Anhang 1
Beitrag von Frau Dr. D. Schönfeld zu Aufgabe 20.2
$z = \pi$ und $z = \pi/E$

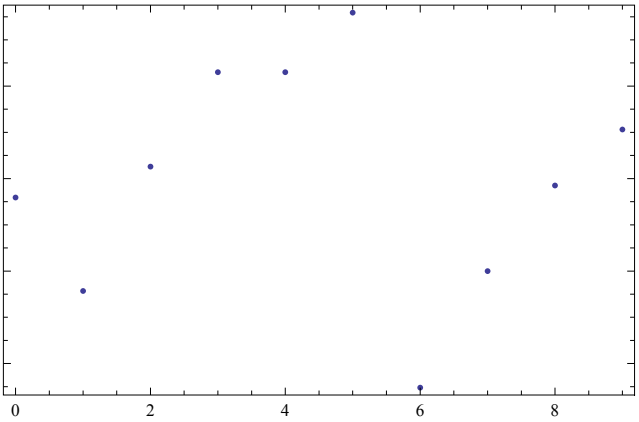
In[227]:=
```
(* stellenweise Auswertung der reellen Zahl*)
t = 1 000 000; x = RealDigits[N[Pi, t]];
Print[N[Pi, 100]]; xx = {0, 1, 2, 3, 4, 5, 6, 7, 8, 9};
Print["Digits\n", Table[x[[1, i]], {i, 1, 100}]];
ziffer = delta1ziffer =
  delta2ziffer = delta3ziffer = delta4ziffer = delta5ziffer = Table[0, {i, 10}];
delta1sequ = delta2sequ = delta3sequ = delta4sequ = delta5sequ = Table[0, {i, t}];
Table[{ziffer[[x[[1, i]] + 1]]++;}, {i, 1, t}];
Print["Digits-density\n", ziffer];
ListPlot[Table[{xx[[i]], ziffer[[i]]}, {i, 10}], Frame → True]
ListLinePlot[Table[{xx[[i]], ziffer[[i]]}, {i, 10}], Frame → True]
Table[delta1sequ[[i]] = Abs[x[[1, i + 1]] - x[[1, i]]], {i, 1, t - 1}];
Print["Delta1-sequenz\n", Table[delta1sequ[[i]], {i, 1, 100}]];
Table[{delta1ziffer[[delta1sequ[[i]] + 1]]++;}, {i, 1, t - 1}];
Print["Delta1-density=\n", delta1ziffer];
ListPlot[Table[{xx[[i]], delta1ziffer[[i]]}, {i, 10}], Frame → True]
ListLinePlot[Table[{xx[[i]], delta1ziffer[[i]]}, {i, 10}], Frame → True]
Table[delta2sequ[[i]] = Abs[delta1sequ[[i + 1]] - delta1sequ[[i]]], {i, 1, t - 2}];
Print["Delta2-sequenz\n", Table[delta2sequ[[i]], {i, 1, 100}]];
Table[{delta2ziffer[[delta2sequ[[i]] + 1]]++;}, {i, 1, t - 2}];
Print["Delta2-density=\n", delta2ziffer];
ListPlot[Table[{xx[[i]], delta2ziffer[[i]]}, {i, 10}], Frame → True]
ListLinePlot[Table[{xx[[i]], delta2ziffer[[i]]}, {i, 10}], Frame → True]
Table[delta3sequ[[i]] = Abs[delta2sequ[[i + 1]] - delta2sequ[[i]]], {i, 1, t - 3}];
Print["Delta3-sequenz\n", Table[delta3sequ[[i]], {i, 1, 100}]];
Table[{delta3ziffer[[delta3sequ[[i]] + 1]]++;}, {i, 1, t - 3}];
Print["Delta3-density=\n", delta3ziffer];
ListPlot[Table[{xx[[i]], delta3ziffer[[i]]}, {i, 10}], Frame → True]
ListLinePlot[Table[{xx[[i]], delta3ziffer[[i]]}, {i, 10}], Frame → True]
Table[delta4sequ[[i]] = Abs[delta3sequ[[i + 1]] - delta3sequ[[i]]], {i, 1, t - 4}];
Print["Delta4-sequenz\n", Table[delta4sequ[[i]], {i, 1, 100}]];
Table[{delta4ziffer[[delta4sequ[[i]] + 1]]++;}, {i, 1, t - 4}];
Print["Delta4-density=\n", delta4ziffer];
ListPlot[Table[{xx[[i]], delta4ziffer[[i]]}, {i, 10}], Frame → True]
ListLinePlot[Table[{xx[[i]], delta4ziffer[[i]]}, {i, 10}], Frame → True]
Table[delta5sequ[[i]] = Abs[delta4sequ[[i + 1]] - delta4sequ[[i]]], {i, 1, t - 5}];
Print["Delta5-sequenz\n", Table[delta5sequ[[i]], {i, 1, 100}]];
Table[{delta5ziffer[[delta5sequ[[i]] + 1]]++;}, {i, 1, t - 5}];
Print["Delta5-density=\n", delta5ziffer];
ListPlot[Table[{xx[[i]], delta5ziffer[[i]]}, {i, 10}], Frame → True]
ListLinePlot[Table[{xx[[i]], delta5ziffer[[i]]}, {i, 10}], Frame → True]
```

```
3.14159265358979323846264338327950288419716939937510582097494459230781640628620899862-
 8034825342117068

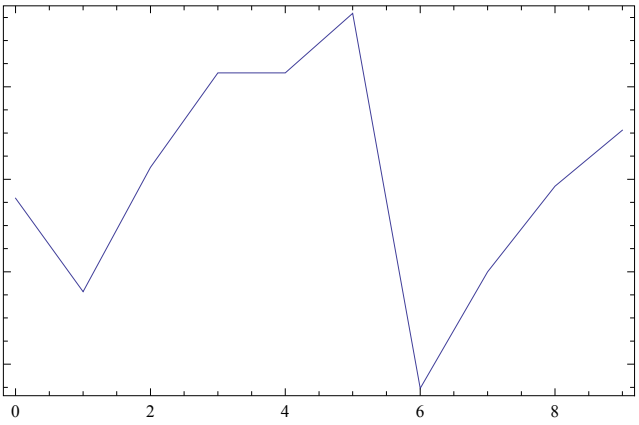
Digits
{3, 1, 4, 1, 5, 9, 2, 6, 5, 3, 5, 8, 9, 7, 9, 3, 2, 3, 8, 4, 6, 2,
  6, 4, 3, 3, 8, 3, 2, 7, 9, 5, 0, 2, 8, 8, 4, 1, 9, 7, 1, 6, 9, 3, 9, 9, 3, 7,
  5, 1, 0, 5, 8, 2, 0, 9, 7, 4, 9, 4, 4, 5, 9, 2, 3, 0, 7, 8, 1, 6, 4, 0, 6, 2,
  8, 6, 2, 0, 8, 9, 9, 8, 6, 2, 8, 0, 3, 4, 8, 2, 5, 3, 4, 2, 1, 1, 7, 0, 6, 7}

Digits-density
{99959, 99757, 100026, 100230, 100230, 100359, 99548, 99800, 99985, 100106}
```

