

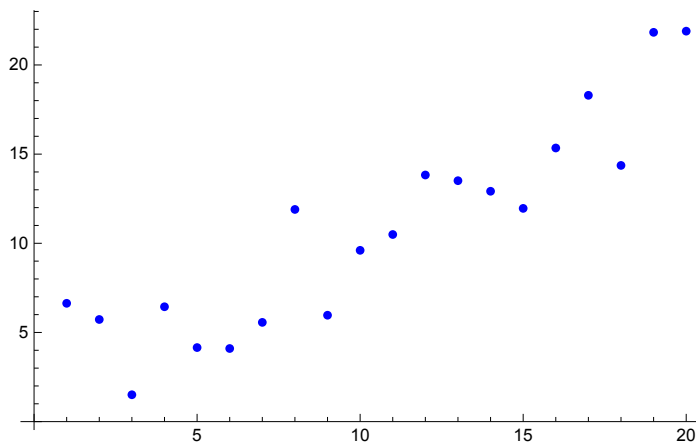
Neural networks

DotPlusLayer

```
reguladate = Table[x → x + RandomVariate[NormalDistribution[0, 2.15]], {x, 1, 20, 1}]
```

```
{1 → 6.63454, 2 → 5.72724, 3 → 1.50659, 4 → 6.44093, 5 → 4.15262,  
6 → 4.10021, 7 → 5.56502, 8 → 11.8978, 9 → 5.96632, 10 → 9.60541,  
11 → 10.4927, 12 → 13.8298, 13 → 13.5101, 14 → 12.9174, 15 → 11.9571,  
16 → 15.3438, 17 → 18.2973, 18 → 14.3663, 19 → 21.8289, 20 → 21.8948}
```

```
a1 = ListPlot[List @@@ reguladate, PlotStyle → Blue]
```



```
trained = NetTrain[DotPlusLayer[1], reguladate]
```

```
LinearLayer[  Parameters  
OutputDimensions: 1 ]
```

```
trained[2.1]
```

```
3.29528
```

```
trained[30]
```

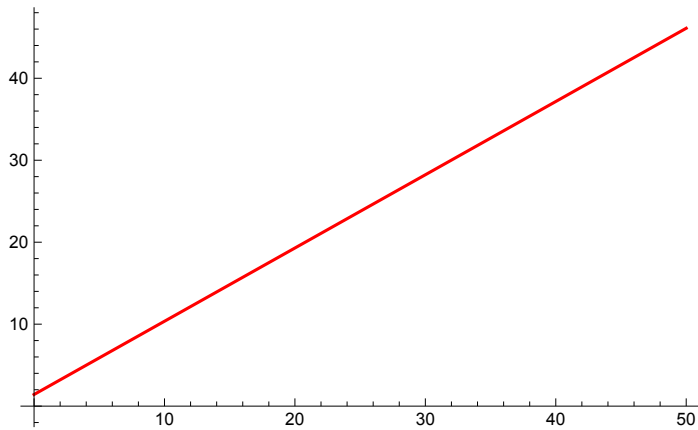
```
28.2275
```

```
functie[x_] := trained[x]
```

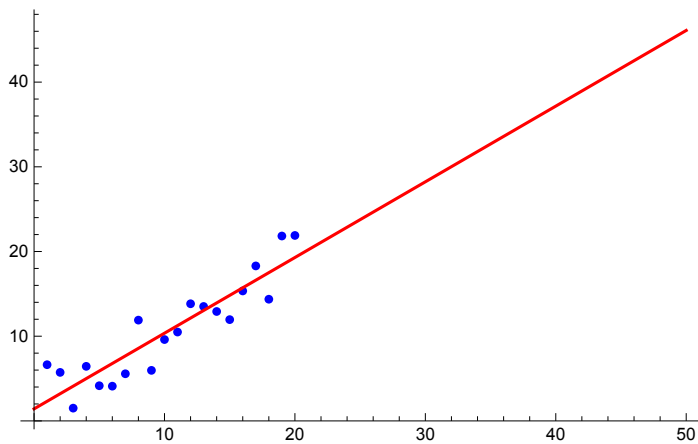
```
functie[50]
```

```
46.1
```

```
a2 = Plot[functie[x], {x, 0, 50}, PlotStyle -> Red]
```



```
Show[a1, a2, PlotRange -> All]
```

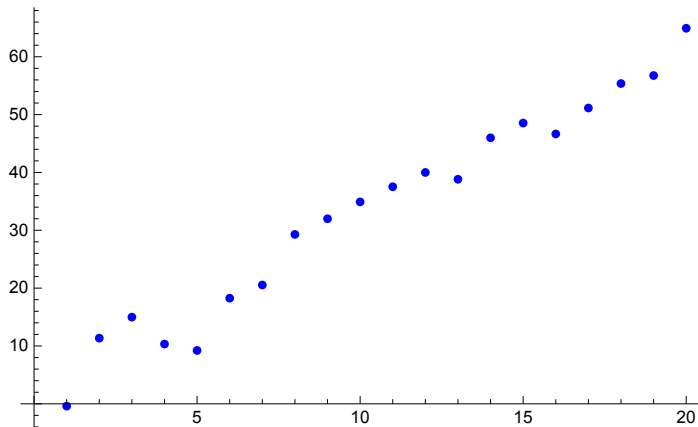


LinearLayer

```
reguladate = Table[x -> 2 + 3 x + RandomVariate[NormalDistribution[0, 3.15]], {x, 1, 20, 1}]
```

```
{1 -> -0.402336, 2 -> 11.3502, 3 -> 14.9819, 4 -> 10.3306, 5 -> 9.22105, 6 -> 18.2579, 7 -> 20.5361,
8 -> 29.289, 9 -> 31.9972, 10 -> 34.9098, 11 -> 37.5276, 12 -> 39.9984, 13 -> 38.819, 14 -> 45.9891,
15 -> 48.5388, 16 -> 46.6553, 17 -> 51.1378, 18 -> 55.3732, 19 -> 56.7545, 20 -> 64.9276}
```

```
a1 = ListPlot[List @@@ reguladate, PlotStyle → Blue]
```



```
trained = NetTrain[LinearLayer[1], reguladate]
```

```
LinearLayer[  Parameters  
OutputDimensions: 1 ]
```

```
trained[2.1]
```

```
7.50171
```

```
trained[30]
```

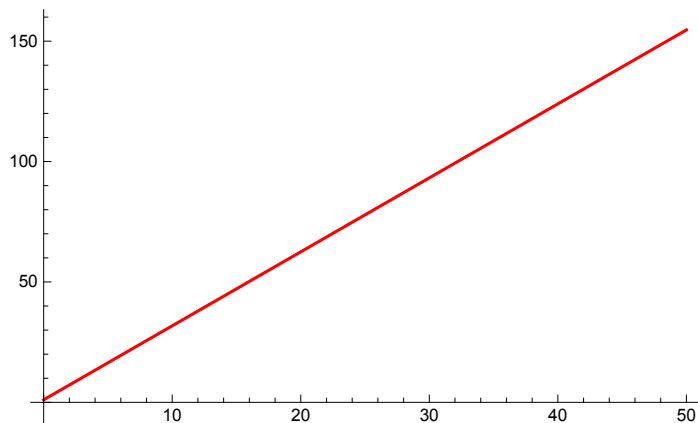
```
93.2209
```

```
functie[x_] := trained[x]
```

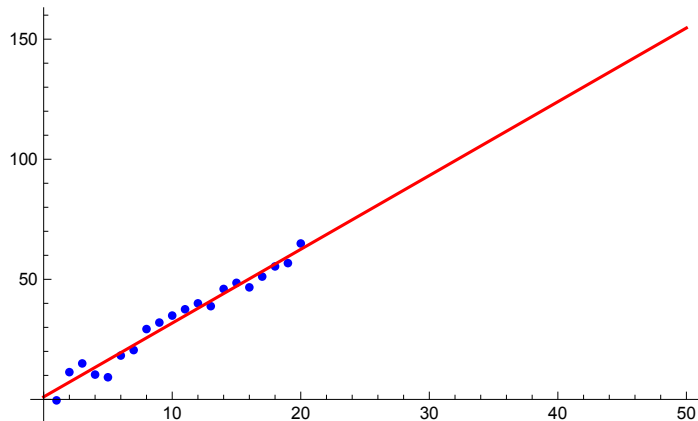
```
functie[50]
```

```
154.668
```

```
a2 = Plot[functie[x], {x, 0, 50}, PlotStyle → Red]
```



Show[a1, a2, PlotRange -> All]

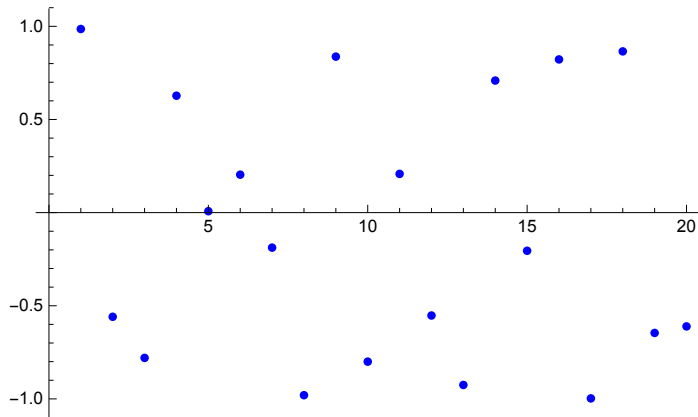


Layer Tanh

```
reguladate = Table[x → Cos[x^2 * RandomVariate[NormalDistribution[0, 5.15]]], {x, 1, 20, 1}]
```

```
{1 → 0.985754, 2 → -0.559224, 3 → -0.779901, 4 → 0.62758, 5 → 0.00746819,
 6 → 0.203642, 7 → -0.187971, 8 → -0.980139, 9 → 0.837413, 10 → -0.800055,
 11 → 0.20788, 12 → -0.552379, 13 → -0.925174, 14 → 0.708908, 15 → -0.204906,
 16 → 0.822354, 17 → -0.997342, 18 → 0.865533, 19 → -0.645925, 20 → -0.610862}
```

```
a1 = ListPlot[List @@@ reguladate, PlotStyle → Blue]
```



```
net = NetChain[{100, Tanh, 200, Tanh, 300, Tanh, 1}, "Input" → "Scalar", "Output" → "Scalar"]
```

```
NetChain [  ]
```



```
NetInitialize[net]
```

```
NetChain [  ]
```



```
trained = NetTrain[net, reguladate]
```

```
NetChain [  ]
```



```
trained[2.1]
```

```
-0.653471
```

```
trained[30]
```

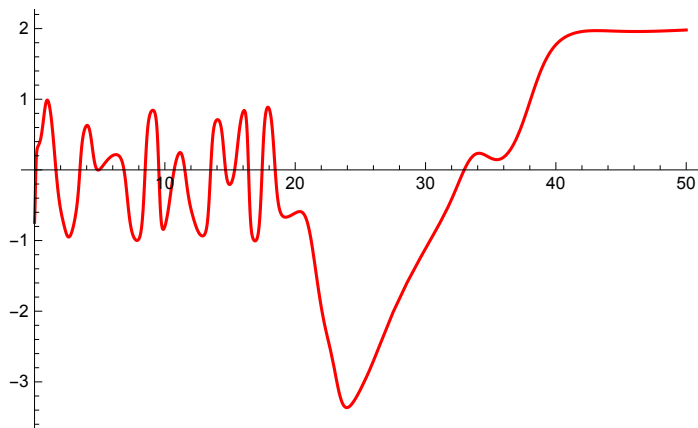
```
-1.11262
```

```
functie[x_] := trained[x]
```

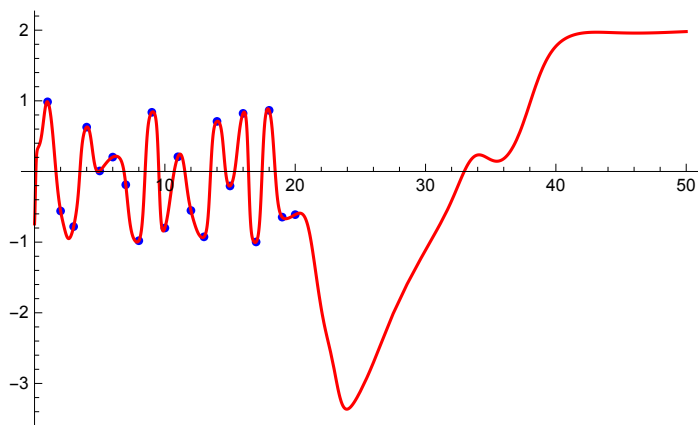
```
functie[50]
```

```
1.98
```

```
a2 = Plot[functie[x], {x, 0, 50}, PlotStyle -> Red, PlotRange -> All]
```



```
Show[a1, a2, PlotRange -> All]
```

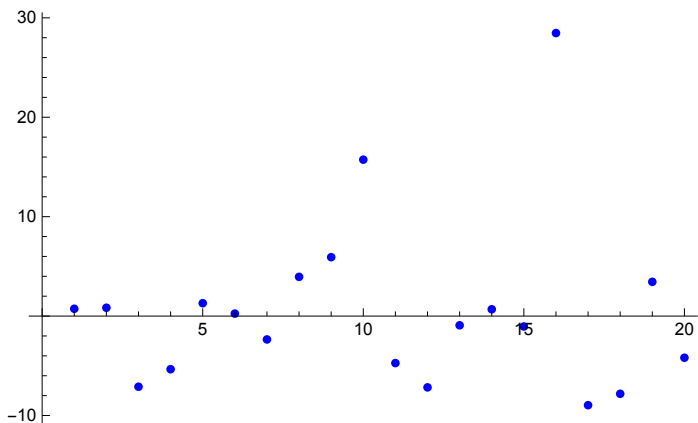


Layer sin

```
reguladate = Table[x → RandomVariate[NormalDistribution[0, x]], {x, 1, 20, 1}]
```

```
{1 → 0.737043, 2 → 0.837901, 3 → -7.1074, 4 → -5.34506, 5 → 1.2952,
 6 → 0.249947, 7 → -2.35012, 8 → 3.94718, 9 → 5.92476, 10 → 15.733,
 11 → -4.72705, 12 → -7.17228, 13 → -0.927406, 14 → 0.683429, 15 → -1.04603,
 16 → 28.4683, 17 → -8.96418, 18 → -7.81669, 19 → 3.44493, 20 → -4.18927}
```

```
a1 = ListPlot[List @@@ reguladate, PlotStyle → Blue]
```



```
net = NetChain[{100, Cos, 200, Sin, 300, 1}, "Input" → "Scalar", "Output" → "Scalar"]
```

```
NetChain [  ] 
```

```
NetInitialize[net]
```

```
NetChain [  ] 
```

```
trained = NetTrain[net, reguladate]
```

```
NetChain [  ] 
```

```
trained[2.1]
```

```
0.0395353
```

```
trained[30]
```

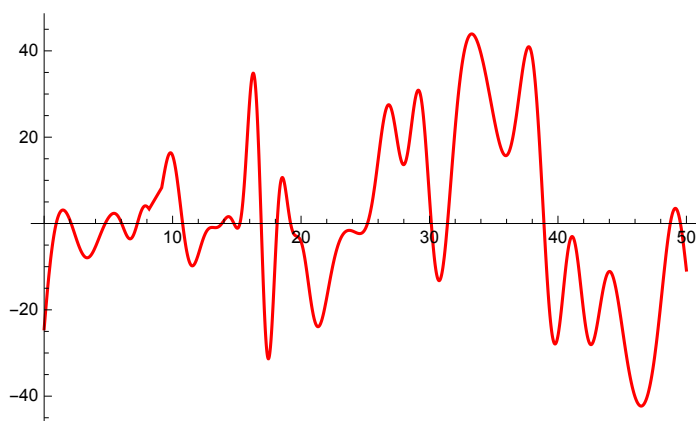
```
5.94944
```

```
functie[x_] := trained[x]
```

