
2 312 004    3.13588
2 312 005    3.13589
2 312 006    3.13589
2 312 007    3.13589
2 312 008    3.13589
2 312 009    3.1359
2 312 010    3.1359
2 312 011    3.1359
2 312 012    3.1359
2 312 013    3.1359
2 312 014    3.1359
2 312 015    3.1359
2 312 016    3.1359
2 312 017    3.1359
2 312 018    3.13591
2 312 019    3.13591
2 312 020    3.13591
2 312 021    3.13589
2 312 022    3.13589
2 312 023    3.13589
2 312 024    3.13589
2 312 025    3.13589
2 312 026    3.1359
2 312 027    3.13588
2 312 028    3.13588
2 312 029    3.13589
2 312 030    3.13589
2 312 031    3.13589
2 312 032    3.13589
2 312 033    3.13589
2 312 034    3.13589
2 312 035    3.13589
2 312 036    3.13589
2 312 037    3.13589
2 312 038    3.13589
2 312 039    3.1359
2 312 040    3.1359
2 312 041    3.13591
2 312 042    3.13591
2 312 043    3.13591
```

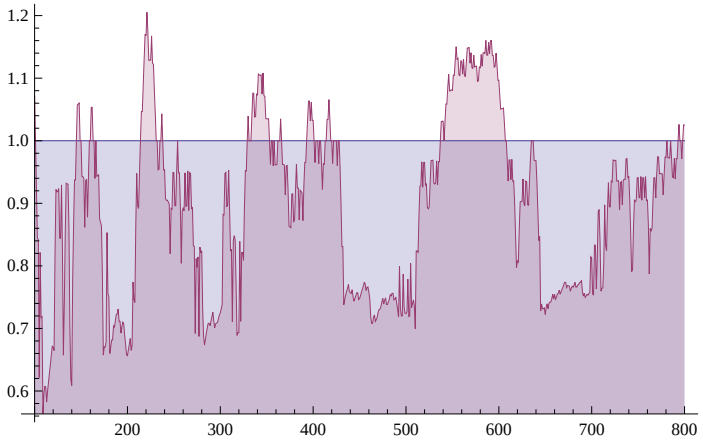
```
2 312 044    3.13591
2 312 045    3.13591
2 312 046    3.13591
2 312 047    3.13592
2 312 048    3.13592
2 312 049    3.13592
2 312 050    3.13592
2 312 051    3.13592
2 312 052    3.13592
2 312 053    3.13592
2 312 054    3.13592
2 312 055    3.13592
2 312 056    3.13592
2 312 057    3.13593
2 312 058    3.13593
2 312 059    3.13594
2 312 060    3.13594
2 312 061    3.13594
2 312 062    3.13594
2 312 063    3.13594
2 312 064    3.13594
2 312 065    3.13594
2 312 066    3.13595
2 312 067    3.13595
2 312 068    3.13595
2 312 069    3.13593
2 312 070    3.13593
2 312 071    3.13593
2 312 072    3.13593
2 312 073    3.13593
2 312 074    3.13594
2 312 075    3.13594
2 312 076    3.13594
2 312 077    3.13595
2 312 078    3.13595
2 312 079    3.13595
2 312 080    3.13595
2 312 081    3.13596
2 312 082    3.13596
2 312 083    3.13596
2 312 084    3.13596
2 312 085    3.13596
2 312 086    3.13596
2 312 087    3.13597
2 312 088    3.13597
2 312 089    3.13597
2 312 090    3.13597
2 312 091    3.13597
2 312 092    3.13597
2 312 093    3.13597
2 312 094    3.13597
2 312 095    3.13598
2 312 096    3.13598
2 312 097    3.13598
2 312 098    3.13598
2 312 099    3.13596
2 312 100    3.13596
```