Out[231]=



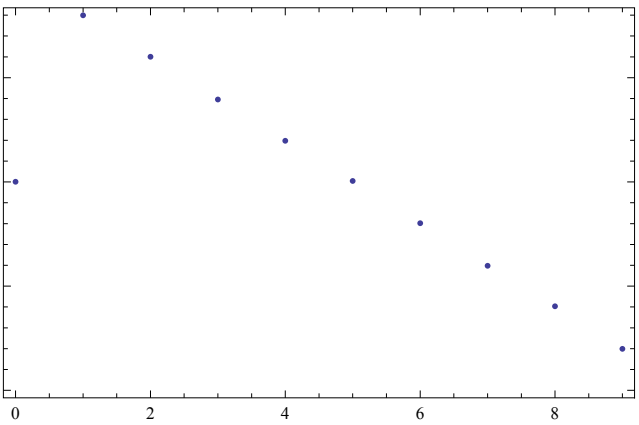
Out[232]=



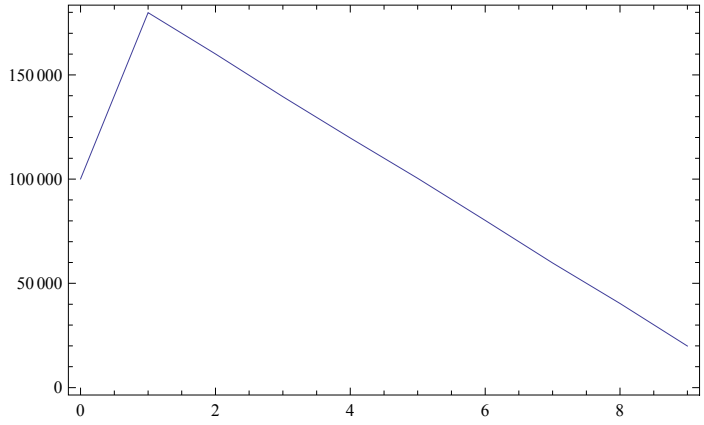

```
Delta1-sequenz
{2, 3, 3, 4, 4, 7, 4, 1, 2, 2, 3, 1, 2, 2, 6, 1, 1, 5, 4, 2, 4, 4,
  2, 1, 0, 5, 5, 1, 5, 2, 4, 5, 2, 6, 0, 4, 3, 8, 2, 6, 5, 3, 6, 6, 0, 6, 4, 2,
  4, 1, 5, 3, 6, 2, 9, 2, 3, 5, 5, 0, 1, 4, 7, 1, 3, 7, 1, 7, 5, 2, 4, 6, 4, 6,
  2, 4, 2, 8, 1, 0, 1, 2, 4, 6, 8, 3, 1, 4, 6, 3, 2, 1, 2, 1, 0, 6, 7, 6, 1, 2}
```

```
Delta1-density=
{100 072, 179 909, 160 029, 139 558, 119 744, 100 432, 80 200, 59 749, 40 358, 19 948}
```