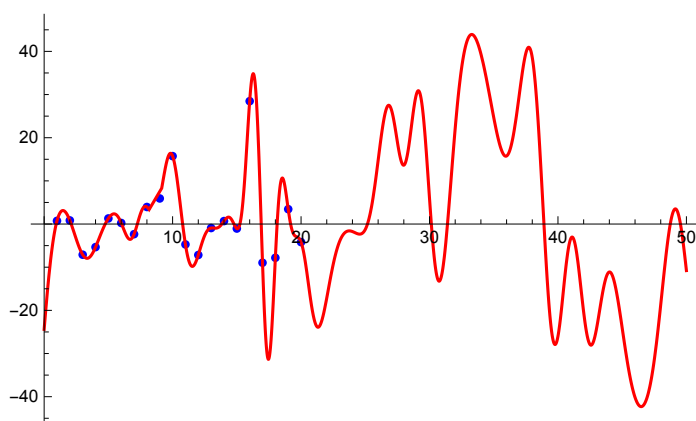
```
functie[50]
```

```
-10.7839
```

```
a2 = Plot[functie[x], {x, 0, 50}, PlotStyle -> Red, PlotRange -> All]
```



```
Show[a1, a2, PlotRange -> All]
```



2D functions

```
data = Flatten@Table[{x, y} -> Sin[x * y] + RandomVariate[NormalDistribution[2, 0.3]],
  {x, 0, 3, 0.1}, {y, 0, 3, 0.1}] // Quiet
```

```
{ {0., 0.} -> 2.11289, {0., 0.1} -> 2.26564, {0., 0.2} -> 2.29053, {0., 0.3} -> 1.73815,
  {0., 0.4} -> 1.30435, {0., 0.5} -> 1.69109, {0., 0.6} -> 1.64868, {0., 0.7} -> 2.80639,
  {0., 0.8} -> 2.0879, {0., 0.9} -> 2.53788, {0., 1.} -> 2.14735, {0., 1.1} -> 1.79893,
  {0., 1.2} -> 1.47437, {0., 1.3} -> 1.89341, {0., 1.4} -> 1.51692, {0., 1.5} -> 1.55888,
  {0., 1.6} -> 1.5329, {0., 1.7} -> 2.51131, {0., 1.8} -> 1.55656, {0., 1.9} -> 2.11363,
  {0., 2.} -> 2.2675, {0., 2.1} -> 2.17487, {0., 2.2} -> 1.59716, {0., 2.3} -> 1.64995,
  {0., 2.4} -> 2.26202, {0., 2.5} -> 2.16599, {0., 2.6} -> 2.04525, {0., 2.7} -> 2.22155,
  {0., 2.8} -> 2.33143, {0., 2.9} -> 1.82698, {0., 3.} -> 1.92378, {0.1, 0.} -> 1.8471,
  {0.1, 0.1} -> 1.58425, {0.1, 0.2} -> 1.88495, {0.1, 0.3} -> 1.93586, {0.1, 0.4} -> 2.20078,
  {0.1, 0.5} -> 2.21852, {0.1, 0.6} -> 1.39216, {0.1, 0.7} -> 1.62719, {0.1, 0.8} -> 2.20622,
  {0.1, 0.9} -> 2.00288, {0.1, 1.} -> 1.63865, {0.1, 1.1} -> 2.38968, {0.1, 1.2} -> 1.73871,
  {0.1, 1.3} -> 1.88953, {0.1, 1.4} -> 1.94629, {0.1, 1.5} -> 2.61169, {0.1, 1.6} -> 2.16392,
  {0.1, 1.7} -> 1.98712, {0.1, 1.8} -> 2.32838, {0.1, 1.9} -> 2.31036, {0.1, 2.} -> 2.22973,
  {0.1, 2.1} -> 2.64166, {0.1, 2.2} -> 2.01237, {0.1, 2.3} -> 1.54924, {0.1, 2.4} -> 1.74472,
  {0.1, 2.5} -> 2.60351, {0.1, 2.6} -> 2.49737, {0.1, 2.7} -> 1.88238, {0.1, 2.8} -> 2.59036,
```

$\{0.1, 2.9\} \rightarrow 2.12652$, $\{0.1, 3.\} \rightarrow 2.22874$, $\{0.2, 0.\} \rightarrow 1.52081$, $\{0.2, 0.1\} \rightarrow 1.81283$,
 $\{0.2, 0.2\} \rightarrow 1.95201$, $\{0.2, 0.3\} \rightarrow 2.27685$, $\{0.2, 0.4\} \rightarrow 1.82138$, $\{0.2, 0.5\} \rightarrow 2.18407$,
 $\{0.2, 0.6\} \rightarrow 1.80435$, $\{0.2, 0.7\} \rightarrow 2.20692$, $\{0.2, 0.8\} \rightarrow 2.04304$, $\{0.2, 0.9\} \rightarrow 2.00807$,
 $\{0.2, 1.\} \rightarrow 2.05414$, $\{0.2, 1.1\} \rightarrow 2.31092$, $\{0.2, 1.2\} \rightarrow 1.91825$, $\{0.2, 1.3\} \rightarrow 2.49094$,
 $\{0.2, 1.4\} \rightarrow 2.39715$, $\{0.2, 1.5\} \rightarrow 1.87982$, $\{0.2, 1.6\} \rightarrow 2.49961$, $\{0.2, 1.7\} \rightarrow 2.05843$,
 $\{0.2, 1.8\} \rightarrow 2.08363$, $\{0.2, 1.9\} \rightarrow 1.91209$, $\{0.2, 2.\} \rightarrow 2.15863$, $\{0.2, 2.1\} \rightarrow 2.67569$,
 $\{0.2, 2.2\} \rightarrow 2.59871$, $\{0.2, 2.3\} \rightarrow 2.33705$, $\{0.2, 2.4\} \rightarrow 2.44673$, $\{0.2, 2.5\} \rightarrow 2.37247$,
 $\{0.2, 2.6\} \rightarrow 2.51947$, $\{0.2, 2.7\} \rightarrow 2.35654$, $\{0.2, 2.8\} \rightarrow 2.45063$, $\{0.2, 2.9\} \rightarrow 2.8186$,
 $\{0.2, 3.\} \rightarrow 2.75943$, $\{0.3, 0.\} \rightarrow 2.02261$, $\{0.3, 0.1\} \rightarrow 2.12376$, $\{0.3, 0.2\} \rightarrow 1.84196$,
 $\{0.3, 0.3\} \rightarrow 2.49799$, $\{0.3, 0.4\} \rightarrow 2.36382$, $\{0.3, 0.5\} \rightarrow 2.35163$, $\{0.3, 0.6\} \rightarrow 2.45259$,
 $\{0.3, 0.7\} \rightarrow 2.69444$, $\{0.3, 0.8\} \rightarrow 1.71982$, $\{0.3, 0.9\} \rightarrow 2.06327$, $\{0.3, 1.\} \rightarrow 2.0088$,
 $\{0.3, 1.1\} \rightarrow 1.92496$, $\{0.3, 1.2\} \rightarrow 2.57924$, $\{0.3, 1.3\} \rightarrow 2.506$, $\{0.3, 1.4\} \rightarrow 2.09374$,
 $\{0.3, 1.5\} \rightarrow 2.3352$, $\{0.3, 1.6\} \rightarrow 2.83489$, $\{0.3, 1.7\} \rightarrow 2.87741$, $\{0.3, 1.8\} \rightarrow 2.59964$,
 $\{0.3, 1.9\} \rightarrow 2.79906$, $\{0.3, 2.\} \rightarrow 3.04404$, $\{0.3, 2.1\} \rightarrow 2.93251$, $\{0.3, 2.2\} \rightarrow 2.65223$,
 $\{0.3, 2.3\} \rightarrow 2.40783$, $\{0.3, 2.4\} \rightarrow 2.92643$, $\{0.3, 2.5\} \rightarrow 2.28316$, $\{0.3, 2.6\} \rightarrow 2.72035$,
 $\{0.3, 2.7\} \rightarrow 2.54155$, $\{0.3, 2.8\} \rightarrow 2.44396$, $\{0.3, 2.9\} \rightarrow 3.63115$, $\{0.3, 3.\} \rightarrow 3.01372$,
 $\{0.4, 0.\} \rightarrow 1.81915$, $\{0.4, 0.1\} \rightarrow 2.21404$, $\{0.4, 0.2\} \rightarrow 2.15639$, $\{0.4, 0.3\} \rightarrow 1.95927$,
 $\{0.4, 0.4\} \rightarrow 1.98408$, $\{0.4, 0.5\} \rightarrow 1.95256$, $\{0.4, 0.6\} \rightarrow 2.89471$, $\{0.4, 0.7\} \rightarrow 2.50077$,
 $\{0.4, 0.8\} \rightarrow 2.26398$, $\{0.4, 0.9\} \rightarrow 2.08334$, $\{0.4, 1.\} \rightarrow 1.79904$, $\{0.4, 1.1\} \rightarrow 2.89673$,
 $\{0.4, 1.2\} \rightarrow 2.08357$, $\{0.4, 1.3\} \rightarrow 2.02173$, $\{0.4, 1.4\} \rightarrow 2.36217$, $\{0.4, 1.5\} \rightarrow 2.60302$,
 $\{0.4, 1.6\} \rightarrow 3.02738$, $\{0.4, 1.7\} \rightarrow 2.57431$, $\{0.4, 1.8\} \rightarrow 2.95213$, $\{0.4, 1.9\} \rightarrow 2.76854$,
 $\{0.4, 2.\} \rightarrow 2.83277$, $\{0.4, 2.1\} \rightarrow 2.44634$, $\{0.4, 2.2\} \rightarrow 2.72668$, $\{0.4, 2.3\} \rightarrow 2.94736$,
 $\{0.4, 2.4\} \rightarrow 3.11739$, $\{0.4, 2.5\} \rightarrow 3.31612$, $\{0.4, 2.6\} \rightarrow 2.56791$, $\{0.4, 2.7\} \rightarrow 2.76763$,
 $\{0.4, 2.8\} \rightarrow 2.90525$, $\{0.4, 2.9\} \rightarrow 2.71314$, $\{0.4, 3.\} \rightarrow 2.39708$, $\{0.5, 0.\} \rightarrow 2.00575$,
 $\{0.5, 0.1\} \rightarrow 2.1837$, $\{0.5, 0.2\} \rightarrow 2.25194$, $\{0.5, 0.3\} \rightarrow 2.12363$, $\{0.5, 0.4\} \rightarrow 2.23692$,
 $\{0.5, 0.5\} \rightarrow 1.82201$, $\{0.5, 0.6\} \rightarrow 1.66872$, $\{0.5, 0.7\} \rightarrow 2.38084$, $\{0.5, 0.8\} \rightarrow 2.55067$,
 $\{0.5, 0.9\} \rightarrow 2.27622$, $\{0.5, 1.\} \rightarrow 2.07896$, $\{0.5, 1.1\} \rightarrow 2.06188$, $\{0.5, 1.2\} \rightarrow 2.59062$,
 $\{0.5, 1.3\} \rightarrow 2.799$, $\{0.5, 1.4\} \rightarrow 3.04627$, $\{0.5, 1.5\} \rightarrow 3.22452$, $\{0.5, 1.6\} \rightarrow 2.9738$,
 $\{0.5, 1.7\} \rightarrow 3.05653$, $\{0.5, 1.8\} \rightarrow 3.03898$, $\{0.5, 1.9\} \rightarrow 2.96006$, $\{0.5, 2.\} \rightarrow 2.92414$,
 $\{0.5, 2.1\} \rightarrow 2.54966$, $\{0.5, 2.2\} \rightarrow 2.69725$, $\{0.5, 2.3\} \rightarrow 3.08363$, $\{0.5, 2.4\} \rightarrow 3.12824$,
 $\{0.5, 2.5\} \rightarrow 3.7558$, $\{0.5, 2.6\} \rightarrow 2.98448$, $\{0.5, 2.7\} \rightarrow 2.98222$, $\{0.5, 2.8\} \rightarrow 2.66246$,
 $\{0.5, 2.9\} \rightarrow 2.93611$, $\{0.5, 3.\} \rightarrow 3.10911$, $\{0.6, 0.\} \rightarrow 1.96138$, $\{0.6, 0.1\} \rightarrow 2.07392$,
 $\{0.6, 0.2\} \rightarrow 1.28671$, $\{0.6, 0.3\} \rightarrow 1.85098$, $\{0.6, 0.4\} \rightarrow 2.55793$, $\{0.6, 0.5\} \rightarrow 1.96259$,
 $\{0.6, 0.6\} \rightarrow 2.53469$, $\{0.6, 0.7\} \rightarrow 2.39305$, $\{0.6, 0.8\} \rightarrow 2.26323$, $\{0.6, 0.9\} \rightarrow 2.55434$,
 $\{0.6, 1.\} \rightarrow 2.60554$, $\{0.6, 1.1\} \rightarrow 3.1649$, $\{0.6, 1.2\} \rightarrow 2.43925$, $\{0.6, 1.3\} \rightarrow 2.86082$,
 $\{0.6, 1.4\} \rightarrow 3.04841$, $\{0.6, 1.5\} \rightarrow 2.56333$, $\{0.6, 1.6\} \rightarrow 3.36193$, $\{0.6, 1.7\} \rightarrow 3.05611$,
 $\{0.6, 1.8\} \rightarrow 2.29825$, $\{0.6, 1.9\} \rightarrow 2.66112$, $\{0.6, 2.\} \rightarrow 3.07806$, $\{0.6, 2.1\} \rightarrow 3.54015$,
 $\{0.6, 2.2\} \rightarrow 3.46969$, $\{0.6, 2.3\} \rightarrow 2.66505$, $\{0.6, 2.4\} \rightarrow 3.0001$, $\{0.6, 2.5\} \rightarrow 2.83732$,
 $\{0.6, 2.6\} \rightarrow 2.71533$, $\{0.6, 2.7\} \rightarrow 2.58382$, $\{0.6, 2.8\} \rightarrow 2.76177$, $\{0.6, 2.9\} \rightarrow 3.2279$,
 $\{0.6, 3.\} \rightarrow 2.7619$, $\{0.7, 0.\} \rightarrow 2.59053$, $\{0.7, 0.1\} \rightarrow 2.209$, $\{0.7, 0.2\} \rightarrow 2.19886$,
 $\{0.7, 0.3\} \rightarrow 2.32823$, $\{0.7, 0.4\} \rightarrow 2.15212$, $\{0.7, 0.5\} \rightarrow 1.78253$, $\{0.7, 0.6\} \rightarrow 2.12006$,
 $\{0.7, 0.7\} \rightarrow 2.40649$, $\{0.7, 0.8\} \rightarrow 2.26239$, $\{0.7, 0.9\} \rightarrow 2.88375$, $\{0.7, 1.\} \rightarrow 2.42973$,
 $\{0.7, 1.1\} \rightarrow 3.09727$, $\{0.7, 1.2\} \rightarrow 2.49344$, $\{0.7, 1.3\} \rightarrow 3.14458$, $\{0.7, 1.4\} \rightarrow 2.70826$,
 $\{0.7, 1.5\} \rightarrow 2.58481$, $\{0.7, 1.6\} \rightarrow 3.14654$, $\{0.7, 1.7\} \rightarrow 2.86212$, $\{0.7, 1.8\} \rightarrow 3.04172$,
 $\{0.7, 1.9\} \rightarrow 3.11195$, $\{0.7, 2.\} \rightarrow 2.77151$, $\{0.7, 2.1\} \rightarrow 3.60001$, $\{0.7, 2.2\} \rightarrow 2.7909$,
 $\{0.7, 2.3\} \rightarrow 2.4027$, $\{0.7, 2.4\} \rightarrow 3.48125$, $\{0.7, 2.5\} \rightarrow 3.24036$, $\{0.7, 2.6\} \rightarrow 3.37891$,
 $\{0.7, 2.7\} \rightarrow 2.70558$, $\{0.7, 2.8\} \rightarrow 2.75738$, $\{0.7, 2.9\} \rightarrow 2.68403$, $\{0.7, 3.\} \rightarrow 2.58118$,
 $\{0.8, 0.\} \rightarrow 2.08503$, $\{0.8, 0.1\} \rightarrow 1.78363$, $\{0.8, 0.2\} \rightarrow 2.09896$, $\{0.8, 0.3\} \rightarrow 2.06571$,
 $\{0.8, 0.4\} \rightarrow 2.06525$, $\{0.8, 0.5\} \rightarrow 2.39691$, $\{0.8, 0.6\} \rightarrow 2.28864$, $\{0.8, 0.7\} \rightarrow 2.38003$,
 $\{0.8, 0.8\} \rightarrow 2.40416$, $\{0.8, 0.9\} \rightarrow 2.08451$, $\{0.8, 1.\} \rightarrow 2.37986$, $\{0.8, 1.1\} \rightarrow 2.78563$,
 $\{0.8, 1.2\} \rightarrow 3.39632$, $\{0.8, 1.3\} \rightarrow 2.88516$, $\{0.8, 1.4\} \rightarrow 3.00868$, $\{0.8, 1.5\} \rightarrow 2.46523$,