```
Table[{n, (1 + 1 / List @@ NRoots[DDD[n, x] == 0, x][[All, 2]])[[Floor[Log[2, n]] - 1]]},
  {n, 3000, 3100}] // TableForm
```

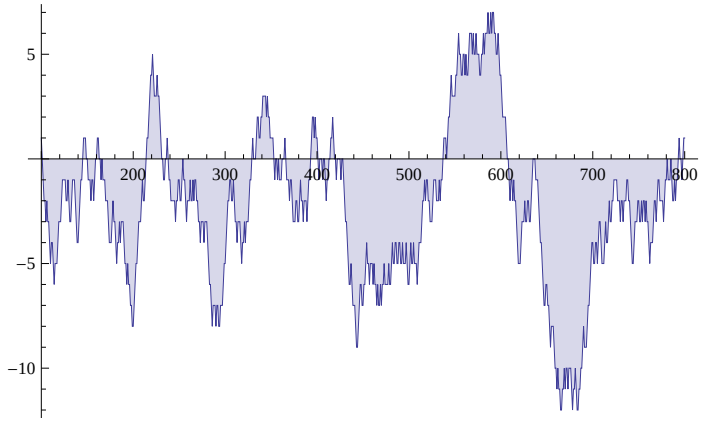
```
3000    0.0963284
3001    0.118497
3002    0.161083
3003    0.114568
3004    0.116244
3005    0.0928747
3006    0.0917045
3007    0.0724982
3008    0.0725378
3009    0.0939202
3010    0.0710646
3011    0.0878256
3012    0.086834
3013    0.069179
3014    0.0886674
3015    0.0876493
3016    0.0873493
3017    0.0695501
3018    0.0892121
3019    0.107974
3020    0.106502
3021    0.134576
3022    0.109173
3023    0.130868
3024    0.130874
3025    0.130722
3026    0.171764
3027    0.135018
3028    0.137378
3029    0.110826
3030    0.0856058
3031    0.068332
3032    0.0685182
3033    0.0691302
3034    0.0885638
3035    0.0703974
3036    0.0711599
3037    0.087985
3038    0.0869866
3039    0.0692658
3040    0.0692076
3041    0.0853113
3042    0.0853548
3043    0.0680959
3044    0.0687005
3045    0.051215
3046    0.0372398
3047    0.0241409
3048    0.0240886
```

3049	0.0366599
3050	0.0364002
3051	0.03648
3052	0.0362232
3053	0.0235276
3054	0.0367217
3055	0.0512062
3056	0.0512662
3057	0.0372769
3058	0.0520638
3059	0.0686811
3060	0.0686552
3061	0.084539
3062	0.067543
3063	0.0520937
3064	0.0522223
3065	0.0379105
3066	0.0239017
3067	0.0363533
3068	0.0360985
3069	0.0358479
3070	0.0498555
3071	0.0363346
3072	0.0363396
3073	0.0236011
3074	0.0368415
3075	0.036579
3076	0.0368317
3077	0.023901
3078	0.0238757
3079	0.0363079
3080	0.0363933
3081	0.0506984
3082	0.0666419
3083	0.0818201
3084	0.0810059
3085	0.0650322
3086	0.0503382
3087	0.0503351
3088	0.0503928
3089	0.0641275
3090	0.0482474
3091	0.0352409
3092	0.0354734
3093	0.0230716
3094	0.0110171
3095	4.44089×10^{-16}
3096	2.22045×10^{-16}
3097	−0.0105989
3098	−0.0208262
3099	−0.0307204
3100	−0.0307183

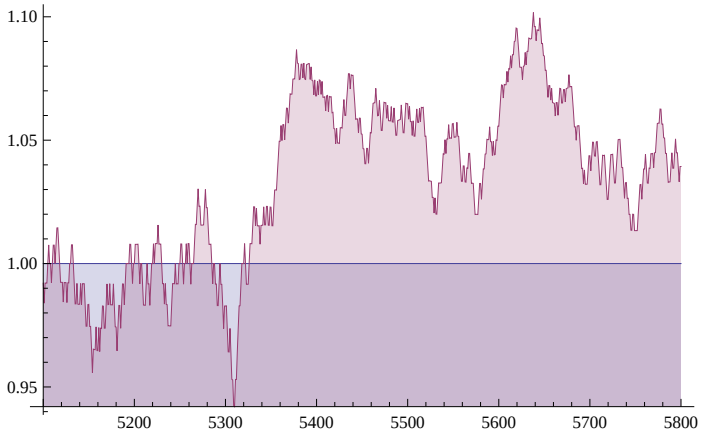
```
DiscretePlot[
  {1, Re[(-1 / List @@ NRoots[ DDD[n, x] == 0, x][[All, 2]])[[Floor[Log[2, n]] - 1]]]},
  {n, 100, 800}] // TableForm
```



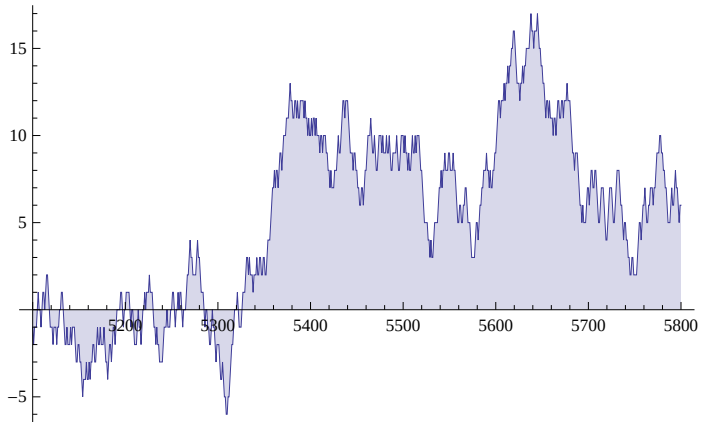