Out[236]=



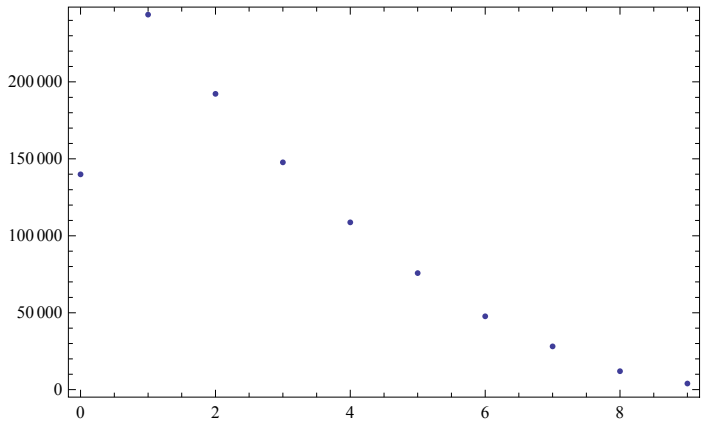
Out[237]=



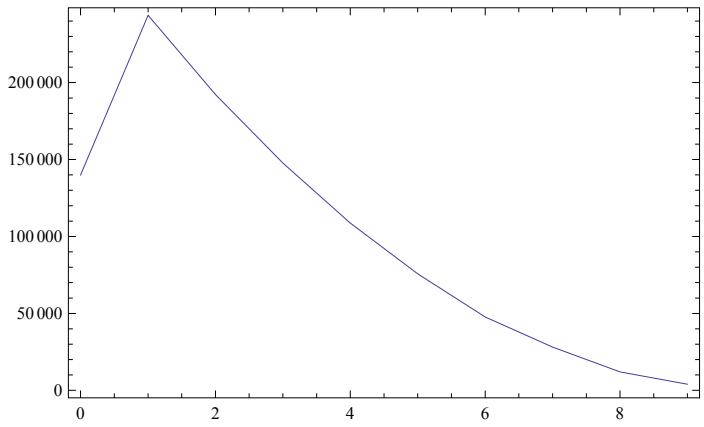

```
Delta2-sequenz
{1, 0, 1, 0, 3, 3, 3, 1, 0, 1, 2, 1, 0, 4, 5, 0, 4, 1, 2, 2, 0, 2,
  1, 1, 5, 0, 4, 4, 3, 2, 1, 3, 4, 6, 4, 1, 5, 6, 4, 1, 2, 3, 0, 6, 6, 2, 2, 2,
  3, 4, 2, 3, 4, 7, 7, 1, 2, 0, 5, 1, 3, 3, 6, 2, 4, 6, 6, 2, 3, 2, 2, 2, 2, 4,
  2, 2, 6, 7, 1, 1, 1, 2, 2, 2, 5, 2, 3, 2, 3, 1, 1, 1, 1, 1, 6, 1, 1, 5, 1, 1}
```

```
Delta2-density=
{139 974, 243 698, 192 271, 147 724, 108 693, 75 767, 47 702, 28 099, 12 032, 4038}
```

Out[241]=



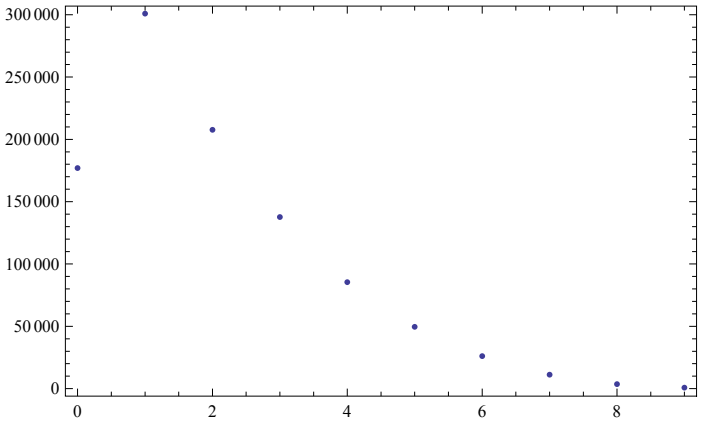
Out[242]=



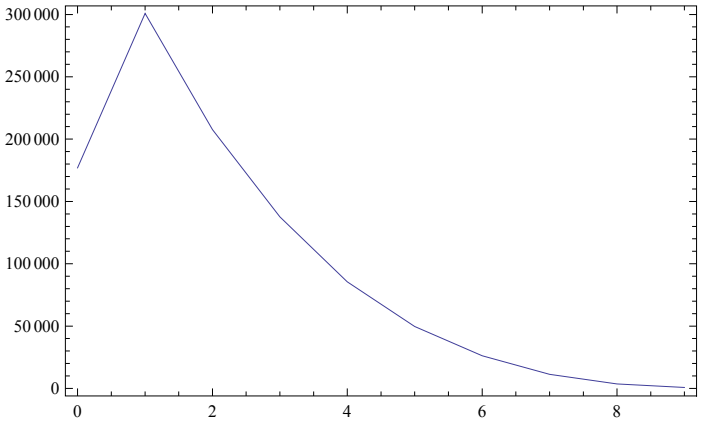

```
Delta3-sequenz
{1, 1, 1, 3, 0, 0, 2, 1, 1, 1, 1, 1, 4, 1, 5, 4, 3, 1, 0, 2, 2, 1,
  0, 4, 5, 4, 0, 1, 1, 1, 2, 1, 2, 2, 3, 4, 1, 2, 3, 1, 1, 3, 6, 0, 4, 0, 0, 1,
  1, 2, 1, 1, 3, 0, 6, 1, 2, 5, 4, 2, 0, 3, 4, 2, 2, 0, 4, 1, 1, 0, 0, 0, 2, 2,
  0, 4, 1, 6, 0, 0, 1, 0, 0, 3, 3, 1, 1, 1, 2, 0, 0, 0, 0, 5, 5, 0, 4, 4, 0, 4}
```

```
Delta3-density=
{176 954, 300 871, 207 625, 137 653, 85 487, 49 631, 26 120, 11 249, 3619, 788}
```