{0.8, 1.6} → 2.6372, {0.8, 1.7} → 2.80359, {0.8, 1.8} → 2.80771, {0.8, 1.9} → 2.33058,
 {0.8, 2.} → 2.97358, {0.8, 2.1} → 3.41813, {0.8, 2.2} → 3.39645, {0.8, 2.3} → 3.19727,
 {0.8, 2.4} → 3.55176, {0.8, 2.5} → 2.78224, {0.8, 2.6} → 2.61627, {0.8, 2.7} → 2.21792,
 {0.8, 2.8} → 2.90214, {0.8, 2.9} → 3.28105, {0.8, 3.} → 2.35518, {0.9, 0.} → 1.68669,
 {0.9, 0.1} → 2.13542, {0.9, 0.2} → 2.17806, {0.9, 0.3} → 2.44647, {0.9, 0.4} → 2.71159,
 {0.9, 0.5} → 2.17148, {0.9, 0.6} → 2.32035, {0.9, 0.7} → 2.65102, {0.9, 0.8} → 2.61005,
 {0.9, 0.9} → 2.50438, {0.9, 1.} → 2.36518, {0.9, 1.1} → 3.01158, {0.9, 1.2} → 2.86431,
 {0.9, 1.3} → 2.97439, {0.9, 1.4} → 3.1048, {0.9, 1.5} → 2.93071, {0.9, 1.6} → 3.15923,
 {0.9, 1.7} → 3.26488, {0.9, 1.8} → 2.47403, {0.9, 1.9} → 3.19654, {0.9, 2.} → 3.07117,
 {0.9, 2.1} → 3.54857, {0.9, 2.2} → 3.20875, {0.9, 2.3} → 2.50934, {0.9, 2.4} → 2.59181,
 {0.9, 2.5} → 2.95691, {0.9, 2.6} → 2.25113, {0.9, 2.7} → 2.11966, {0.9, 2.8} → 2.49511,
 {0.9, 2.9} → 2.85801, {0.9, 3.} → 2.67909, {1., 0.} → 2.15806, {1., 0.1} → 1.57996,
 {1., 0.2} → 2.64309, {1., 0.3} → 2.63023, {1., 0.4} → 2.48597, {1., 0.5} → 2.42241,
 {1., 0.6} → 2.65909, {1., 0.7} → 3.10914, {1., 0.8} → 3.18362, {1., 0.9} → 2.98424,
 {1., 1.} → 2.93385, {1., 1.1} → 2.98619, {1., 1.2} → 3.22214, {1., 1.3} → 3.04566,
 {1., 1.4} → 2.65847, {1., 1.5} → 2.94437, {1., 1.6} → 3.11087, {1., 1.7} → 2.41956,
 {1., 1.8} → 2.83429, {1., 1.9} → 3.05008, {1., 2.} → 3.02116, {1., 2.1} → 2.60467,
 {1., 2.2} → 3.29376, {1., 2.3} → 2.2836, {1., 2.4} → 2.95021, {1., 2.5} → 2.45817,
 {1., 2.6} → 2.58668, {1., 2.7} → 2.30857, {1., 2.8} → 2.42985, {1., 2.9} → 2.14252,
 {1., 3.} → 1.73891, {1.1, 0.} → 1.91127, {1.1, 0.1} → 2.1264, {1.1, 0.2} → 2.22303,
 {1.1, 0.3} → 2.04529, {1.1, 0.4} → 2.98994, {1.1, 0.5} → 2.92497, {1.1, 0.6} → 2.36407,
 {1.1, 0.7} → 2.49943, {1.1, 0.8} → 3.0859, {1.1, 0.9} → 2.80182, {1.1, 1.} → 3.66893,
 {1.1, 1.1} → 3.03619, {1.1, 1.2} → 2.9074, {1.1, 1.3} → 2.66989, {1.1, 1.4} → 3.2264,
 {1.1, 1.5} → 3.59036, {1.1, 1.6} → 2.59785, {1.1, 1.7} → 3.08527, {1.1, 1.8} → 2.71992,
 {1.1, 1.9} → 2.93855, {1.1, 2.} → 2.78045, {1.1, 2.1} → 3.10046, {1.1, 2.2} → 2.39617,
 {1.1, 2.3} → 2.21044, {1.1, 2.4} → 2.60232, {1.1, 2.5} → 2.63207, {1.1, 2.6} → 2.40981,
 {1.1, 2.7} → 2.10521, {1.1, 2.8} → 2.19038, {1.1, 2.9} → 1.93039, {1.1, 3.} → 1.84304,
 {1.2, 0.} → 2.12147, {1.2, 0.1} → 1.78865, {1.2, 0.2} → 2.27592, {1.2, 0.3} → 2.80423,
 {1.2, 0.4} → 2.3672, {1.2, 0.5} → 2.61181, {1.2, 0.6} → 2.64723, {1.2, 0.7} → 3.02006,
 {1.2, 0.8} → 2.81402, {1.2, 0.9} → 2.9222, {1.2, 1.} → 3.13008, {1.2, 1.1} → 2.79269,
 {1.2, 1.2} → 3.18171, {1.2, 1.3} → 3.59071, {1.2, 1.4} → 3.0314, {1.2, 1.5} → 3.04249,
 {1.2, 1.6} → 3.047, {1.2, 1.7} → 2.69438, {1.2, 1.8} → 2.69325, {1.2, 1.9} → 2.45003,
 {1.2, 2.} → 2.6783, {1.2, 2.1} → 2.42294, {1.2, 2.2} → 3.02649, {1.2, 2.3} → 2.00822,
 {1.2, 2.4} → 2.21055, {1.2, 2.5} → 1.68427, {1.2, 2.6} → 2.18874, {1.2, 2.7} → 1.74099,
 {1.2, 2.8} → 2.04011, {1.2, 2.9} → 1.56699, {1.2, 3.} → 1.6524, {1.3, 0.} → 1.64937,
 {1.3, 0.1} → 1.93248, {1.3, 0.2} → 1.94531, {1.3, 0.3} → 2.1245, {1.3, 0.4} → 1.88783,
 {1.3, 0.5} → 2.44677, {1.3, 0.6} → 2.6614, {1.3, 0.7} → 2.87182, {1.3, 0.8} → 2.65538,
 {1.3, 0.9} → 2.92813, {1.3, 1.} → 2.73479, {1.3, 1.1} → 3.54751, {1.3, 1.2} → 3.09364,
 {1.3, 1.3} → 3.00432, {1.3, 1.4} → 3.31962, {1.3, 1.5} → 2.95354, {1.3, 1.6} → 2.71358,
 {1.3, 1.7} → 3.03643, {1.3, 1.8} → 2.45664, {1.3, 1.9} → 2.59266, {1.3, 2.} → 2.31569,
 {1.3, 2.1} → 3.37991, {1.3, 2.2} → 2.31672, {1.3, 2.3} → 2.11606, {1.3, 2.4} → 2.08242,
 {1.3, 2.5} → 1.67553, {1.3, 2.6} → 1.66159, {1.3, 2.7} → 1.48367, {1.3, 2.8} → 1.90669,
 {1.3, 2.9} → 1.09314, {1.3, 3.} → 1.19443, {1.4, 0.} → 1.84991, {1.4, 0.1} → 1.97765,
 {1.4, 0.2} → 2.32778, {1.4, 0.3} → 1.97373, {1.4, 0.4} → 2.27717, {1.4, 0.5} → 2.6052,
 {1.4, 0.6} → 2.10705, {1.4, 0.7} → 2.92614, {1.4, 0.8} → 3.0681, {1.4, 0.9} → 3.25522,
 {1.4, 1.} → 2.83836, {1.4, 1.1} → 3.0273, {1.4, 1.2} → 3.15946, {1.4, 1.3} → 2.72201,
 {1.4, 1.4} → 3.23174, {1.4, 1.5} → 2.3855, {1.4, 1.6} → 3.63468, {1.4, 1.7} → 2.68847,
 {1.4, 1.8} → 2.50303, {1.4, 1.9} → 2.60869, {1.4, 2.} → 2.11628, {1.4, 2.1} → 2.59504,
 {1.4, 2.2} → 2.12408, {1.4, 2.3} → 1.75337, {1.4, 2.4} → 1.78659, {1.4, 2.5} → 1.56396,
 {1.4, 2.6} → 1.79422, {1.4, 2.7} → 1.99284, {1.4, 2.8} → 1.25447, {1.4, 2.9} → 1.26382,
 {1.4, 3.} → 0.96645, {1.5, 0.} → 2.60779, {1.5, 0.1} → 2.46918, {1.5, 0.2} → 2.29691,

{1.5, 0.3} → 2.42483, {1.5, 0.4} → 2.70815, {1.5, 0.5} → 2.09221, {1.5, 0.6} → 3.34824,
 {1.5, 0.7} → 2.60065, {1.5, 0.8} → 3.56716, {1.5, 0.9} → 2.63342, {1.5, 1.} → 3.2506,
 {1.5, 1.1} → 2.71202, {1.5, 1.2} → 3.04086, {1.5, 1.3} → 3.09819, {1.5, 1.4} → 3.12135,
 {1.5, 1.5} → 2.57837, {1.5, 1.6} → 2.84765, {1.5, 1.7} → 2.49886, {1.5, 1.8} → 2.42286,
 {1.5, 1.9} → 2.63654, {1.5, 2.} → 2.05869, {1.5, 2.1} → 1.58924, {1.5, 2.2} → 1.54574,
 {1.5, 2.3} → 1.7915, {1.5, 2.4} → 1.808, {1.5, 2.5} → 1.34207, {1.5, 2.6} → 1.36433,
 {1.5, 2.7} → 0.999297, {1.5, 2.8} → 0.934132, {1.5, 2.9} → 0.908956, {1.5, 3.} → 1.26098,
 {1.6, 0.} → 2.23026, {1.6, 0.1} → 1.54305, {1.6, 0.2} → 2.07121, {1.6, 0.3} → 2.77496,
 {1.6, 0.4} → 2.46315, {1.6, 0.5} → 2.76499, {1.6, 0.6} → 2.54752, {1.6, 0.7} → 2.86863,
 {1.6, 0.8} → 2.55996, {1.6, 0.9} → 2.99232, {1.6, 1.} → 2.49992, {1.6, 1.1} → 3.19786,
 {1.6, 1.2} → 2.90001, {1.6, 1.3} → 2.92559, {1.6, 1.4} → 2.66973, {1.6, 1.5} → 2.77818,
 {1.6, 1.6} → 2.60105, {1.6, 1.7} → 2.85465, {1.6, 1.8} → 2.17425, {1.6, 1.9} → 2.321,
 {1.6, 2.} → 2.32765, {1.6, 2.1} → 1.77715, {1.6, 2.2} → 1.53452, {1.6, 2.3} → 1.8181,
 {1.6, 2.4} → 1.26588, {1.6, 2.5} → 1.39783, {1.6, 2.6} → 1.25475, {1.6, 2.7} → 1.30781,
 {1.6, 2.8} → 0.772193, {1.6, 2.9} → 0.815655, {1.6, 3.} → 1.16064, {1.7, 0.} → 1.71229,
 {1.7, 0.1} → 1.72552, {1.7, 0.2} → 1.9607, {1.7, 0.3} → 2.27673, {1.7, 0.4} → 2.87066,
 {1.7, 0.5} → 3.0931, {1.7, 0.6} → 3.12153, {1.7, 0.7} → 2.59911, {1.7, 0.8} → 2.64766,
 {1.7, 0.9} → 3.19268, {1.7, 1.} → 3.47847, {1.7, 1.1} → 3.34358, {1.7, 1.2} → 2.84734,
 {1.7, 1.3} → 2.59303, {1.7, 1.4} → 2.99395, {1.7, 1.5} → 2.61358, {1.7, 1.6} → 2.33506,
 {1.7, 1.7} → 2.40588, {1.7, 1.8} → 2.05966, {1.7, 1.9} → 2.19991, {1.7, 2.} → 1.66657,
 {1.7, 2.1} → 2.06888, {1.7, 2.2} → 1.48584, {1.7, 2.3} → 1.72937, {1.7, 2.4} → 1.37845,
 {1.7, 2.5} → 1.47828, {1.7, 2.6} → 1.05934, {1.7, 2.7} → 0.808205, {1.7, 2.8} → 1.04441,
 {1.7, 2.9} → 1.21141, {1.7, 3.} → 1.34889, {1.8, 0.} → 2.00371, {1.8, 0.1} → 2.04393,
 {1.8, 0.2} → 2.29708, {1.8, 0.3} → 2.20297, {1.8, 0.4} → 2.37176, {1.8, 0.5} → 2.69255,
 {1.8, 0.6} → 2.90852, {1.8, 0.7} → 3.48367, {1.8, 0.8} → 3.32447, {1.8, 0.9} → 3.5739,
 {1.8, 1.} → 2.94749, {1.8, 1.1} → 2.21264, {1.8, 1.2} → 3.5304, {1.8, 1.3} → 2.23981,
 {1.8, 1.4} → 2.69199, {1.8, 1.5} → 2.34102, {1.8, 1.6} → 2.30202, {1.8, 1.7} → 2.03423,
 {1.8, 1.8} → 1.81569, {1.8, 1.9} → 1.08571, {1.8, 2.} → 1.41496, {1.8, 2.1} → 1.18541,
 {1.8, 2.2} → 0.851263, {1.8, 2.3} → 1.36228, {1.8, 2.4} → 0.931005, {1.8, 2.5} → 1.95522,
 {1.8, 2.6} → 1.22491, {1.8, 2.7} → 1.01423, {1.8, 2.8} → 0.899424, {1.8, 2.9} → 0.863821,
 {1.8, 3.} → 1.56367, {1.9, 0.} → 1.4311, {1.9, 0.1} → 1.80094, {1.9, 0.2} → 2.45084,
 {1.9, 0.3} → 2.74263, {1.9, 0.4} → 2.68882, {1.9, 0.5} → 2.40206, {1.9, 0.6} → 2.79635,
 {1.9, 0.7} → 2.97488, {1.9, 0.8} → 2.12934, {1.9, 0.9} → 3.52422, {1.9, 1.} → 2.93945,
 {1.9, 1.1} → 3.22925, {1.9, 1.2} → 3.2705, {1.9, 1.3} → 3.06788, {1.9, 1.4} → 2.20146,
 {1.9, 1.5} → 1.90952, {1.9, 1.6} → 2.32087, {1.9, 1.7} → 1.78372, {1.9, 1.8} → 1.46979,
 {1.9, 1.9} → 1.911, {1.9, 2.} → 1.24686, {1.9, 2.1} → 0.945672, {1.9, 2.2} → 0.98535,
 {1.9, 2.3} → 0.958244, {1.9, 2.4} → 0.425935, {1.9, 2.5} → 0.491798,
 {1.9, 2.6} → 1.14412, {1.9, 2.7} → 1.06268, {1.9, 2.8} → 1.33926, {1.9, 2.9} → 1.21087,
 {1.9, 3.} → 1.83497, {2., 0.} → 2.13471, {2., 0.1} → 2.47653, {2., 0.2} → 2.16111,
 {2., 0.3} → 3.1437, {2., 0.4} → 2.67612, {2., 0.5} → 2.72058, {2., 0.6} → 3.11975,
 {2., 0.7} → 3.15578, {2., 0.8} → 2.72435, {2., 0.9} → 2.82364, {2., 1.} → 2.74941,
 {2., 1.1} → 2.63284, {2., 1.2} → 2.44328, {2., 1.3} → 2.41279, {2., 1.4} → 2.43758,
 {2., 1.5} → 2.43353, {2., 1.6} → 1.92754, {2., 1.7} → 1.53216, {2., 1.8} → 1.78346,
 {2., 1.9} → 0.75935, {2., 2.} → 1.37122, {2., 2.1} → 1.03929, {2., 2.2} → 1.12634,
 {2., 2.3} → 1.24059, {2., 2.4} → 0.823112, {2., 2.5} → 1.12157, {2., 2.6} → 1.1807,
 {2., 2.7} → 1.49089, {2., 2.8} → 1.84995, {2., 2.9} → 1.69945, {2., 3.} → 1.65864,
 {2.1, 0.} → 2.08891, {2.1, 0.1} → 1.91997, {2.1, 0.2} → 2.57096, {2.1, 0.3} → 3.02248,
 {2.1, 0.4} → 2.74598, {2.1, 0.5} → 2.90701, {2.1, 0.6} → 2.41224, {2.1, 0.7} → 3.18062,
 {2.1, 0.8} → 2.63879, {2.1, 0.9} → 3.02617, {2.1, 1.} → 2.59275, {2.1, 1.1} → 2.83553,
 {2.1, 1.2} → 2.19907, {2.1, 1.3} → 2.01077, {2.1, 1.4} → 2.07743, {2.1, 1.5} → 1.77198,
 {2.1, 1.6} → 2.43036, {2.1, 1.7} → 1.20977, {2.1, 1.8} → 1.16099, {2.1, 1.9} → 1.44089,