```
DiscretePlot[DDD[n, -1], {n, 100, 800}]
```



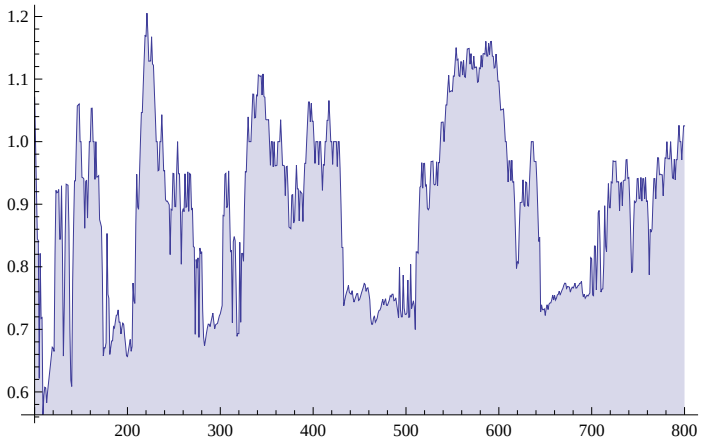

```
DiscretePlot[
  {1, Re[(-1 / List @@ NRoots[DDD[n, x] == 0, x][[All, 2]])[[Floor[Log[2, n]] - 1]]]},
  {n, 5100, 5800}] // TableForm
```



```
DiscretePlot[ DDD[n, -1], {n, 5100, 5800}]
```




```
DiscretePlot[{ Re[(-1 / List @@ NRoots[ DDD[n, x] == 0, x][[All, 2]])[[Floor[Log[2, n]] - 1]]]},
  {n, 100, 800}] // TableForm
```




```
RootLocusPlot[1 / Expand[DDD[43 530 617 337, x]], {k, 0, 1}, FeedbackType → None]
```

```
$Aborted
```

```
(-1 / List @@ NRoots[ (DDa[100, x]) == 0, x][[All, 2]])
```

```
{0.0401208 - 0.0444144 i, 0.0401208 + 0.0444144 i,
 0.251933 - 0.17555 i, 0.251933 + 0.17555 i, 1.07088, 26.8783}
```

```
(-1 / List @@ NRoots[ (DDa[100, x] - 1) == 0, x][[All, 2]])
```

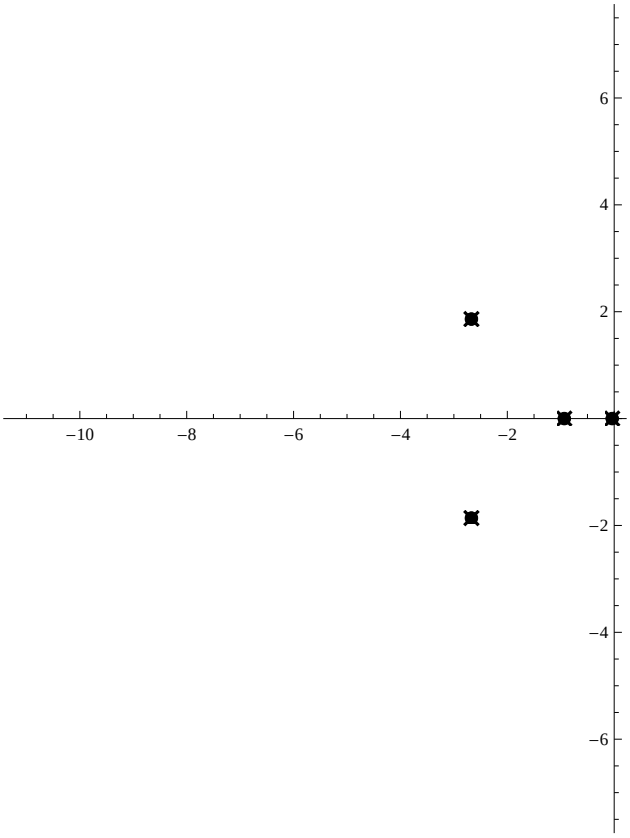
```
Power::infy : Infinite expression 1/0. encountered. >>
```