Out[246]=



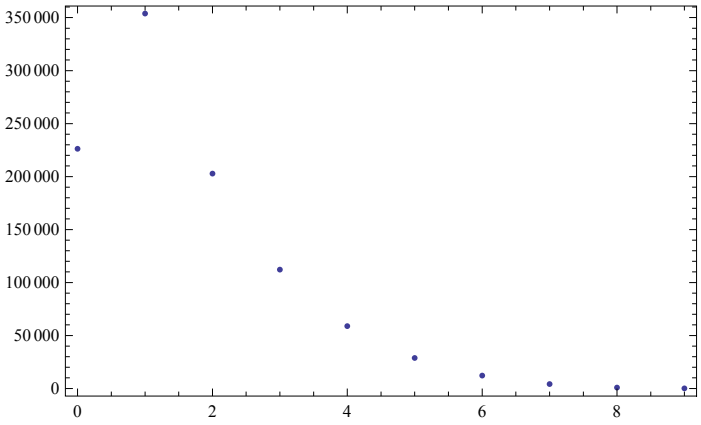
Out[247]=



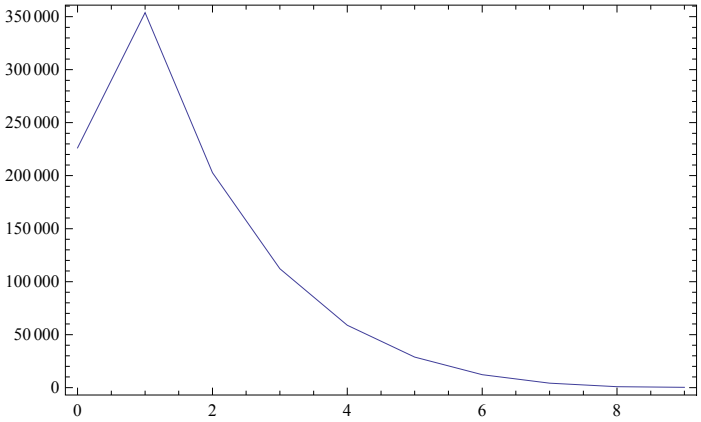

```
Delta4-sequenz
{0, 0, 2, 3, 0, 2, 1, 0, 0, 0, 0, 3, 3, 4, 1, 1, 2, 1, 2, 0, 1, 1,
  4, 1, 1, 4, 1, 0, 0, 1, 1, 1, 0, 1, 1, 3, 1, 1, 2, 0, 2, 3, 6, 4, 4, 0, 1, 0,
  1, 1, 0, 2, 3, 6, 5, 1, 3, 1, 2, 2, 3, 1, 2, 0, 2, 4, 3, 0, 1, 0, 0, 2, 0, 2,
  4, 3, 5, 6, 0, 1, 1, 0, 3, 0, 2, 0, 0, 1, 2, 0, 0, 0, 5, 0, 5, 4, 0, 4, 4, 4}
```

```
Delta4-density=
{226 252, 353 905, 202 761, 112 170, 58 835, 28 749, 12 138, 4186, 834, 166}
```

Out[251]=



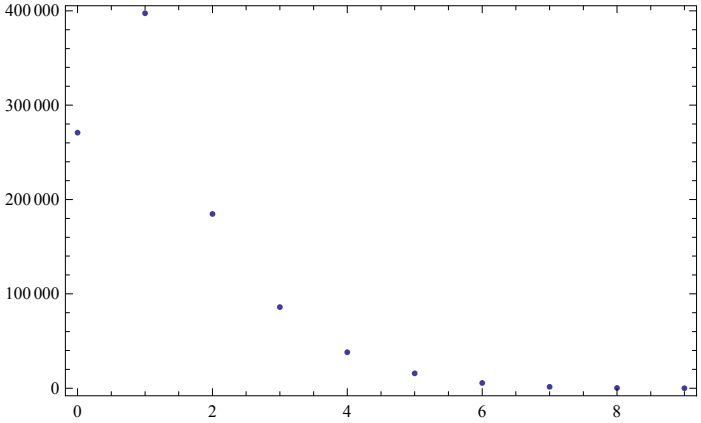
Out[252]=



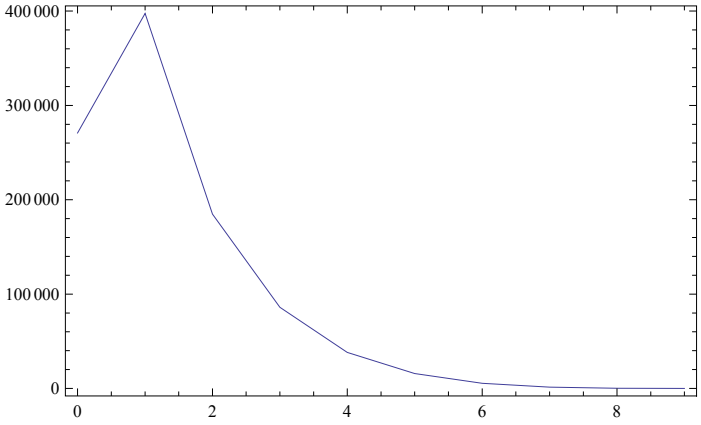

```
Delta5-sequenz
{0, 2, 1, 3, 2, 1, 1, 0, 0, 0, 3, 0, 1, 3, 0, 1, 1, 1, 2, 1, 0, 3,
  3, 0, 3, 3, 1, 0, 1, 0, 0, 1, 1, 0, 2, 2, 0, 1, 2, 2, 1, 3, 2, 0, 4, 1, 1, 1,
  0, 1, 2, 1, 3, 1, 4, 2, 2, 1, 0, 1, 2, 1, 2, 2, 2, 1, 3, 1, 1, 0, 2, 2, 2, 2,
  1, 2, 1, 6, 1, 0, 1, 3, 3, 2, 2, 0, 1, 1, 2, 0, 0, 5, 5, 5, 1, 4, 4, 0, 0, 1}
```

```
Delta5-density=
{270 795, 397 469, 184 766, 85 962, 38 111, 15 728, 5482, 1428, 222, 32}
```