{2.1, 2.} → 1.2418, {2.1, 2.1} → 1.29694, {2.1, 2.2} → 0.869165, {2.1, 2.3} → 0.845287,
 {2.1, 2.4} → 1.60582, {2.1, 2.5} → 0.603807, {2.1, 2.6} → 1.4498, {2.1, 2.7} → 0.90932,
 {2.1, 2.8} → 1.36297, {2.1, 2.9} → 1.87861, {2.1, 3.} → 1.92584, {2.2, 0.} → 2.14659,
 {2.2, 0.1} → 1.94432, {2.2, 0.2} → 2.16807, {2.2, 0.3} → 3.06044, {2.2, 0.4} → 2.89564,
 {2.2, 0.5} → 2.34026, {2.2, 0.6} → 2.71652, {2.2, 0.7} → 2.64543, {2.2, 0.8} → 3.03376,
 {2.2, 0.9} → 2.58397, {2.2, 1.} → 2.59676, {2.2, 1.1} → 2.52393, {2.2, 1.2} → 2.96528,
 {2.2, 1.3} → 2.30423, {2.2, 1.4} → 2.32204, {2.2, 1.5} → 1.79159, {2.2, 1.6} → 1.36885,
 {2.2, 1.7} → 1.53551, {2.2, 1.8} → 1.42756, {2.2, 1.9} → 0.730012, {2.2, 2.} → 0.582559,
 {2.2, 2.1} → 0.542765, {2.2, 2.2} → 0.864282, {2.2, 2.3} → 0.76504, {2.2, 2.4} → 1.12597,
 {2.2, 2.5} → 0.946583, {2.2, 2.6} → 1.10693, {2.2, 2.7} → 1.67811, {2.2, 2.8} → 2.288,
 {2.2, 2.9} → 1.82579, {2.2, 3.} → 2.47321, {2.3, 0.} → 1.73168, {2.3, 0.1} → 2.34775,
 {2.3, 0.2} → 2.59798, {2.3, 0.3} → 2.98721, {2.3, 0.4} → 2.94788, {2.3, 0.5} → 2.67637,
 {2.3, 0.6} → 3.03699, {2.3, 0.7} → 2.98035, {2.3, 0.8} → 2.64886, {2.3, 0.9} → 3.01816,
 {2.3, 1.} → 3.12882, {2.3, 1.1} → 2.42824, {2.3, 1.2} → 2.032, {2.3, 1.3} → 1.98881,
 {2.3, 1.4} → 2.00446, {2.3, 1.5} → 1.20705, {2.3, 1.6} → 1.2748, {2.3, 1.7} → 1.26141,
 {2.3, 1.8} → 0.927418, {2.3, 1.9} → 0.856345, {2.3, 2.} → 1.24069, {2.3, 2.1} → 1.2148,
 {2.3, 2.2} → 0.920422, {2.3, 2.3} → 0.810715, {2.3, 2.4} → 1.10974,
 {2.3, 2.5} → 1.65502, {2.3, 2.6} → 1.62886, {2.3, 2.7} → 1.78879, {2.3, 2.8} → 2.70036,
 {2.3, 2.9} → 2.68998, {2.3, 3.} → 2.93146, {2.4, 0.} → 2.06734, {2.4, 0.1} → 1.63526,
 {2.4, 0.2} → 2.52139, {2.4, 0.3} → 2.24222, {2.4, 0.4} → 2.40803, {2.4, 0.5} → 2.95597,
 {2.4, 0.6} → 2.66682, {2.4, 0.7} → 3.20166, {2.4, 0.8} → 2.5426, {2.4, 0.9} → 3.22117,
 {2.4, 1.} → 3.3951, {2.4, 1.1} → 2.2593, {2.4, 1.2} → 1.77623, {2.4, 1.3} → 2.38842,
 {2.4, 1.4} → 1.8546, {2.4, 1.5} → 1.07058, {2.4, 1.6} → 1.3968, {2.4, 1.7} → 1.44696,
 {2.4, 1.8} → 1.2094, {2.4, 1.9} → 1.29772, {2.4, 2.} → 1.48315, {2.4, 2.1} → 0.937729,
 {2.4, 2.2} → 1.15092, {2.4, 2.3} → 1.43632, {2.4, 2.4} → 2.00343, {2.4, 2.5} → 1.61742,
 {2.4, 2.6} → 2.01315, {2.4, 2.7} → 2.54644, {2.4, 2.8} → 2.43946, {2.4, 2.9} → 2.56383,
 {2.4, 3.} → 3.23699, {2.5, 0.} → 2.43278, {2.5, 0.1} → 2.1154, {2.5, 0.2} → 2.42281,
 {2.5, 0.3} → 2.10706, {2.5, 0.4} → 2.90449, {2.5, 0.5} → 2.7532, {2.5, 0.6} → 3.34767,
 {2.5, 0.7} → 2.34979, {2.5, 0.8} → 2.88623, {2.5, 0.9} → 2.67598, {2.5, 1.} → 3.29429,
 {2.5, 1.1} → 2.20226, {2.5, 1.2} → 1.82505, {2.5, 1.3} → 1.87474, {2.5, 1.4} → 1.65669,
 {2.5, 1.5} → 1.52681, {2.5, 1.6} → 1.57488, {2.5, 1.7} → 1.53481, {2.5, 1.8} → 1.14318,
 {2.5, 1.9} → 1.39462, {2.5, 2.} → 1.02958, {2.5, 2.1} → 1.59852, {2.5, 2.2} → 1.55331,
 {2.5, 2.3} → 1.45864, {2.5, 2.4} → 1.44799, {2.5, 2.5} → 2.35865, {2.5, 2.6} → 2.35352,
 {2.5, 2.7} → 2.05755, {2.5, 2.8} → 2.56017, {2.5, 2.9} → 2.96746, {2.5, 3.} → 2.72315,
 {2.6, 0.} → 1.61322, {2.6, 0.1} → 2.16773, {2.6, 0.2} → 2.53088, {2.6, 0.3} → 3.35359,
 {2.6, 0.4} → 2.93968, {2.6, 0.5} → 3.54616, {2.6, 0.6} → 2.93926, {2.6, 0.7} → 3.14575,
 {2.6, 0.8} → 2.53699, {2.6, 0.9} → 2.6875, {2.6, 1.} → 2.18006, {2.6, 1.1} → 2.17048,
 {2.6, 1.2} → 2.00865, {2.6, 1.3} → 1.50817, {2.6, 1.4} → 1.1982, {2.6, 1.5} → 1.35421,
 {2.6, 1.6} → 0.711302, {2.6, 1.7} → 1.11596, {2.6, 1.8} → 0.946889,
 {2.6, 1.9} → 0.845301, {2.6, 2.} → 1.22136, {2.6, 2.1} → 1.06455, {2.6, 2.2} → 1.9719,
 {2.6, 2.3} → 1.75959, {2.6, 2.4} → 2.19808, {2.6, 2.5} → 1.97671, {2.6, 2.6} → 2.02662,
 {2.6, 2.7} → 2.95788, {2.6, 2.8} → 2.57119, {2.6, 2.9} → 2.81946, {2.6, 3.} → 3.26377,
 {2.7, 0.} → 2.40321, {2.7, 0.1} → 2.45965, {2.7, 0.2} → 2.92629, {2.7, 0.3} → 3.00607,
 {2.7, 0.4} → 3.08841, {2.7, 0.5} → 3.11259, {2.7, 0.6} → 2.82351, {2.7, 0.7} → 2.73755,
 {2.7, 0.8} → 2.81392, {2.7, 0.9} → 2.34893, {2.7, 1.} → 1.97485, {2.7, 1.1} → 1.58234,
 {2.7, 1.2} → 2.00673, {2.7, 1.3} → 2.22548, {2.7, 1.4} → 1.28551, {2.7, 1.5} → 1.01404,
 {2.7, 1.6} → 1.35, {2.7, 1.7} → 0.722813, {2.7, 1.8} → 1.18382, {2.7, 1.9} → 1.20239,
 {2.7, 2.} → 1.43732, {2.7, 2.1} → 1.38704, {2.7, 2.2} → 1.91329, {2.7, 2.3} → 2.71658,
 {2.7, 2.4} → 2.18936, {2.7, 2.5} → 2.15868, {2.7, 2.6} → 3.00833, {2.7, 2.7} → 2.6429,
 {2.7, 2.8} → 2.73625, {2.7, 2.9} → 2.89413, {2.7, 3.} → 2.99047, {2.8, 0.} → 2.27539,
 {2.8, 0.1} → 2.2098, {2.8, 0.2} → 2.26081, {2.8, 0.3} → 2.75279, {2.8, 0.4} → 2.62072,

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{2.8, 0.9} → 2.15497, {2.8, 1.} → 2.31027, {2.8, 1.1} → 1.81854, {2.8, 1.2} → 1.87275,
{2.8, 1.3} → 1.57722, {2.8, 1.4} → 1.37937, {2.8, 1.5} → 0.994139, {2.8, 1.6} → 1.16163,
{2.8, 1.7} → 1.00669, {2.8, 1.8} → 0.951355, {2.8, 1.9} → 1.25741, {2.8, 2.} → 1.89921,
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{2.9, 0.6} → 2.8397, {2.9, 0.7} → 3.04818, {2.9, 0.8} → 3.17725, {2.9, 0.9} → 2.19697,
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{3., 2.3} → 2.9299, {3., 2.4} → 2.77542, {3., 2.5} → 2.93252, {3., 2.6} → 2.85024,
{3., 2.7} → 2.53433, {3., 2.8} → 3.04102, {3., 2.9} → 2.6011, {3., 3.} → 2.59091}
```

```
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961
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```
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```
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```
data[[2]]
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{0., 0.1} → 2.26564
```

```
data[[1]][[1]]
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```
{0., 0.}
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```
data[[1]][[2]]
```

```
2.11289
```

```
data[[1]][[1]][[1]]
```

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0.
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```
data[[1]][[1]][[2]]
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0.
```

```
tabel =
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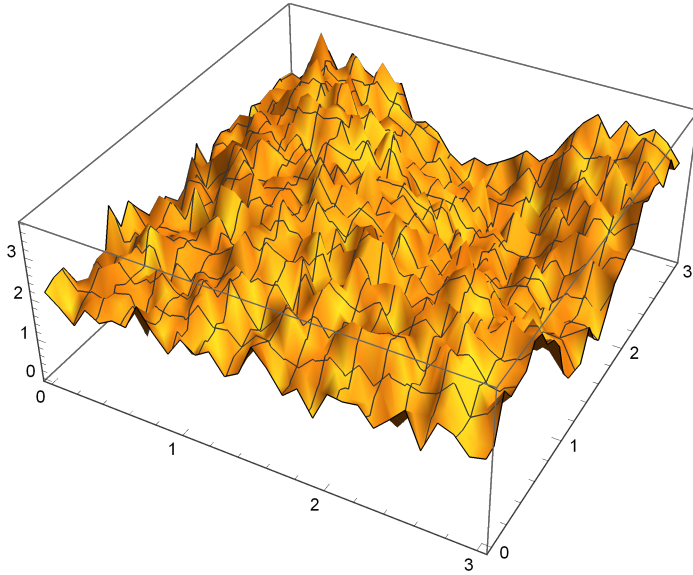
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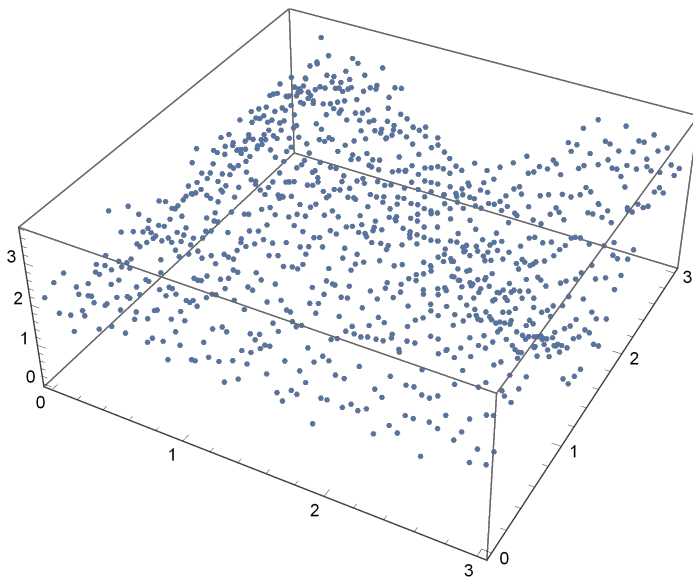
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```

ListPlot3D[tabel]



ListPointPlot3D[tabel]