```
{0.0401206 - 0.0444142 i, 0.0401206 + 0.0444142 i,
 0.252763 - 0.176711 i, 0.252763 + 0.176711 i, 1., ComplexInfinity}
```

```
(-1 / List @@ NRoots[ (DDa[100, x] - 1) / x == 0, x][[All, 2]])
```

```
{0.0401206 - 0.0444142 i, 0.0401206 + 0.0444142 i,
 0.252763 - 0.176711 i, 0.252763 + 0.176711 i, 1.}
```

```
RootLocusPlot[1 / Expand[DDa[100, x]], {k, 0, 1}, FeedbackType → None]
```




```
(List @@ NRoots[ (DDa[100, x]) == 0, x][[All, 2]])
```

```
{-11.1997 - 12.3982 i, -11.1997 + 12.3982 i,
 -2.67195 - 1.86184 i, -2.67195 + 1.86184 i, -0.933809, -0.0372047}
```

```
(List @@ NRoots[ ((DDD[100 000, x] - 1) / x) == 0, x][[All, 2]])
```

```
rr1 := {-56.64116605832289` - 181.11603126185645` i,
  -56.64116605832289` + 181.11603126185645` i, -36.31942565534795`,
  -21.11288550721666` - 38.849319644086606` i, -21.11288550721666` + 38.849319644086606` i,
  -9.764286440884442` - 14.385380039003522` i, -9.764286440884442` + 14.385380039003522` i,
  -4.797724164350477` - 7.268617575567637` i, -4.797724164350477` + 7.268617575567637` i,
  -3.0884655016248503` - 3.388391127081218` i, -3.0884655016248503` + 3.388391127081218` i,
  -2.1224553042937124` - 1.3260130474564402` i,
  -2.1224553042937124` + 1.3260130474564402` i, -1.448195969849161`, -1.0607653625930609`}
```

```
(List @@ NRoots[ ((DDD[100 000, x])) == 0, x][[All, 2]])
```

```
rr2 := {-56.641166058322895` - 181.11603126185645` i,
  -56.641166058322895` + 181.11603126185645` i, -36.31942565534757`,
  -21.11288550721674` - 38.84931964408693` i, -21.11288550721674` + 38.84931964408693` i,
  -9.76428644069197` - 14.385380039419529` i, -9.76428644069197` + 14.385380039419529` i,
  -4.797724032615504` - 7.268617517399808` i, -4.797724032615504` + 7.268617517399808` i,
  -3.08847538375192` - 3.38838962034819` i, -3.08847538375192` + 3.38838962034819` i,
  -2.1222879433588195` - 1.3261002367389711` i, -2.1222879433588195` + 1.3261002367389711` i,
  -1.449858582932226`, -1.059314138745821`, -0.00010383223512402999`}
```

```
(List @@ NRoots[ ((DDD[100 000, x] - 1) / x) == 0, x][[All, 2]] -
  List @@ NRoots[ ((DDD[100 000, x])) == 0, x][[All, 2]])
```

Thread::tdlen : Objects of unequal length in
{−56.6412 − 181.116 i, −56.6412 + 181.116 i, −36.3194, −21.1129 − 38.8493 i, −21.1129 + 38.8493 i, −9.76429 − 14.3854 i, ≪3≫, −3.08847 − 3.38839 i, −3.08847 + 3.38839 i, −2.12246 − 1.32601 i, −2.12246 + 1.32601 i, −1.4482, −1.06077} + {≪1≫} cannot be combined. ≫