Out[255]=



Out[256]=



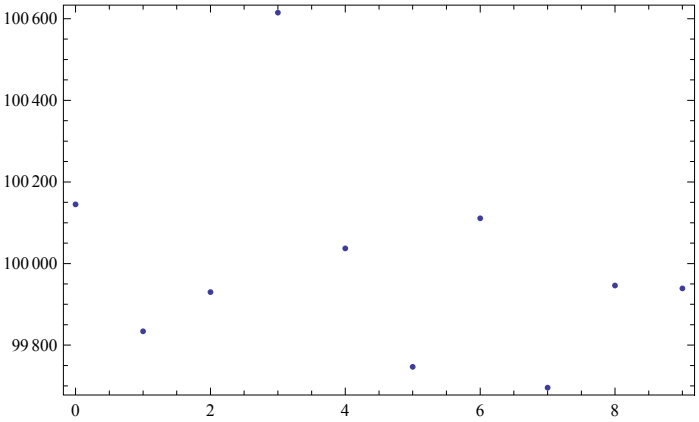
In[257]:=
```
(* stellenweise Auswertung der reellen Zahl*)
t = 1 000 000; x = RealDigits[N[Pi / E, t]];
Print[N[Pi / E, 100]]; xx = {0, 1, 2, 3, 4, 5, 6, 7, 8, 9};
Print["Digits\n", Table[x[[1, i]], {i, 1, 100}]];
ziffer = delta1ziffer =
  delta2ziffer = delta3ziffer = delta4ziffer = delta5ziffer = Table[0, {i, 10}];
delta1sequ = delta2sequ = delta3sequ = delta4sequ = delta5sequ = Table[0, {i, t}];
Table[{ziffer[[x[[1, i]] + 1]] ++;}, {i, 1, t}];
Print["Digits-density\n", ziffer];
ListPlot[Table[{xx[[i]], ziffer[[i]]}, {i, 10}], Frame → True]
ListLinePlot[Table[{xx[[i]], ziffer[[i]]}, {i, 10}], Frame → True]
Table[delta1sequ[[i]] = Abs[x[[1, i + 1]] - x[[1, i]]], {i, 1, t - 1}];
Print["Delta1-sequenz\n", Table[delta1sequ[[i]], {i, 1, 100}]];
Table[{delta1ziffer[[delta1sequ[[i]] + 1]] ++;}, {i, 1, t - 1}];
Print["Delta1-density=\n", delta1ziffer];
ListPlot[Table[{xx[[i]], delta1ziffer[[i]]}, {i, 10}], Frame → True]
ListLinePlot[Table[{xx[[i]], delta1ziffer[[i]]}, {i, 10}], Frame → True]
Table[delta2sequ[[i]] = Abs[delta1sequ[[i + 1]] - delta1sequ[[i]]], {i, 1, t - 2}];
Print["Delta2-sequenz\n", Table[delta2sequ[[i]], {i, 1, 100}]];
Table[{delta2ziffer[[delta2sequ[[i]] + 1]] ++;}, {i, 1, t - 2}];
Print["Delta2-density=\n", delta2ziffer];
ListPlot[Table[{xx[[i]], delta2ziffer[[i]]}, {i, 10}], Frame → True]
ListLinePlot[Table[{xx[[i]], delta2ziffer[[i]]}, {i, 10}], Frame → True]
Table[delta3sequ[[i]] = Abs[delta2sequ[[i + 1]] - delta2sequ[[i]]], {i, 1, t - 3}];
Print["Delta3-sequenz\n", Table[delta3sequ[[i]], {i, 1, 100}]];
Table[{delta3ziffer[[delta3sequ[[i]] + 1]] ++;}, {i, 1, t - 3}];
Print["Delta3-density=\n", delta3ziffer];
ListPlot[Table[{xx[[i]], delta3ziffer[[i]]}, {i, 10}], Frame → True]
ListLinePlot[Table[{xx[[i]], delta3ziffer[[i]]}, {i, 10}], Frame → True]
Table[delta4sequ[[i]] = Abs[delta3sequ[[i + 1]] - delta3sequ[[i]]], {i, 1, t - 4}];
Print["Delta4-sequenz\n", Table[delta4sequ[[i]], {i, 1, 100}]];
Table[{delta4ziffer[[delta4sequ[[i]] + 1]] ++;}, {i, 1, t - 4}];
Print["Delta4-density=\n", delta4ziffer];
ListPlot[Table[{xx[[i]], delta4ziffer[[i]]}, {i, 10}], Frame → True]
ListLinePlot[Table[{xx[[i]], delta4ziffer[[i]]}, {i, 10}], Frame → True]
Table[delta5sequ[[i]] = Abs[delta4sequ[[i + 1]] - delta4sequ[[i]]], {i, 1, t - 5}];
Print["Delta5-sequenz\n", Table[delta5sequ[[i]], {i, 1, 100}]];
Table[{delta5ziffer[[delta5sequ[[i]] + 1]] ++;}, {i, 1, t - 5}];
Print["Delta5-density=\n", delta5ziffer];
ListPlot[Table[{xx[[i]], delta5ziffer[[i]]}, {i, 10}], Frame → True]
ListLinePlot[Table[{xx[[i]], delta5ziffer[[i]]}, {i, 10}], Frame → True]
```

```
1.155727349790921717910093183312696299120851023164415820499706535327288631840916939440188434235673559
```