```
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```
NetChain [  ]
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trained = NetTrain[net, data, BatchSize -> 1024]
```

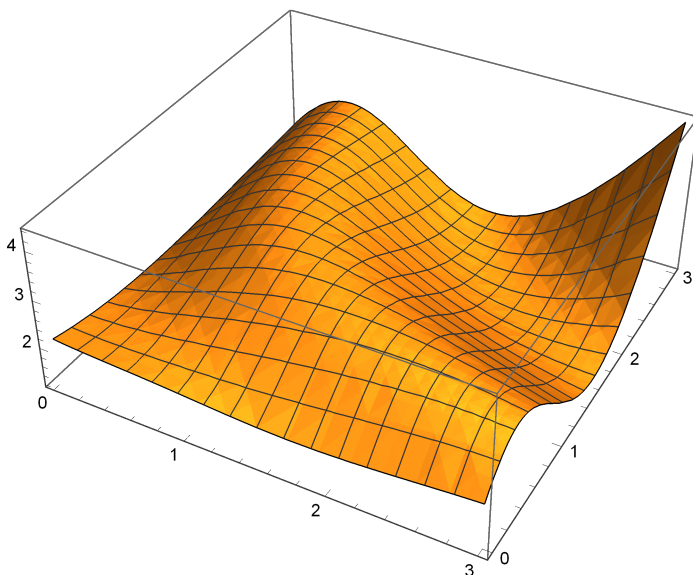
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NetChain [  ]
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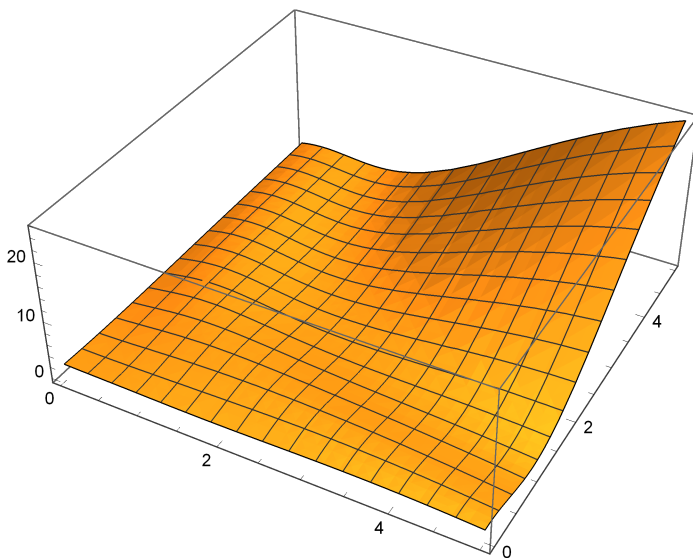
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trained[{1, 0}]
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1.97271

```
Plot3D[trained[{x, y}], {x, 0, 3}, {y, 0, 3}, NormalsFunction -> None, PlotRange -> All]
```



```
Plot3D[trained[{x, y}], {x, 0, 5}, {y, 0, 5}, NormalsFunction -> None, PlotRange -> All]
```



2D functions(a)

```
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 {0., 0.8} -> 0.696707, {0., 0.9} -> 0.62161, {0., 1.} -> 0.540302, {0., 1.1} -> 0.453596,
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 {0., 1.6} -> -0.0291995, {0., 1.7} -> -0.128844, {0., 1.8} -> -0.227202, {0., 1.9} -> -0.32329,
 {0., 2.} -> -0.416147, {0., 2.1} -> -0.504846, {0., 2.2} -> -0.588501, {0., 2.3} -> -0.666276,
 {0., 2.4} -> -0.737394, {0., 2.5} -> -0.801144, {0., 2.6} -> -0.856889, {0., 2.7} -> -0.904072,
 {0., 2.8} -> -0.942222, {0., 2.9} -> -0.970958, {0., 3.} -> -0.989992, {0.1, 0.} -> 0.995004,
```

$\{0.1, 0.1\} \rightarrow 0.990066$, $\{0.1, 0.2\} \rightarrow 0.975335$, $\{0.1, 0.3\} \rightarrow 0.951056$, $\{0.1, 0.4\} \rightarrow 0.917572$,
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 {1.3, 0.2} → 0.327818, {1.3, 0.3} → 0.350989, {1.3, 0.4} → 0.368036, {1.3, 0.5} → 0.377984,
 {1.3, 0.6} → 0.37999, {1.3, 0.7} → 0.373357, {1.3, 0.8} → 0.357558, {1.3, 0.9} → 0.332249,
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 {1.4, 0.2} → 0.247156, {1.4, 0.3} → 0.278916, {1.4, 0.4} → 0.303984, {1.4, 0.5} → 0.320928,
 {1.4, 0.6} → 0.328496, {1.4, 0.7} → 0.325651, {1.4, 0.8} → 0.311599, {1.4, 0.9} → 0.285814,
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 {1.5, 1.7} → -0.440611, {1.5, 1.8} → -0.5601, {1.5, 1.9} → -0.67932,
 {1.5, 2.} → -0.795337, {1.5, 2.1} → -0.905166, {1.5, 2.2} → -1.00585,
 {1.5, 2.3} → -1.09451, {1.5, 2.4} → -1.16845, {1.5, 2.5} → -1.2252, {1.5, 2.6} → -1.26259,
 {1.5, 2.7} → -1.27879, {1.5, 2.8} → -1.27237, {1.5, 2.9} → -1.24239, {1.5, 3.} → -1.18833,
 {1.6, 0.} → -0.0291995, {1.6, 0.1} → 0.0304737, {1.6, 0.2} → 0.0873645,
 {1.6, 0.3} → 0.13849, {1.6, 0.4} → 0.181049, {1.6, 0.5} → 0.21251, {1.6, 0.6} → 0.23069,
 {1.6, 0.7} → 0.233824, {1.6, 0.8} → 0.220622, {1.6, 0.9} → 0.190315, {1.6, 1.} → 0.142685,
 {1.6, 1.1} → 0.0780822, {1.6, 1.2} → -0.00257687, {1.6, 1.3} → -0.0978252,
 {1.6, 1.4} → -0.205677, {1.6, 1.5} → -0.323672, {1.6, 1.6} → -0.448939,
 {1.6, 1.7} → -0.578266, {1.6, 1.8} → -0.708179, {1.6, 1.9} → -0.835039,
 {1.6, 2.} → -0.955133, {1.6, 2.1} → -1.06478, {1.6, 2.2} → -1.16041, {1.6, 2.3} → -1.2387,
 {1.6, 2.4} → -1.29664, {1.6, 2.5} → -1.33163, {1.6, 2.6} → -1.34153,
 {1.6, 2.7} → -1.3248, {1.6, 2.8} → -1.28045, {1.6, 2.9} → -1.20818, {1.6, 3.} → -1.10832,
 {1.7, 0.} → -0.128844, {1.7, 0.1} → -0.0580197, {1.7, 0.2} → 0.0101975,
 {1.7, 0.3} → 0.0720304, {1.7, 0.4} → 0.123947, {1.7, 0.5} → 0.162779, {1.7, 0.6} → 0.185832,
 {1.7, 0.7} → 0.190975, {1.7, 0.8} → 0.176721, {1.7, 0.9} → 0.142279, {1.7, 1.} → 0.0875927,
 {1.7, 1.1} → 0.0133492, {1.7, 1.2} → -0.0790295, {1.7, 1.3} → -0.187421,
 {1.7, 1.4} → -0.30906, {1.7, 1.5} → -0.440611, {1.7, 1.6} → -0.578266,
 {1.7, 1.7} → -0.717851, {1.7, 1.8} → -0.854955, {1.7, 1.9} → -0.985051,
 {1.7, 2.} → -1.10364, {1.7, 2.1} → -1.20639, {1.7, 2.2} → -1.28926, {1.7, 2.3} → -1.34863,
 {1.7, 2.4} → -1.38144, {1.7, 2.5} → -1.38525, {1.7, 2.6} → -1.35836, {1.7, 2.7} → -1.29985,
 {1.7, 2.8} → -1.20966, {1.7, 2.9} → -1.08857, {1.7, 3.} → -0.938203, {1.8, 0.} → -0.227202,
 {1.8, 0.1} → -0.14426, {1.8, 0.2} → -0.0638726, {1.8, 0.3} → 0.00928989,
 {1.8, 0.4} → 0.0708836, {1.8, 0.5} → 0.117051, {1.8, 0.6} → 0.144564,
 {1.8, 0.7} → 0.150947, {1.8, 0.8} → 0.13457, {1.8, 0.9} → 0.0947176, {1.8, 1.} → 0.0316253,
 {1.8, 1.1} → -0.0535202, {1.8, 1.2} → -0.158609, {1.8, 1.3} → -0.28067,
 {1.8, 1.4} → -0.415964, {1.8, 1.5} → -0.5601, {1.8, 1.6} → -0.708179,
 {1.8, 1.7} → -0.854955, {1.8, 1.8} → -0.995007, {1.8, 1.9} → -1.12292,

{1.8, 2.} → -1.23349, {1.8, 2.1} → -1.32185, {1.8, 2.2} → -1.3837, {1.8, 2.3} → -1.41543,
 {1.8, 2.4} → -1.41426, {1.8, 2.5} → -1.37833, {1.8, 2.6} → -1.30681, {1.8, 2.7} → -1.19992,
 {1.8, 2.8} → -1.05897, {1.8, 2.9} → -0.886297, {1.8, 3.} → -0.685266, {1.9, 0.} → -0.32329,
 {1.9, 0.1} → -0.227288, {1.9, 0.2} → -0.133926, {1.9, 0.3} → -0.0488691,
 {1.9, 0.4} → 0.0226454, {1.9, 0.5} → 0.0760218, {1.9, 0.6} → 0.10749, {1.9, 0.7} → 0.11426,
 {1.9, 0.8} → 0.094638, {1.9, 0.9} → 0.0481045, {1.9, 1.} → -0.0246581,
 {1.9, 1.1} → -0.121778, {1.9, 1.2} → -0.240254, {1.9, 1.3} → -0.376061,
 {1.9, 1.4} → -0.524289, {1.9, 1.5} → -0.67932, {1.9, 1.6} → -0.835039,
 {1.9, 1.7} → -0.985051, {1.9, 1.8} → -1.12292, {1.9, 1.9} → -1.24243,
 {1.9, 2.} → -1.33779, {1.9, 2.1} → -1.40387, {1.9, 2.2} → -1.43642, {1.9, 2.3} → -1.43222,
 {1.9, 2.4} → -1.38921, {1.9, 2.5} → -1.30663, {1.9, 2.6} → -1.185, {1.9, 2.7} → -1.02621,
 {1.9, 2.8} → -0.833403, {1.9, 2.9} → -0.610919, {1.9, 3.} → -0.364173,
 {2., 0.} → -0.416147, {2., 0.1} → -0.306177, {2., 0.2} → -0.199083, {2., 0.3} → -0.101634,
 {2., 0.4} → -0.0200376, {2., 0.5} → 0.0403274, {2., 0.6} → 0.0751503, {2., 0.7} → 0.0813776,
 {2., 0.8} → 0.0573513, {2., 0.9} → 0.00288947, {2., 1.} → -0.0806951, {2., 1.1} → -0.190639,
 {2., 1.2} → -0.322832, {2., 1.3} → -0.471978, {2., 1.4} → -0.63181, {2., 1.5} → -0.795337,
 {2., 1.6} → -0.955133, {2., 1.7} → -1.10364, {2., 1.8} → -1.23349, {2., 1.9} → -1.33779,
 {2., 2.} → -1.41045, {2., 2.1} → -1.4464, {2., 2.2} → -1.44186, {2., 2.3} → -1.39449,
 {2., 2.4} → -1.3035, {2., 2.5} → -1.16972, {2., 2.6} → -0.995607, {2., 2.7} → -0.785153,
 {2., 2.8} → -0.543768, {2., 2.9} → -0.27809, {2., 3.} → 0.00424669, {2.1, 0.} → -0.504846,
 {2.1, 0.1} → -0.380041, {2.1, 0.2} → -0.258516, {2.1, 0.3} → -0.148249,
 {2.1, 0.4} → -0.0565005, {2.1, 0.5} → 0.0105345, {2.1, 0.6} → 0.0480182,
 {2.1, 0.7} → 0.052702, {2.1, 0.8} → 0.023085, {2.1, 0.9} → -0.0405069,
 {2.1, 1.} → -0.135926, {2.1, 1.1} → -0.259289, {2.1, 1.2} → -0.405149,
 {2.1, 1.3} → -0.566729, {2.1, 1.4} → -0.736227, {2.1, 1.5} → -0.905166,
 {2.1, 1.6} → -1.06478, {2.1, 1.7} → -1.20639, {2.1, 1.8} → -1.32185, {2.1, 1.9} → -1.40387,
 {2.1, 2.} → -1.4464, {2.1, 2.1} → -1.44489, {2.1, 2.2} → -1.39653, {2.1, 2.3} → -1.30042,
 {2.1, 2.4} → -1.15761, {2.1, 2.5} → -0.971087, {2.1, 2.6} → -0.745704,
 {2.1, 2.7} → -0.487976, {2.1, 2.8} → -0.205838, {2.1, 2.9} → 0.0916763,
 {2.1, 3.} → 0.394792, {2.2, 0.} → -0.588501, {2.2, 0.1} → -0.448046, {2.2, 0.2} → -0.311454,
 {2.2, 0.3} → -0.188027, {2.2, 0.4} → -0.0861499, {2.2, 0.5} → -0.0128648,
 {2.2, 0.6} → 0.0264928, {2.2, 0.7} → 0.0285677, {2.2, 0.8} → -0.00783818,
 {2.2, 0.9} → -0.0816972, {2.2, 1.} → -0.189798, {2.2, 1.1} → -0.326899,
 {2.2, 1.2} → -0.485976, {2.2, 1.3} → -0.658571, {2.2, 1.4} → -0.835205,
 {2.2, 1.5} → -1.00585, {2.2, 1.6} → -1.16041, {2.2, 1.7} → -1.28926, {2.2, 1.8} → -1.3837,
 {2.2, 1.9} → -1.43642, {2.2, 2.} → -1.44186, {2.2, 2.1} → -1.39653, {2.2, 2.2} → -1.2992,
 {2.2, 2.3} → -1.15099, {2.2, 2.4} → -0.95534, {2.2, 2.5} → -0.717929,
 {2.2, 2.6} → -0.446383, {2.2, 2.7} → -0.149976, {2.2, 2.8} → 0.160788,
 {2.2, 2.9} → 0.474641, {2.2, 3.} → 0.780058, {2.3, 0.} → -0.666276, {2.3, 0.1} → -0.509416,
 {2.3, 0.2} → -0.357196, {2.3, 0.3} → -0.220352, {2.3, 0.4} → -0.108471,
 {2.3, 0.5} → -0.0294584, {2.3, 0.6} → 0.0108954, {2.3, 0.7} → 0.00923914,
 {2.3, 0.8} → -0.0351522, {2.3, 0.9} → -0.120331, {2.3, 1.} → -0.241775,
 {2.3, 1.1} → -0.392626, {2.3, 1.2} → -0.564058, {2.3, 1.3} → -0.745746,
 {2.3, 1.4} → -0.926427, {2.3, 1.5} → -1.09451, {2.3, 1.6} → -1.2387, {2.3, 1.7} → -1.34863,
 {2.3, 1.8} → -1.41543, {2.3, 1.9} → -1.43222, {2.3, 2.} → -1.39449, {2.3, 2.1} → -1.30042,
 {2.3, 2.2} → -1.15099, {2.3, 2.3} → -0.949922, {2.3, 2.4} → -0.703615,
 {2.3, 2.5} → -0.42078, {2.3, 2.6} → -0.112049, {2.3, 2.7} → 0.210542, {2.3, 2.8} → 0.534151,
 {2.3, 2.9} → 0.845757, {2.3, 3.} → 1.13281, {2.4, 0.} → -0.737394, {2.4, 0.1} → -0.563441,
 {2.4, 0.2} → -0.39511, {2.4, 0.3} → -0.244687, {2.4, 0.4} → -0.123031,
 {2.4, 0.5} → -0.0389191, {2.4, 0.6} → 0.00146585, {2.4, 0.7} → -0.00509195,
 {2.4, 0.8} → -0.0586493, {2.4, 0.9} → -0.156096, {2.4, 1.} → -0.291335,

{2.4, 1.1} → -0.455634, {2.4, 1.2} → -0.638139, {2.4, 1.3} → -0.826509,
 {2.4, 1.4} → -1.00764, {2.4, 1.5} → -1.16845, {2.4, 1.6} → -1.29664, {2.4, 1.7} → -1.38144,
 {2.4, 1.8} → -1.41426, {2.4, 1.9} → -1.38921, {2.4, 2.} → -1.3035, {2.4, 2.1} → -1.15761,
 {2.4, 2.2} → -0.95534, {2.4, 2.3} → -0.703615, {2.4, 2.4} → -0.412143,
 {2.4, 2.5} → -0.0929031, {2.4, 2.6} → 0.24049, {2.4, 2.7} → 0.573524, {2.4, 2.8} → 0.891572,
 {2.4, 2.9} → 1.18069, {2.4, 3.} → 1.42836, {2.5, 0.} → -0.801144, {2.5, 0.1} → -0.609485,
 {2.5, 0.2} → -0.424647, {2.5, 0.3} → -0.260584, {2.5, 0.4} → -0.129487,
 {2.5, 0.5} → -0.0410079, {2.5, 0.6} → -0.00164016, {2.5, 0.7} → -0.0143088,
 {2.5, 0.8} → -0.0781823, {2.5, 0.9} → -0.188725, {2.5, 1.} → -0.337985,
 {2.5, 1.1} → -0.515097, {2.5, 1.2} → -0.70698, {2.5, 1.3} → -0.899163,
 {2.5, 1.4} → -1.07672, {2.5, 1.5} → -1.2252, {2.5, 1.6} → -1.33163, {2.5, 1.7} → -1.38525,
 {2.5, 1.8} → -1.37833, {2.5, 1.9} → -1.30663, {2.5, 2.} → -1.16972, {2.5, 2.1} → -0.971087,
 {2.5, 2.2} → -0.717929, {2.5, 2.3} → -0.42078, {2.5, 2.4} → -0.0929031,
 {2.5, 2.5} → 0.250483, {2.5, 2.6} → 0.593098, {2.5, 2.7} → 0.918561, {2.5, 2.8} → 1.21136,
 {2.5, 2.9} → 1.45777, {2.5, 3.} → 1.64667, {2.6, 0.} → -0.856889, {2.6, 0.1} → -0.646992,
 {2.6, 0.2} → -0.445342, {2.6, 0.3} → -0.267679, {2.6, 0.4} → -0.127588,
 {2.6, 0.5} → -0.035577, {2.6, 0.6} → 0.00164694, {2.6, 0.7} → -0.0183706,
 {2.6, 0.8} → -0.0936652, {2.6, 0.9} → -0.217992, {2.6, 1.} → -0.381257,
 {2.6, 1.1} → -0.570214, {2.6, 1.2} → -0.769377, {2.6, 1.3} → -0.962088,
 {2.6, 1.4} → -1.13167, {2.6, 1.5} → -1.26259, {2.6, 1.6} → -1.34153,
 {2.6, 1.7} → -1.35836, {2.6, 1.8} → -1.30681, {2.6, 1.9} → -1.185, {2.6, 2.} → -0.995607,
 {2.6, 2.1} → -0.745704, {2.6, 2.2} → -0.446383, {2.6, 2.3} → -0.112049,
 {2.6, 2.4} → 0.24049, {2.6, 2.5} → 0.593098, {2.6, 2.6} → 0.927468, {2.6, 2.7} → 1.22631,
 {2.6, 2.8} → 1.47444, {2.6, 2.9} → 1.65978, {2.6, 3.} → 1.77411, {2.7, 0.} → -0.904072,
 {2.7, 0.1} → -0.675491, {2.7, 0.2} → -0.456822, {2.7, 0.3} → -0.265705,
 {2.7, 0.4} → -0.117177, {2.7, 0.5} → -0.0225714, {2.7, 0.6} → 0.01131,
 {2.7, 0.7} → -0.0173126, {2.7, 0.8} → -0.105073, {2.7, 0.9} → -0.243718,
 {2.7, 1.} → -0.42072, {2.7, 1.1} → -0.620216, {2.7, 1.2} → -0.824181,
 {2.7, 1.3} → -1.01377, {2.7, 1.4} → -1.17074, {2.7, 1.5} → -1.27879, {2.7, 1.6} → -1.3248,
 {2.7, 1.7} → -1.29985, {2.7, 1.8} → -1.19992, {2.7, 1.9} → -1.02621, {2.7, 2.} → -0.785153,
 {2.7, 2.1} → -0.487976, {2.7, 2.2} → -0.149976, {2.7, 2.3} → 0.210542,
 {2.7, 2.4} → 0.573524, {2.7, 2.5} → 0.918561, {2.7, 2.6} → 1.22631, {2.7, 2.7} → 1.47983,
 {2.7, 2.8} → 1.66577, {2.7, 2.9} → 1.77528, {2.7, 3.} → 1.8046, {2.8, 0.} → -0.942222,
 {2.8, 0.1} → -0.694603, {2.8, 0.2} → -0.458806, {2.8, 0.3} → -0.254492,
 {2.8, 0.4} → -0.0981943, {2.8, 0.5} → -0.00203004, {2.8, 0.6} → 0.027245,
 {2.8, 0.7} → -0.0112452, {2.8, 0.8} → -0.112442, {2.8, 0.9} → -0.265769,
 {2.8, 1.} → -0.45598, {2.8, 1.1} → -0.664379, {2.8, 1.2} → -0.870319,
 {2.8, 1.3} → -1.05285, {2.8, 1.4} → -1.19241, {2.8, 1.5} → -1.27237, {2.8, 1.6} → -1.28045,
 {2.8, 1.7} → -1.20966, {2.8, 1.8} → -1.05897, {2.8, 1.9} → -0.833403,
 {2.8, 2.} → -0.543768, {2.8, 2.1} → -0.205838, {2.8, 2.2} → 0.160788, {2.8, 2.3} → 0.534151,
 {2.8, 2.4} → 0.891572, {2.8, 2.5} → 1.21136, {2.8, 2.6} → 1.47444, {2.8, 2.7} → 1.66577,
 {2.8, 2.8} → 1.77547, {2.8, 2.9} → 1.79954, {2.8, 3.} → 1.74012, {2.9, 0.} → -0.970958,
 {2.9, 0.1} → -0.70404, {2.9, 0.2} → -0.451111, {2.9, 0.3} → -0.233966,
 {2.9, 0.4} → -0.0706767, {2.9, 0.5} → 0.0259148, {2.9, 0.6} → 0.0492625,
 {2.9, 0.7} → -0.000352675, {2.9, 0.8} → -0.115869, {2.9, 0.9} → -0.284061,
 {2.9, 1.} → -0.486683, {2.9, 1.1} → -0.702032, {2.9, 1.2} → -0.906809,
 {2.9, 1.3} → -1.07812, {2.9, 1.4} → -1.19543, {2.9, 1.5} → -1.24239, {2.9, 1.6} → -1.20818,
 {2.9, 1.7} → -1.08857, {2.9, 1.8} → -0.886297, {2.9, 1.9} → -0.610919,
 {2.9, 2.} → -0.27809, {2.9, 2.1} → 0.0916763, {2.9, 2.2} → 0.474641, {2.9, 2.3} → 0.845757,
 {2.9, 2.4} → 1.18069, {2.9, 2.5} → 1.45777, {2.9, 2.6} → 1.65978, {2.9, 2.7} → 1.77528,
 {2.9, 2.8} → 1.79954, {2.9, 2.9} → 1.73488, {2.9, 3.} → 1.59045, {3., 0.} → -0.989992,