```
99 999 Product[ 1 + 1 / (j - 1), {j, rr1}]
```

$9633.77 + 1.73471 \times 10^{-13}\, i$

```
N[Sum[ MangoldtLambda[j] / Log[j], {j, 2, 100 000}]]
```

9633.77

```
(1 + 1 / (-1 + List @@ NRoots[ ((DDD[100 000, x] - 1) / x) == 0, x][[All, 2]]))
```

{0.998404 + 0.00501352 i, 0.998404 − 0.00501352 i, 0.973204, 0.988934 + 0.0194417 i,
 0.988934 − 0.0194417 i, 0.966654 + 0.0445631 i, 0.966654 − 0.0445631 i,
 0.932933 + 0.0840824 i, 0.932933 − 0.0840824 i, 0.855002 + 0.12017 i,
 0.855002 − 0.12017 i, 0.728672 + 0.115225 i, 0.728672 − 0.115225 i, 0.591536, 0.514743}

```
N[Sum[MoebiusMu[j], {j, 2, 100 000}]]
```

−49.

```
99 999 Product[ 1 + 2 / (j - 1), {j, rr1}]
```

$49. - 1.35524 \times 10^{-15}\, i$

```
(1 + 2 / (-1 + List @@ NRoots[ ((DDD[100 000, x] - 1) / x) == 0, x][[All, 2]]))
```

{0.996809 + 0.010027 i, 0.996809 − 0.010027 i, 0.946409, 0.977868 + 0.0388834 i,
 0.977868 − 0.0388834 i, 0.933309 + 0.0891263 i, 0.933309 − 0.0891263 i,
 0.865865 + 0.168165 i, 0.865865 − 0.168165 i, 0.710004 + 0.240339 i,
 0.710004 − 0.240339 i, 0.457344 + 0.23045 i, 0.457344 − 0.23045 i, 0.183072, 0.0294868}

```
(100 000^.5) / 100 000
```

0.00316228

```
Product[ 1 + 2 / (j - 1), {j, rr1}]
```

$0.000490005 - 1.35525 \times 10^{-20}\, i$

```
(1 - 1 / (-1 + List @@ NRoots[ ((DDD[100 000, x] - 1) / x) == 0, x][[All, 2]]))
```

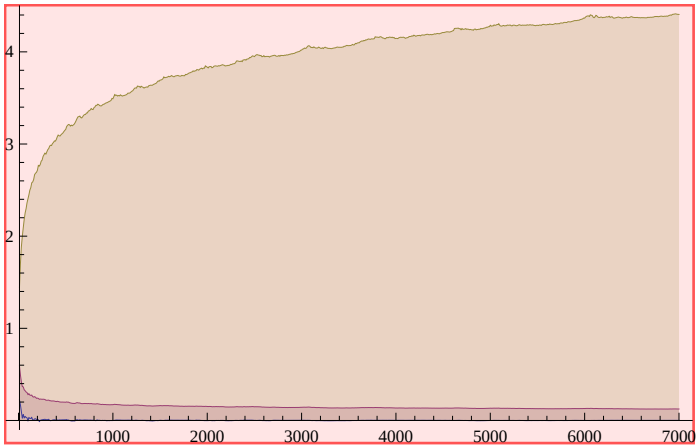
{1.0016 − 0.00501352 i, 1.0016 + 0.00501352 i, 1.0268, 1.01107 − 0.0194417 i,
 1.01107 + 0.0194417 i, 1.03335 − 0.0445631 i, 1.03335 + 0.0445631 i,
 1.06707 − 0.0840824 i, 1.06707 + 0.0840824 i, 1.145 − 0.12017 i,
 1.145 + 0.12017 i, 1.27133 − 0.115225 i, 1.27133 + 0.115225 i, 1.40846, 1.48526}

```
ff[n_, z_] :=
 ff[n, z] = Re[(1 - (z - 1) / (-1 + List @@ NRoots[ ((DDD[n, x] - 1) / x) == 0, x][[All, 2]]))]
```