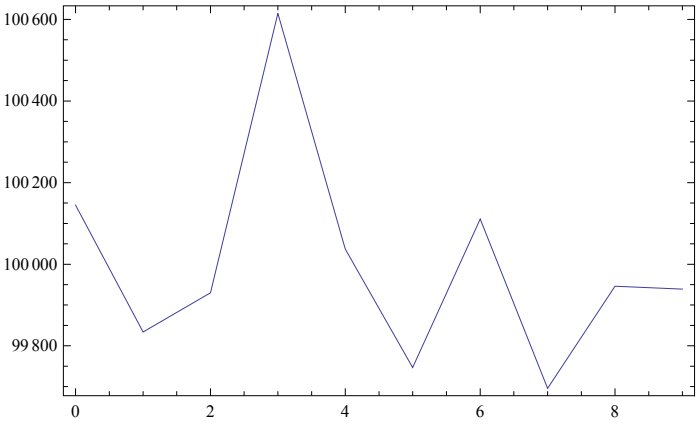
```
Digits
{1, 1, 5, 5, 7, 2, 7, 3, 4, 9, 7, 9, 0, 9, 2, 1, 7, 1, 7, 9, 1, 0,
  0, 9, 3, 1, 8, 3, 3, 1, 2, 6, 9, 6, 2, 9, 9, 1, 2, 0, 8, 5, 1, 0, 2, 3, 1, 6,
  4, 4, 1, 5, 8, 2, 0, 4, 9, 9, 7, 0, 6, 5, 3, 5, 3, 2, 7, 2, 8, 8, 6, 3, 1, 8,
  4, 0, 9, 1, 6, 9, 3, 9, 4, 4, 0, 1, 8, 8, 4, 3, 4, 2, 3, 5, 6, 7, 3, 5, 5, 8}
```

```
Digits-density
{100 145, 99 834, 99 930, 100 615, 100 037, 99 747, 100 111, 99 696, 99 946, 99 939}
```

Out[261]=



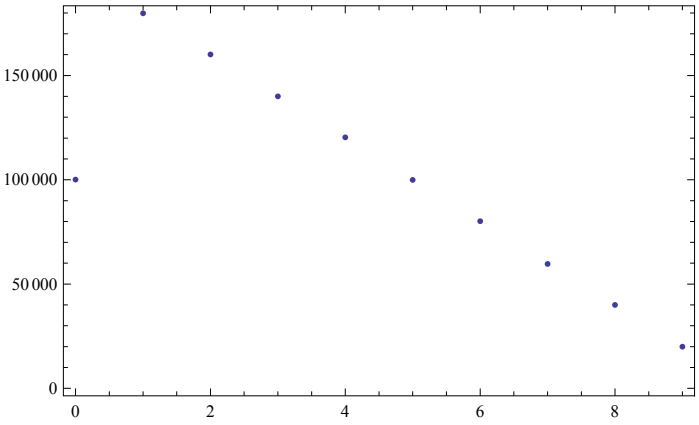
Out[262]=



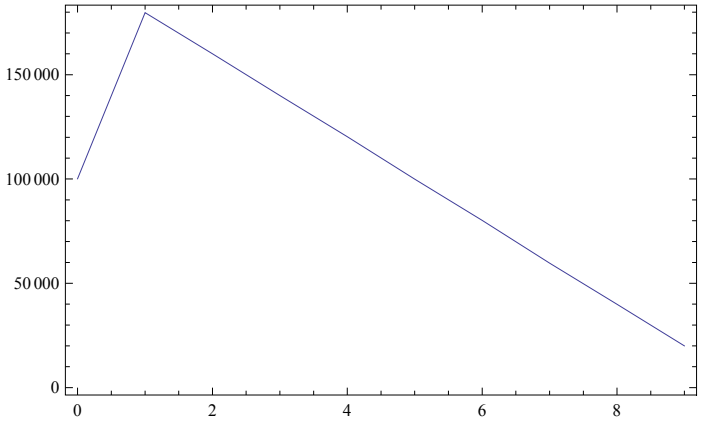

```
Delta1-sequenz
{0, 4, 0, 2, 5, 5, 4, 1, 5, 2, 2, 9, 9, 7, 1, 6, 6, 6, 2, 8, 1, 0,
  9, 6, 2, 7, 5, 0, 2, 1, 4, 3, 3, 4, 7, 0, 8, 1, 2, 8, 3, 4, 1, 2, 1, 2, 5, 2,
  0, 3, 4, 3, 6, 2, 4, 5, 0, 2, 7, 6, 1, 2, 2, 2, 1, 5, 5, 6, 0, 2, 3, 2, 7, 4,
  4, 9, 8, 5, 3, 6, 6, 5, 0, 4, 1, 7, 0, 4, 1, 1, 2, 1, 2, 1, 1, 4, 2, 0, 3, 0}
```

```
Delta1-density=
{100 111, 179 794, 160 072, 140 028, 120 322, 99 933, 80 155, 59 645, 39 972, 19 967}
```