```
{3., 0.1} → -0.703615, {3., 0.2} → -0.433652, {3., 0.3} → -0.204153,
{3., 0.4} → -0.0347591, {3., 0.5} → 0.0610383, {3., 0.6} → 0.0770892,
{3., 0.7} → 0.0151093, {3., 0.8} → -0.115505, {3., 0.9} → -0.298552, {3., 1.} → -0.512524,
{3., 1.1} → -0.73257, {3., 1.2} → -0.932781, {3., 1.3} → -1.08857, {3., 1.4} → -1.17891,
{3., 1.5} → -1.18833, {3., 1.6} → -1.10832, {3., 1.7} → -0.938203, {3., 1.8} → -0.685266,
{3., 1.9} → -0.364173, {3., 2.} → 0.00424669, {3., 2.1} → 0.394792, {3., 2.2} → 0.780058,
{3., 2.3} → 1.13281, {3., 2.4} → 1.42836, {3., 2.5} → 1.64667, {3., 2.6} → 1.77411,
{3., 2.7} → 1.8046, {3., 2.8} → 1.74012, {3., 2.9} → 1.59045, {3., 3.} → 1.37229}
```

tabel =

```
Table[{data[[i]][[1]][[1]], data[[i]][[1]][[2]], data[[i]][[2]]}, {i, 1, Length[data]}]
{{0., 0., 1.}, {0., 0.1, 0.995004}, {0., 0.2, 0.980067}, {0., 0.3, 0.955336},
{0., 0.4, 0.921061}, {0., 0.5, 0.877583}, {0., 0.6, 0.825336}, {0., 0.7, 0.764842},
{0., 0.8, 0.696707}, {0., 0.9, 0.62161}, {0., 1., 0.540302}, {0., 1.1, 0.453596},
{0., 1.2, 0.362358}, {0., 1.3, 0.267499}, {0., 1.4, 0.169967}, {0., 1.5, 0.0707372},
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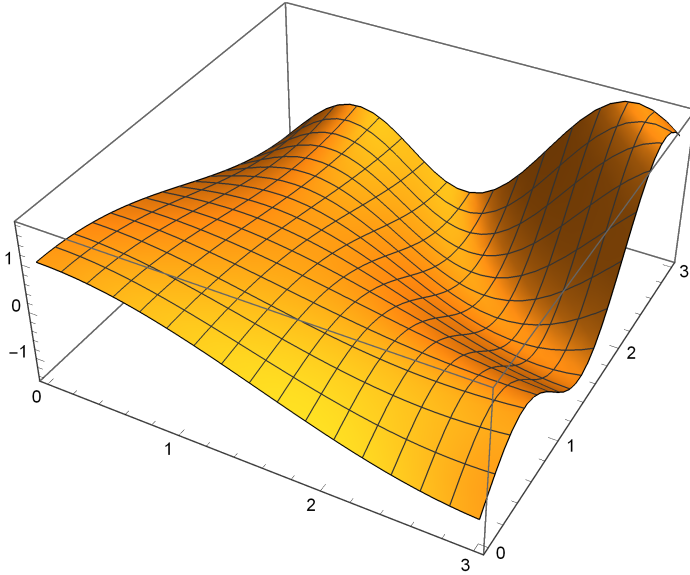
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 {1.7, 2.4, -1.38144}, {1.7, 2.5, -1.38525}, {1.7, 2.6, -1.35836}, {1.7, 2.7, -1.29985},

{1.7, 2.8, -1.20966}, {1.7, 2.9, -1.08857}, {1.7, 3., -0.938203}, {1.8, 0., -0.227202},
 {1.8, 0.1, -0.14426}, {1.8, 0.2, -0.0638726}, {1.8, 0.3, 0.00928989}, {1.8, 0.4, 0.0708836},
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 {1.8, 2.1, -1.32185}, {1.8, 2.2, -1.3837}, {1.8, 2.3, -1.41543}, {1.8, 2.4, -1.41426},
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 {2., 0.6, 0.0751503}, {2., 0.7, 0.0813776}, {2., 0.8, 0.0573513}, {2., 0.9, 0.00288947},
 {2., 1., -0.0806951}, {2., 1.1, -0.190639}, {2., 1.2, -0.322832}, {2., 1.3, -0.471978},
 {2., 1.4, -0.63181}, {2., 1.5, -0.795337}, {2., 1.6, -0.955133}, {2., 1.7, -1.10364},
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 {2., 2.2, -1.44186}, {2., 2.3, -1.39449}, {2., 2.4, -1.3035}, {2., 2.5, -1.16972},
 {2., 2.6, -0.995607}, {2., 2.7, -0.785153}, {2., 2.8, -0.543768}, {2., 2.9, -0.27809},
 {2., 3., 0.00424669}, {2.1, 0., -0.504846}, {2.1, 0.1, -0.380041}, {2.1, 0.2, -0.258516},
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 {2.1, 0.7, 0.052702}, {2.1, 0.8, 0.023085}, {2.1, 0.9, -0.0405069}, {2.1, 1., -0.135926},
 {2.1, 1.1, -0.259289}, {2.1, 1.2, -0.405149}, {2.1, 1.3, -0.566729}, {2.1, 1.4, -0.736227},
 {2.1, 1.5, -0.905166}, {2.1, 1.6, -1.06478}, {2.1, 1.7, -1.20639}, {2.1, 1.8, -1.32185},
 {2.1, 1.9, -1.40387}, {2.1, 2., -1.4464}, {2.1, 2.1, -1.44489}, {2.1, 2.2, -1.39653},
 {2.1, 2.3, -1.30042}, {2.1, 2.4, -1.15761}, {2.1, 2.5, -0.971087}, {2.1, 2.6, -0.745704},
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 {2.2, 0., -0.588501}, {2.2, 0.1, -0.448046}, {2.2, 0.2, -0.311454}, {2.2, 0.3, -0.188027},
 {2.2, 0.4, -0.0861499}, {2.2, 0.5, -0.0128648}, {2.2, 0.6, 0.0264928},
 {2.2, 0.7, 0.0285677}, {2.2, 0.8, -0.00783818}, {2.2, 0.9, -0.0816972},
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 {2.2, 1.4, -0.835205}, {2.2, 1.5, -1.00585}, {2.2, 1.6, -1.16041}, {2.2, 1.7, -1.28926},
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 {2.2, 2.2, -1.2992}, {2.2, 2.3, -1.15099}, {2.2, 2.4, -0.95534}, {2.2, 2.5, -0.717929},
 {2.2, 2.6, -0.446383}, {2.2, 2.7, -0.149976}, {2.2, 2.8, 0.160788}, {2.2, 2.9, 0.474641},
 {2.2, 3., 0.780058}, {2.3, 0., -0.666276}, {2.3, 0.1, -0.509416}, {2.3, 0.2, -0.357196},
 {2.3, 0.3, -0.220352}, {2.3, 0.4, -0.108471}, {2.3, 0.5, -0.0294584},
 {2.3, 0.6, 0.0108954}, {2.3, 0.7, 0.00923914}, {2.3, 0.8, -0.0351522},
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 {2.3, 1.3, -0.745746}, {2.3, 1.4, -0.926427}, {2.3, 1.5, -1.09451}, {2.3, 1.6, -1.2387},
 {2.3, 1.7, -1.34863}, {2.3, 1.8, -1.41543}, {2.3, 1.9, -1.43222}, {2.3, 2., -1.39449},
 {2.3, 2.1, -1.30042}, {2.3, 2.2, -1.15099}, {2.3, 2.3, -0.949922}, {2.3, 2.4, -0.703615},
 {2.3, 2.5, -0.42078}, {2.3, 2.6, -0.112049}, {2.3, 2.7, 0.210542}, {2.3, 2.8, 0.534151},
 {2.3, 2.9, 0.845757}, {2.3, 3., 1.13281}, {2.4, 0., -0.737394}, {2.4, 0.1, -0.563441},
 {2.4, 0.2, -0.39511}, {2.4, 0.3, -0.244687}, {2.4, 0.4, -0.123031}, {2.4, 0.5, -0.0389191},
 {2.4, 0.6, 0.00146585}, {2.4, 0.7, -0.00509195}, {2.4, 0.8, -0.0586493},