```
ff[100 000, -1]
```

```
{0.996809 + 0.010027 i, 0.996809 - 0.010027 i, 0.946409, 0.977868 + 0.0388834 i,
 0.977868 - 0.0388834 i, 0.933309 + 0.0891263 i, 0.933309 - 0.0891263 i,
 0.865865 + 0.168165 i, 0.865865 - 0.168165 i, 0.710004 + 0.240339 i,
 0.710004 - 0.240339 i, 0.457344 + 0.23045 i, 0.457344 - 0.23045 i, 0.183072, 0.0294868}
```

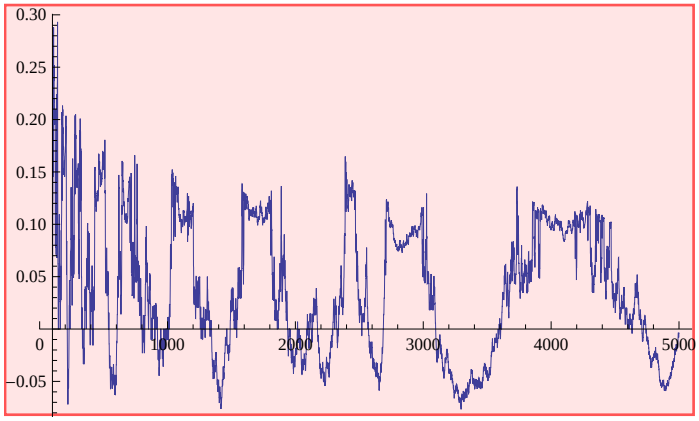
```
DiscretePlot[{Product[v, {v, ff[n, -1]}],
  Product[v, {v, ff[n, 0]}], Product[v, {v, ff[n, 2]}]}, {n, 10, 7000, 10}]
```




```
(1 + 2 / (-1 + List @@ NRoots[((DDD[1 000 000, x] - 1) / x) == 0, x][[All, 2]]))
```

```
{0.998234, 0.983374, 0.988687 + 0.02016 i, 0.988687 - 0.02016 i,
 0.979719 + 0.0490487 i, 0.979719 - 0.0490487 i, 0.926156 + 0.0759418 i,
 0.926156 - 0.0759418 i, 0.913899 + 0.141541 i, 0.913899 - 0.141541 i,
 0.643831, 0.783419 + 0.210792 i, 0.783419 - 0.210792 i, 0.600412 + 0.215079 i,
 0.600412 - 0.215079 i, 0.332513 + 0.14334 i, 0.332513 - 0.14334 i, -0.0136864}
```

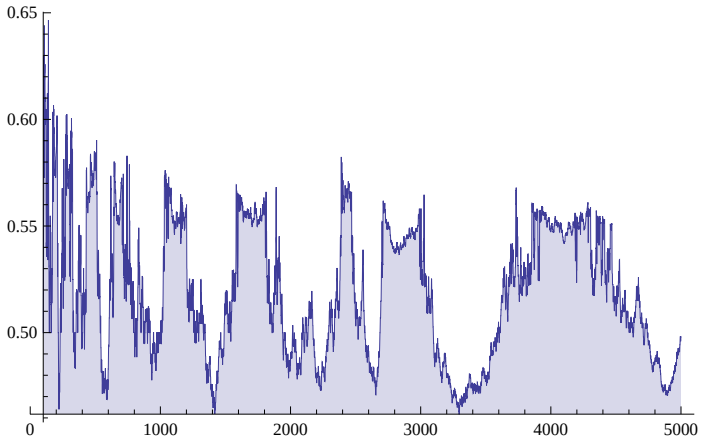
```
DiscretePlot[ff[n, -1][[Length[ff[n, -1]]]], {n, 100, 5000}]
```



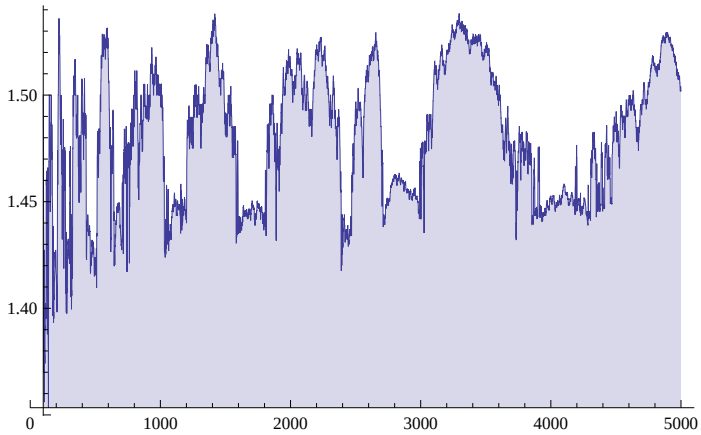