Out[266]=



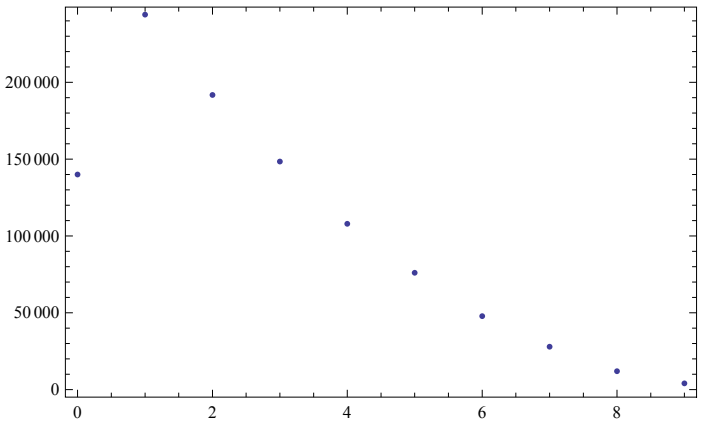
Out[267]=



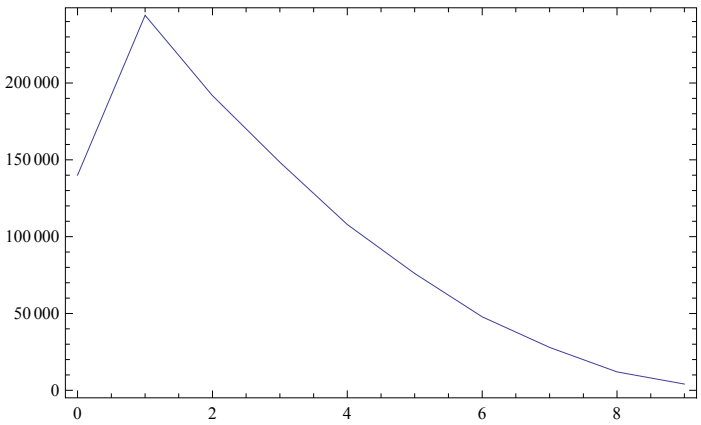

```
Delta2-sequenz
{4, 4, 2, 3, 0, 1, 3, 4, 3, 0, 7, 0, 2, 6, 5, 0, 0, 4, 6, 7, 1, 9,
  3, 4, 5, 2, 5, 2, 1, 3, 1, 0, 1, 3, 7, 8, 7, 1, 6, 5, 1, 3, 1, 1, 1, 3, 3, 2,
  3, 1, 1, 3, 4, 2, 1, 5, 2, 5, 1, 5, 1, 0, 0, 1, 4, 0, 1, 6, 2, 1, 1, 5, 3, 0,
  5, 1, 3, 2, 3, 0, 1, 5, 4, 3, 6, 7, 4, 3, 0, 1, 1, 1, 1, 0, 3, 2, 2, 3, 3, 8}
```

```
Delta2-density=
{140 008, 243 976, 191 786, 148 411, 107 924, 76 032, 47 872, 27 909, 12 019, 4061}
```

Out[271]=



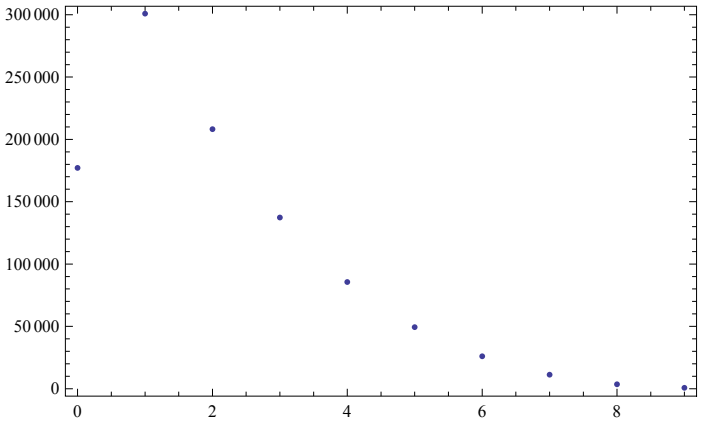
Out[272]=



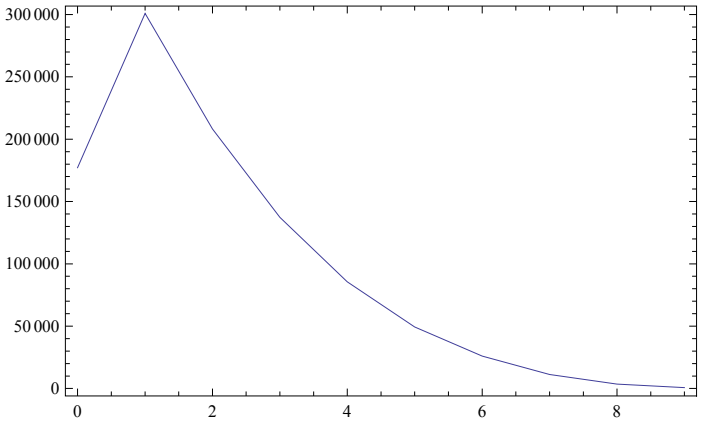

```
Delta3-sequenz
{0, 2, 1, 3, 1, 2, 1, 1, 3, 7, 7, 2, 4, 1, 5, 0, 4, 2, 1, 6, 8, 6,
  1, 1, 3, 3, 3, 1, 2, 2, 1, 1, 2, 4, 1, 1, 6, 5, 1, 4, 2, 2, 0, 0, 2, 0, 1, 1,
  2, 0, 2, 1, 2, 1, 4, 3, 3, 4, 4, 4, 1, 0, 1, 3, 4, 1, 5, 4, 1, 0, 4, 2, 3, 5,
  4, 2, 1, 1, 3, 1, 4, 1, 1, 3, 1, 3, 1, 3, 1, 0, 0, 0, 1, 3, 1, 0, 1, 0, 5, 4}
```

```
Delta3-density=
{177 139, 300 834, 208 196, 137 334, 85 606, 49 390, 25 995, 11 181, 3569, 753}
```