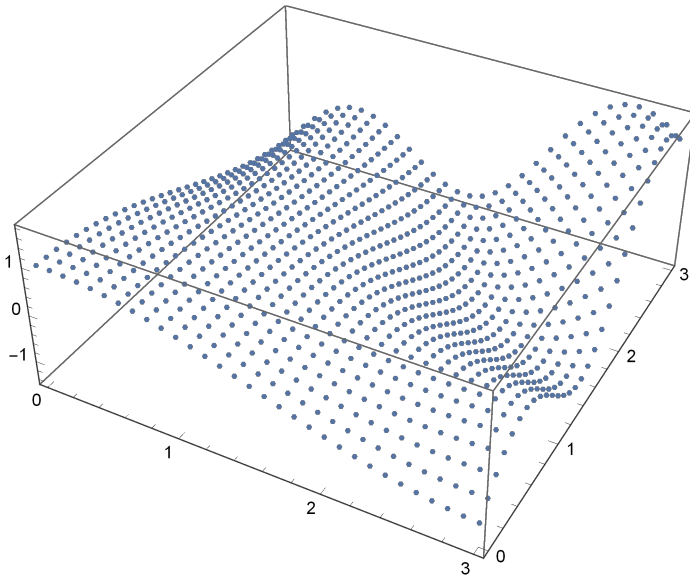
{2.4, 0.9, -0.156096}, {2.4, 1., -0.291335}, {2.4, 1.1, -0.455634}, {2.4, 1.2, -0.638139},
 {2.4, 1.3, -0.826509}, {2.4, 1.4, -1.00764}, {2.4, 1.5, -1.16845}, {2.4, 1.6, -1.29664},
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 {2.4, 2.1, -1.15761}, {2.4, 2.2, -0.95534}, {2.4, 2.3, -0.703615}, {2.4, 2.4, -0.412143},
 {2.4, 2.5, -0.0929031}, {2.4, 2.6, 0.24049}, {2.4, 2.7, 0.573524}, {2.4, 2.8, 0.891572},
 {2.4, 2.9, 1.18069}, {2.4, 3., 1.42836}, {2.5, 0., -0.801144}, {2.5, 0.1, -0.609485},
 {2.5, 0.2, -0.424647}, {2.5, 0.3, -0.260584}, {2.5, 0.4, -0.129487},
 {2.5, 0.5, -0.0410079}, {2.5, 0.6, -0.00164016}, {2.5, 0.7, -0.0143088},
 {2.5, 0.8, -0.0781823}, {2.5, 0.9, -0.188725}, {2.5, 1., -0.337985}, {2.5, 1.1, -0.515097},
 {2.5, 1.2, -0.70698}, {2.5, 1.3, -0.899163}, {2.5, 1.4, -1.07672}, {2.5, 1.5, -1.2252},
 {2.5, 1.6, -1.33163}, {2.5, 1.7, -1.38525}, {2.5, 1.8, -1.37833}, {2.5, 1.9, -1.30663},
 {2.5, 2., -1.16972}, {2.5, 2.1, -0.971087}, {2.5, 2.2, -0.717929}, {2.5, 2.3, -0.42078},
 {2.5, 2.4, -0.0929031}, {2.5, 2.5, 0.250483}, {2.5, 2.6, 0.593098}, {2.5, 2.7, 0.918561},
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 {2.6, 0.4, -0.127588}, {2.6, 0.5, -0.035577}, {2.6, 0.6, 0.00164694},
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 {2.6, 1.8, -1.30681}, {2.6, 1.9, -1.185}, {2.6, 2., -0.995607}, {2.6, 2.1, -0.745704},
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 {2.8, 1.4, -1.19241}, {2.8, 1.5, -1.27237}, {2.8, 1.6, -1.28045}, {2.8, 1.7, -1.20966},
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 {2.8, 3., 1.74012}, {2.9, 0., -0.970958}, {2.9, 0.1, -0.70404}, {2.9, 0.2, -0.451111},
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 {2.9, 2.6, 1.65978}, {2.9, 2.7, 1.77528}, {2.9, 2.8, 1.79954}, {2.9, 2.9, 1.73488},
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 {3., 1.1, -0.73257}, {3., 1.2, -0.932781}, {3., 1.3, -1.08857}, {3., 1.4, -1.17891},
 {3., 1.5, -1.18833}, {3., 1.6, -1.10832}, {3., 1.7, -0.938203}, {3., 1.8, -0.685266},

```
{3., 1.9, -0.364173}, {3., 2., 0.00424669}, {3., 2.1, 0.394792}, {3., 2.2, 0.780058},
{3., 2.3, 1.13281}, {3., 2.4, 1.42836}, {3., 2.5, 1.64667}, {3., 2.6, 1.77411},
{3., 2.7, 1.8046}, {3., 2.8, 1.74012}, {3., 2.9, 1.59045}, {3., 3., 1.37229}}
```

ListPlot3D[tabel]



ListPointPlot3D[tabel]




```
net = NetChain[{60, Cos, Sinh, Tanh, Sinh, 30, Sin, Cos, 60, 1}]
(*net=NetChain[{520, Tanh, 450, Sin, Exp, Tanh, 340, 1}]*)
```

NetChain []



```
trained = NetTrain[net, data]
```

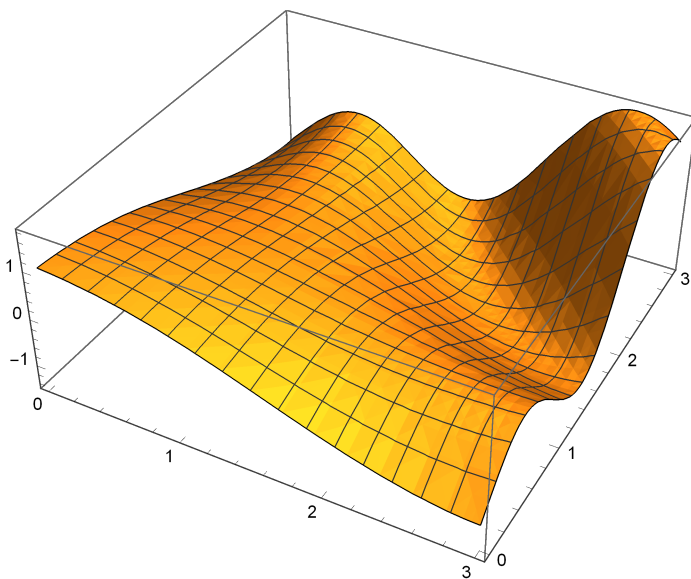
```
NetChain [  ]
```



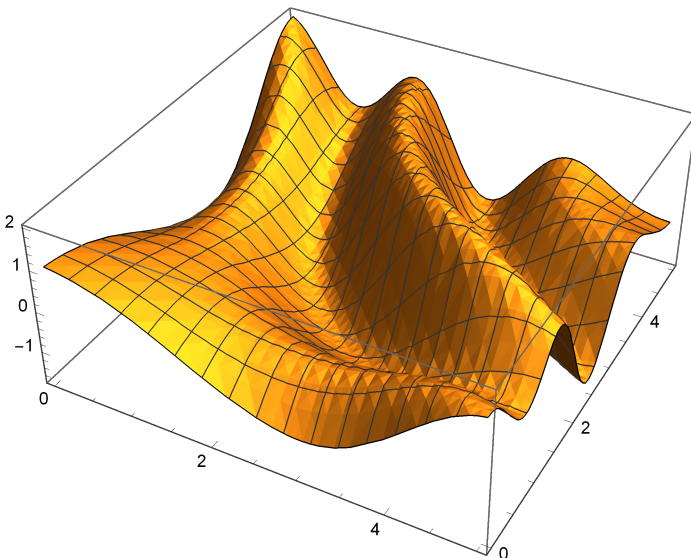
```
trained[{1, 0}]
```

```
0.536928
```

```
Plot3D[trained[{x, y}], {x, 0, 3}, {y, 0, 3}, NormalsFunction -> None, PlotRange -> All]
```

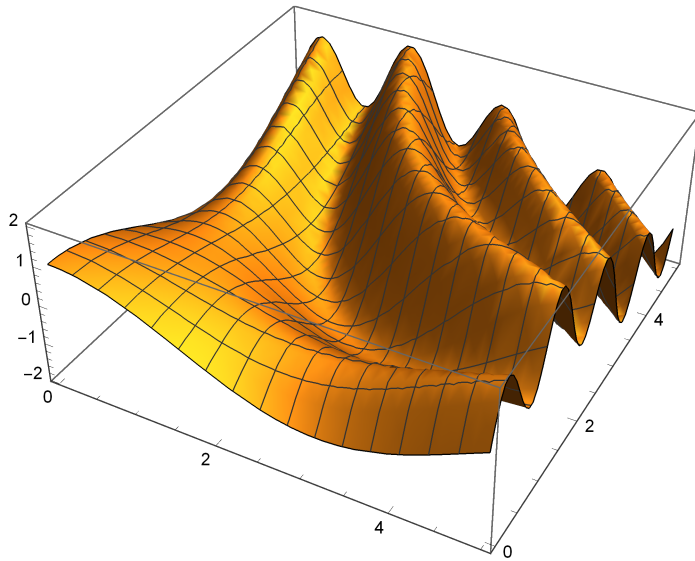


```
Plot3D[trained[{x, y}], {x, 0, 5}, {y, 0, 5}, NormalsFunction -> None, PlotRange -> All]
```



```
functie[x_, y_] := Sin[x * y] + Cos[x + y]
```

```
Plot3D[functie[x, y], {x, 0, 5}, {y, 0, 5}]
```



```
Abs[trained[{5, 5}] - functie[5, 5]]
```

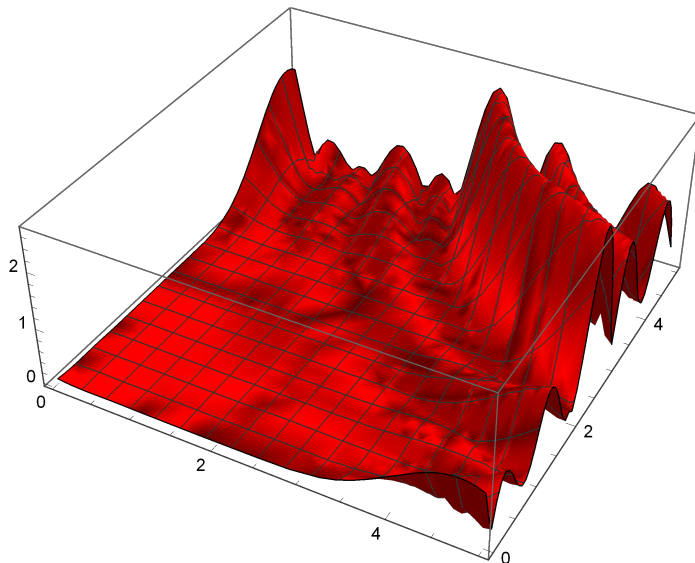
```
0.38661
```

```
Abs[trained[{1, 1}] - functie[1, 1]]
```

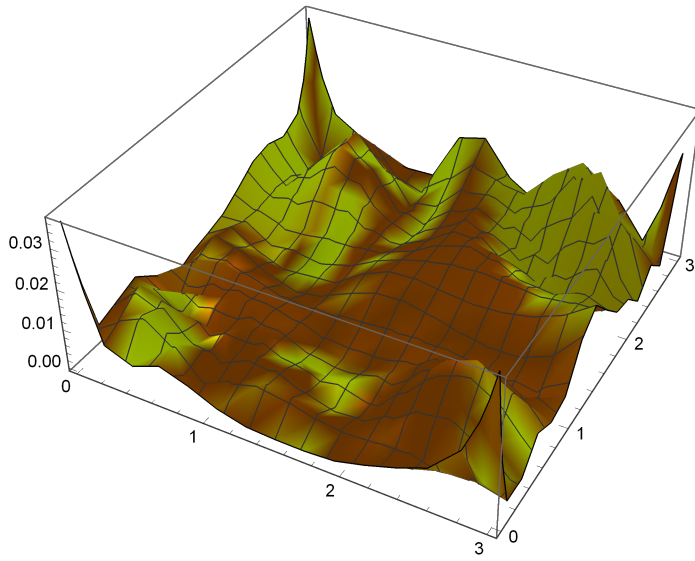
```
0.00431853
```

```
eroare[x_, y_] := Abs[trained[{x, y}] - functie[x, y]]
```

```
Plot3D[eroare[x, y], {x, 0, 5}, {y, 0, 5}, PlotStyle -> Red, PlotRange -> All]
```





```
Plot3D[eroare[x, y], {x, 0, 3}, {y, 0, 3}, PlotStyle -> Yellow, PlotRange -> All]
```



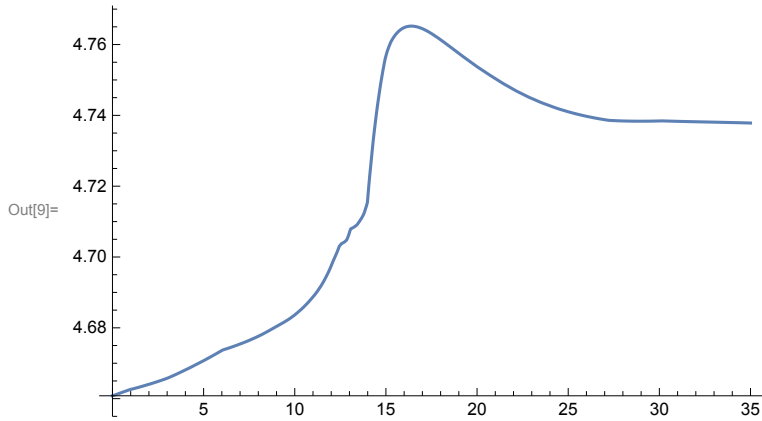
Introducere in Machine Learning - Metode de predictie

```
In[1]:= tabelb = {4.7391, 4.7427, 4.744, 4.7546, 4.7517, 4.7348, 4.7555,  
               4.7601, 4.7628, 4.7648, 4.7569, 4.7142, 4.7081, 4.6975, 4.689, 4.683,  
               4.6822, 4.6771, 4.6782, 4.6764, 4.6722, 4.667, 4.6634, 4.6647, 4.6656}  
nr = Length[tabelb]  
tabela = Table[nr - i + 1, {i, 1, nr}]  
Out[1]= {4.7391, 4.7427, 4.744, 4.7546, 4.7517, 4.7348, 4.7555,  
         4.7601, 4.7628, 4.7648, 4.7569, 4.7142, 4.7081, 4.6975, 4.689, 4.683,  
         4.6822, 4.6771, 4.6782, 4.6764, 4.6722, 4.667, 4.6634, 4.6647, 4.6656}  
Out[2]= 25  
Out[3]= {25, 24, 23, 22, 21, 20, 19, 18, 17, 16, 15, 14, 13, 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1}  
In[4]:= AssociationThread[tabela -> tabelb]  
Out[4]= <| 25 -> 4.7391, 24 -> 4.7427, 23 -> 4.744, 22 -> 4.7546, 21 -> 4.7517, 20 -> 4.7348,  
         19 -> 4.7555, 18 -> 4.7601, 17 -> 4.7628, 16 -> 4.7648, 15 -> 4.7569, 14 -> 4.7142,  
         13 -> 4.7081, 12 -> 4.6975, 11 -> 4.689, 10 -> 4.683, 9 -> 4.6822, 8 -> 4.6771,  
         7 -> 4.6782, 6 -> 4.6764, 5 -> 4.6722, 4 -> 4.667, 3 -> 4.6634, 2 -> 4.6647, 1 -> 4.6656 |>  
In[5]:= trainingset = Normal[%]  
Out[5]= {25 -> 4.7391, 24 -> 4.7427, 23 -> 4.744, 22 -> 4.7546, 21 -> 4.7517, 20 -> 4.7348,  
         19 -> 4.7555, 18 -> 4.7601, 17 -> 4.7628, 16 -> 4.7648, 15 -> 4.7569, 14 -> 4.7142,  
         13 -> 4.7081, 12 -> 4.6975, 11 -> 4.689, 10 -> 4.683, 9 -> 4.6822, 8 -> 4.6771,  
         7 -> 4.6782, 6 -> 4.6764, 5 -> 4.6722, 4 -> 4.667, 3 -> 4.6634, 2 -> 4.6647, 1 -> 4.6656}
```


```
In[6]:= p = Predict[trainingset, Method -> "NeuralNetwork"]  
p[15.5]  
f[x_] := p[x]  
Plot[f[x], {x, 0, 35}]
```