```
ff[1 000 000, -1][[Length[ff[1 000 000, -1]]]]
```

```
-0.0136864
```

```
DiscretePlot[ ff[n, 0][[Length[ff[n, 0]]]], {n, 100, 5000}]
```



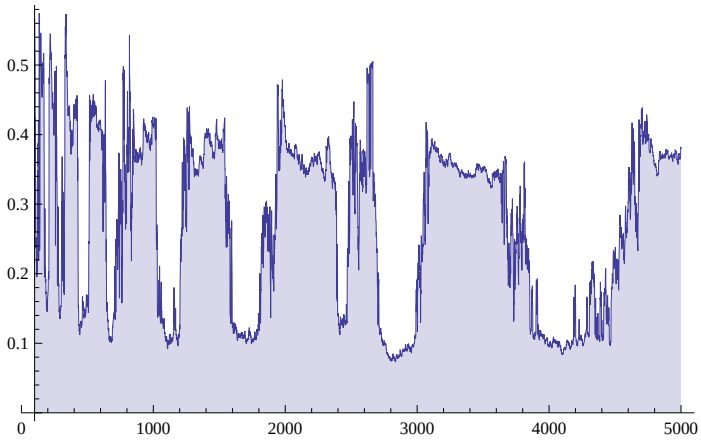

```
DiscretePlot[ ff[n, 2][[Length[ff[n, 2]]]], {n, 100, 5000}]
```



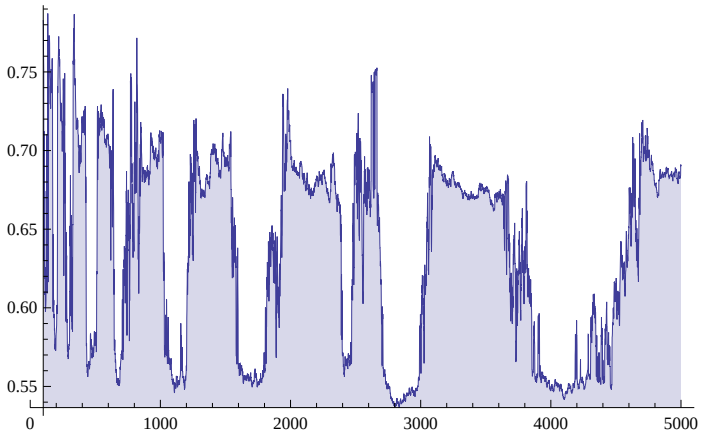

```
Expand[(a + b I) (a - b I)]
```

$a^2 + b^2$

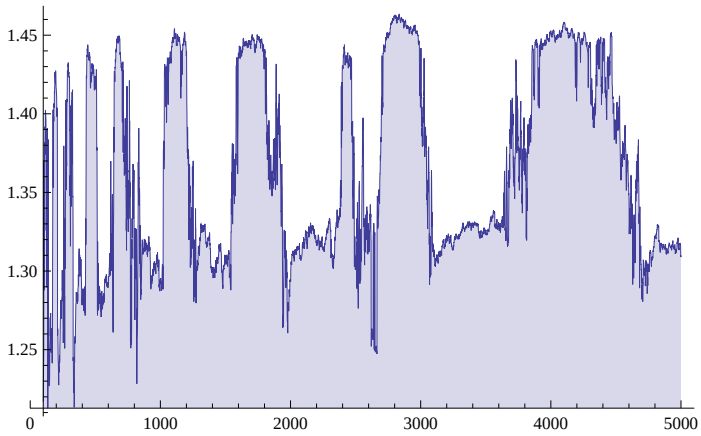
```
DiscretePlot[ ff[n, -1][[-1 + Length[ff[n, -1]]]], {n, 100, 5000}]
```