Out[276]=



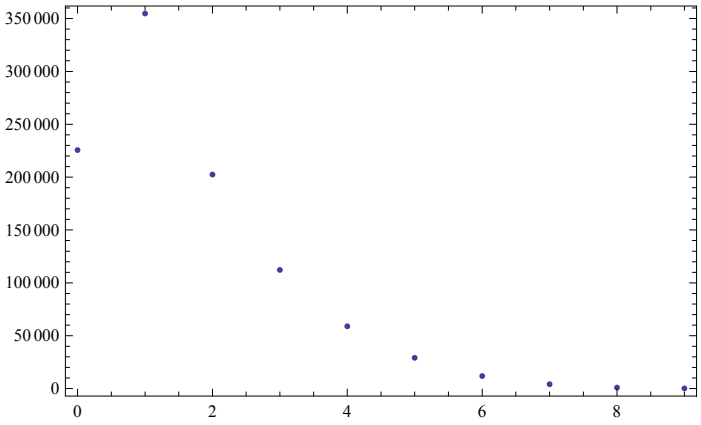
Out[277]=



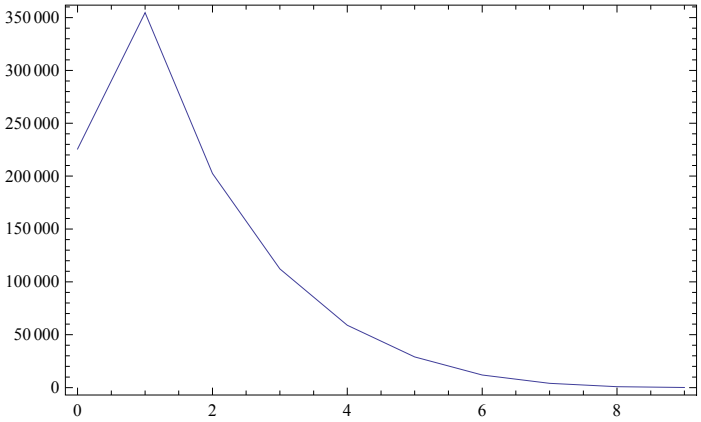

```
Delta4-sequenz
{2, 1, 2, 2, 1, 1, 0, 2, 4, 0, 5, 2, 3, 4, 5, 4, 2, 1, 5, 2, 2, 5,
  0, 2, 0, 0, 2, 1, 0, 1, 0, 1, 2, 3, 0, 5, 1, 4, 3, 2, 0, 2, 0, 2, 2, 1, 0, 1,
  2, 2, 1, 1, 1, 3, 1, 0, 1, 0, 0, 3, 1, 1, 2, 1, 3, 4, 1, 3, 1, 4, 2, 1, 2, 1,
  2, 1, 0, 2, 2, 3, 3, 0, 2, 2, 2, 2, 2, 2, 1, 0, 0, 1, 2, 2, 1, 1, 1, 5, 1, 4}
```

```
Delta4-density=
{225 595, 354 693, 202 492, 112 212, 58 923, 29 053, 11 876, 4073, 921, 158}
```

Out[281]=



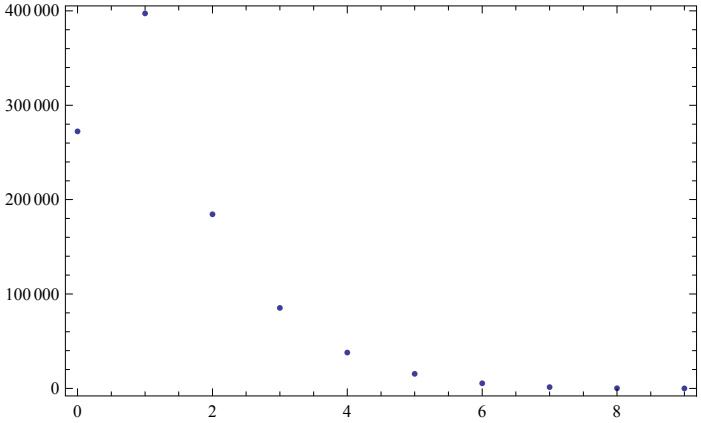
Out[282]=




```
Delta5-sequenz
{1, 1, 0, 1, 0, 1, 2, 2, 4, 5, 3, 1, 1, 1, 1, 2, 1, 4, 3, 0, 3, 5,
  2, 2, 0, 2, 1, 1, 1, 1, 1, 1, 1, 3, 5, 4, 3, 1, 1, 2, 2, 2, 2, 0, 1, 1, 1, 1,
  0, 1, 0, 0, 2, 2, 1, 1, 1, 0, 3, 2, 0, 1, 1, 2, 1, 3, 2, 2, 3, 2, 1, 1, 1, 1,
  1, 1, 2, 0, 1, 0, 3, 2, 0, 0, 0, 0, 0, 1, 1, 0, 1, 1, 0, 1, 0, 0, 4, 4, 3, 4}
```

```
Delta5-density=
{272 367, 397 233, 184 550, 85 344, 37 998, 15 460, 5412, 1344, 256, 31}
```

Out[285]=



Out[286]=