```
DiscretePlot[ ff[n, 0][[-1 + Length[ff[n, 0]]]], {n, 100, 5000}]
```



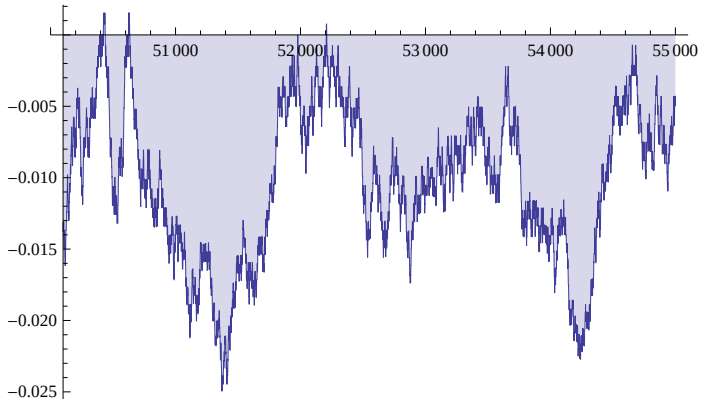

```
DiscretePlot[ ff[n, 2][[-1 + Length[ff[n, 2]]]], {n, 100, 5000}]
```



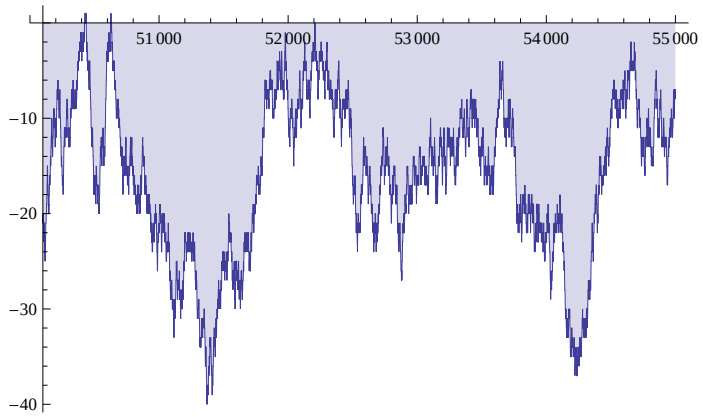

```
(1 + 2 / (-1 + List @@ NRoots[ ((DDD[100 000, x] - 1) / x) == 0, x][[All, 2]]))
```

```
{0.996809 + 0.010027 i, 0.996809 - 0.010027 i, 0.946409, 0.977868 + 0.0388834 i,
 0.977868 - 0.0388834 i, 0.933309 + 0.0891263 i, 0.933309 - 0.0891263 i,
 0.865865 + 0.168165 i, 0.865865 - 0.168165 i, 0.710004 + 0.240339 i,
 0.710004 - 0.240339 i, 0.457344 + 0.23045 i, 0.457344 - 0.23045 i, 0.183072, 0.0294868}
```

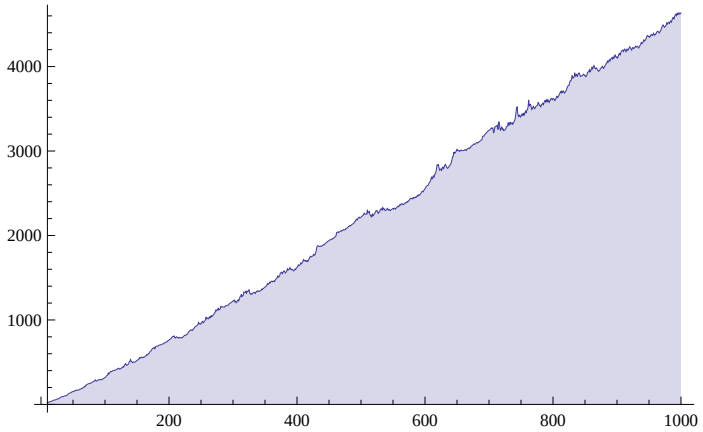
```
DiscretePlot[ ff[n, -1][[Length[ff[n, -1]]]], {n, 50 100, 55 000}]
```



```
DiscretePlot[ -DDD[n, -1], {n, 50 100, 55 000}]
```




```
DiscretePlot[
 1 + 2 (n - 1) Product[ ff[n, 2][[j]], {j, 1, -1 + Length[ff[n, -1]]}], {n, 10, 1000}]
```




```
(1 + 2 / (-1 + List @@ NRoots[ ((DDD[480, x] - 1) / x) == 0, x][[All, 2]]))
```

```
{0.981292, 0.905037 + 0.121114 i, 0.905037 - 0.121114 i, 0.644195 + 0.229302 i,
 0.644195 - 0.229302 i, 0.143483 + 0.132718 i, 0.143483 - 0.132718 i}
```