Out[6]= PredictorFunction [ Input type: Numerical
Method: NeuralNetwork]

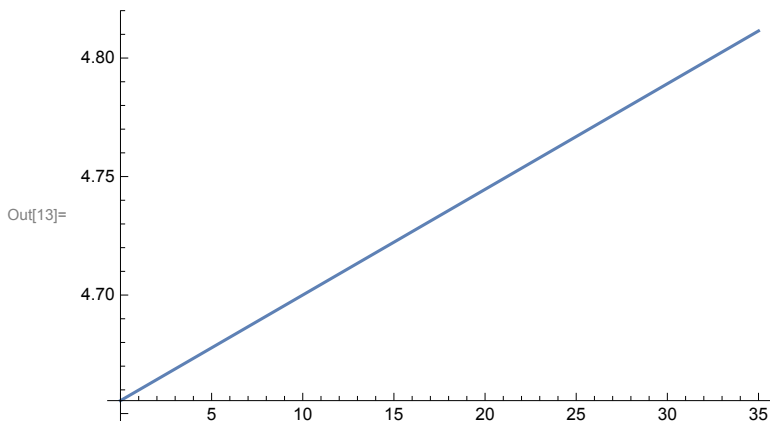
Out[7]= 4.7626



```
In[10]:= p = Predict[trainingset, Method -> "LinearRegression"]  
p[15.5]  
f[x_] := p[x]  
Plot[f[x], {x, 0, 35}]
```

Out[10]= PredictorFunction [ Input type: Numerical
Method: LinearRegression]

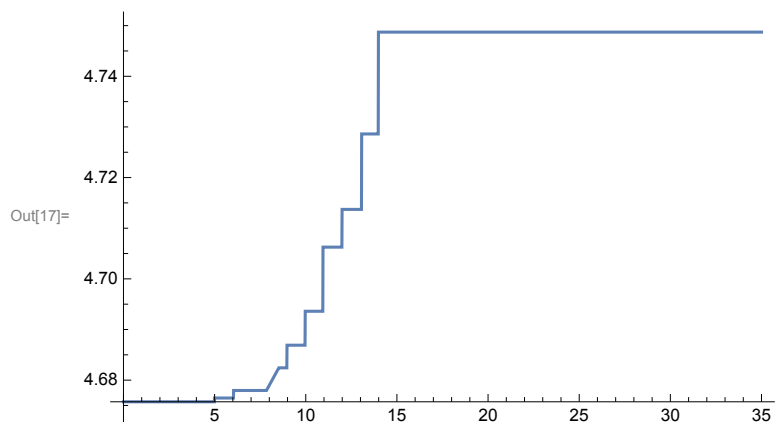
Out[11]= 4.72454



```
In[14]:= p = Predict[trainingset, Method -> "RandomForest"]
p[15.5]
f[x_] := p[x]
Plot[f[x], {x, 0, 35}]
```

```
Out[14]= PredictorFunction[  Input type: Numerical
Method: RandomForest ]
```

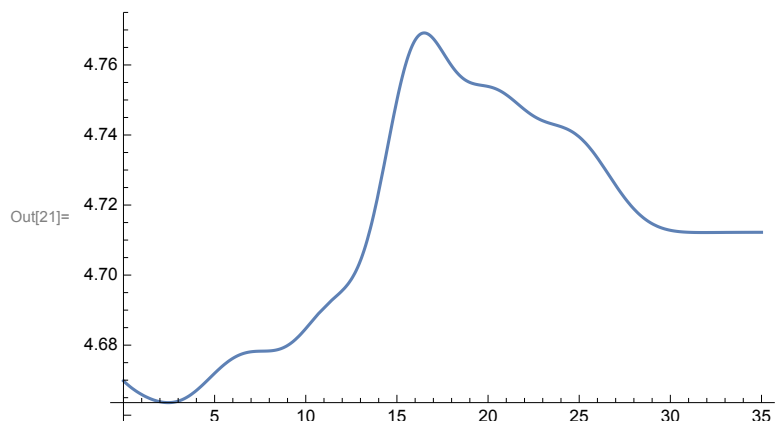
```
Out[15]= 4.74872
```



```
In[18]:= p = Predict[trainingset, Method -> "GaussianProcess"]
p[15.5]
f[x_] := p[x]
Plot[f[x], {x, 0, 35}]
```

```
Out[18]= PredictorFunction[  Input type: Numerical
Method: GaussianProcess ]
```

```
Out[19]= 4.76053
```



Probleme propuse:

a) Sa se determine probabilitatea de a se obtine un cutremur cu a magnitudine sporita in urmatoorii 10 ani, folosind catalogul ROMPLUS [http://www.infp.ro/wp-content/uploads/2015/12/romplus.cat_2.txt]

Introducere in Retele Neurale

```
In[22]:= tabelb = {4.7391, 4.7427, 4.744, 4.7546, 4.7517, 4.7348, 4.7555,  
4.7601, 4.7628, 4.7648, 4.7569, 4.7142, 4.7081, 4.6975, 4.689, 4.683,  
4.6822, 4.6771, 4.6782, 4.6764, 4.6722, 4.667, 4.6634, 4.6647, 4.6656}  
nr = Length[tabelb]  
tabela = Table[nr - i + 1, {i, 1, nr}]
```

```
Out[22]:= {4.7391, 4.7427, 4.744, 4.7546, 4.7517, 4.7348, 4.7555,  
4.7601, 4.7628, 4.7648, 4.7569, 4.7142, 4.7081, 4.6975, 4.689, 4.683,  
4.6822, 4.6771, 4.6782, 4.6764, 4.6722, 4.667, 4.6634, 4.6647, 4.6656}
```

```
Out[23]:= 25
```

```
Out[24]:= {25, 24, 23, 22, 21, 20, 19, 18, 17, 16, 15, 14, 13, 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1}
```

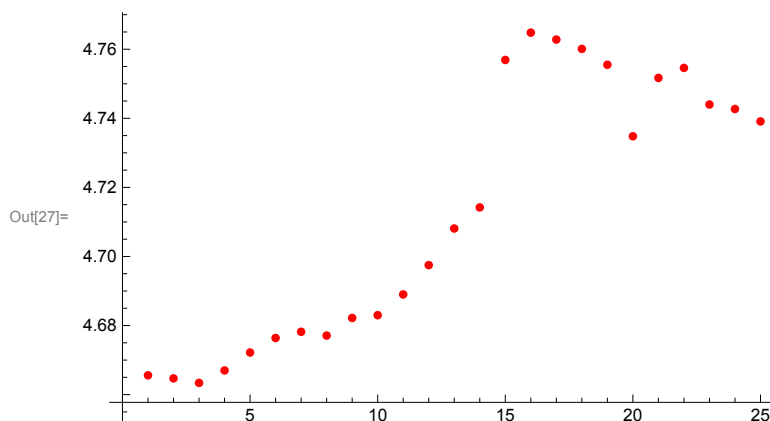
```
In[25]:= AssociationThread[tabela -> tabelb]
```

```
Out[25]:= <| 25 -> 4.7391, 24 -> 4.7427, 23 -> 4.744, 22 -> 4.7546, 21 -> 4.7517, 20 -> 4.7348,  
19 -> 4.7555, 18 -> 4.7601, 17 -> 4.7628, 16 -> 4.7648, 15 -> 4.7569, 14 -> 4.7142,  
13 -> 4.7081, 12 -> 4.6975, 11 -> 4.689, 10 -> 4.683, 9 -> 4.6822, 8 -> 4.6771,  
7 -> 4.6782, 6 -> 4.6764, 5 -> 4.6722, 4 -> 4.667, 3 -> 4.6634, 2 -> 4.6647, 1 -> 4.6656 |>
```

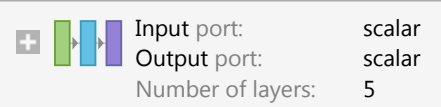
```
In[26]:= trainingset = Normal[%]
```

```
Out[26]:= {25 -> 4.7391, 24 -> 4.7427, 23 -> 4.744, 22 -> 4.7546, 21 -> 4.7517, 20 -> 4.7348,  
19 -> 4.7555, 18 -> 4.7601, 17 -> 4.7628, 16 -> 4.7648, 15 -> 4.7569, 14 -> 4.7142,  
13 -> 4.7081, 12 -> 4.6975, 11 -> 4.689, 10 -> 4.683, 9 -> 4.6822, 8 -> 4.6771,  
7 -> 4.6782, 6 -> 4.6764, 5 -> 4.6722, 4 -> 4.667, 3 -> 4.6634, 2 -> 4.6647, 1 -> 4.6656}
```

```
In[27]:= a1 = plot = ListPlot[List @@@ trainingset, PlotStyle -> Red]
```

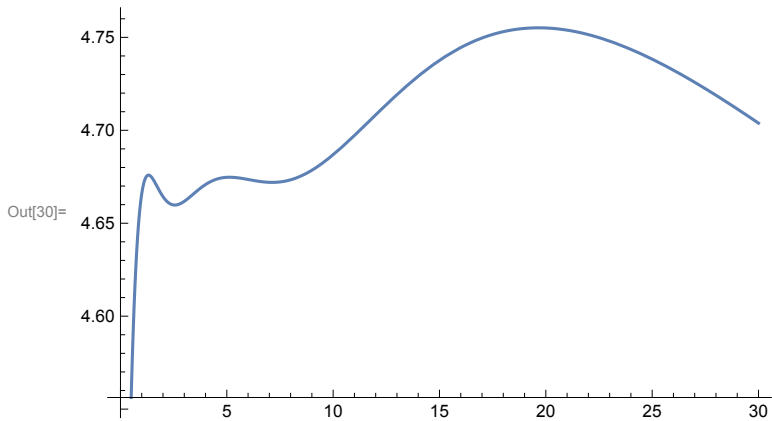


```
In[28]:= net = NetChain[{150, Tanh, 150, Tanh, 1}, "Input" -> "Scalar", "Output" -> "Scalar"];  
net1 = NetTrain[net, trainingset, Method -> "ADAM"]
```

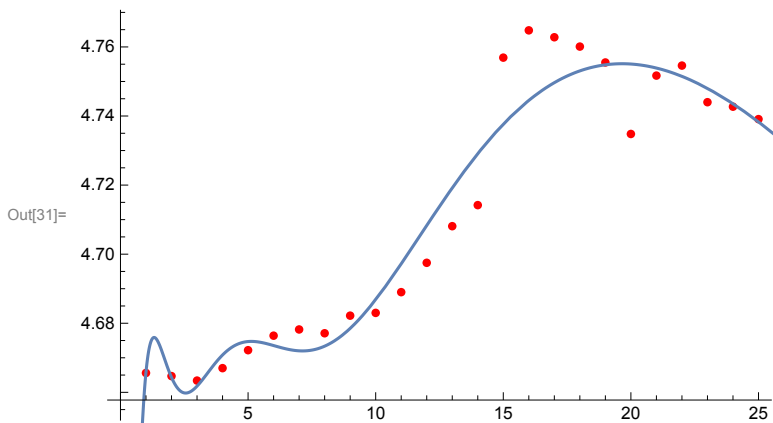
```
Out[29]:= NetChain [  ]
```

Input port:	scalar
Output port:	scalar
Number of layers:	5


In[30]:= **a2 = Show[Plot[net1[x], {x, 0, 30}]]**



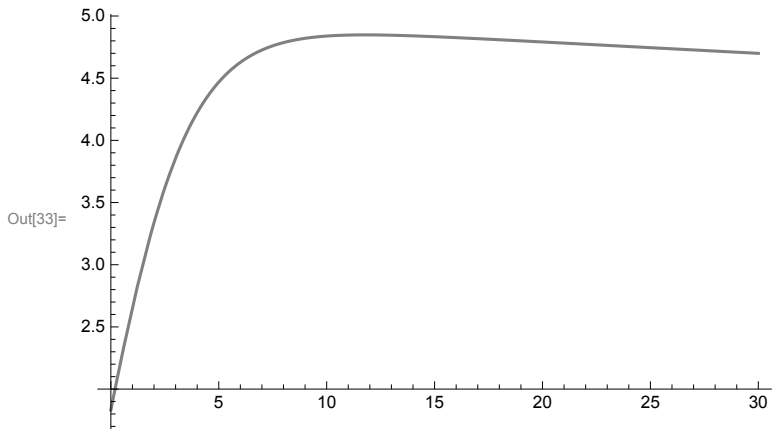
In[31]:= **Show[a1, a2]**



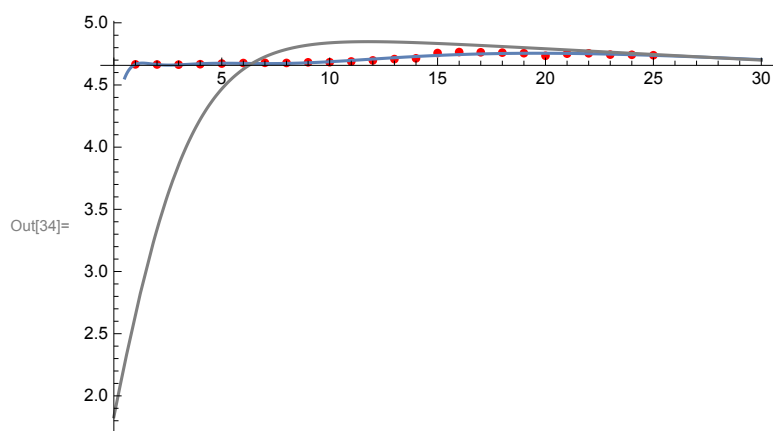
In[32]:= **net2 = NetTrain[net, trainingset, Method -> {"ADAM", "L2Regularization" -> 0.5}]**

Out[32]= NetChain [ Input port: scalar
Output port: scalar
Number of layers: 5]

In[33]:= **a3 = Show[Plot[net2[x], {x, 0, 30}, PlotStyle -> Gray, PlotRange -> All]]**



In[34]:= **Show[a1, a2, a3, PlotRange → All]**



Determinarea sectiunilor eficiente: date experimentale preluate din PHYSICAL REVIEW C 67, 054607(2003) (Tabel IV)

```
In[35]:= tabelb = {2.0, 2.50, 2.75, 3.00, 3.75, 4.375, 5.00,  
6.25, 7.50, 5.50, 6.00, 6.50, 8.093, 12.00, 19.54, 94.00}  
tabela = {48.2, 288.7, 539.4, 994.5, 1282.0, 1485.0, 1765.0,  
1953, 124.1, 566.6, 939.6, 1171, 2023, 2847, 3452, 3600}
```

```
Out[35]:= {2., 2.5, 2.75, 3., 3.75, 4.375, 5., 6.25, 7.5, 5.5, 6., 6.5, 8.093, 12., 19.54, 94.}
```

```
Out[36]:= {48.2, 288.7, 539.4, 994.5, 1282., 1485., 1765.,  
1953, 124.1, 566.6, 939.6, 1171, 2023, 2847, 3452, 3600}
```

```
In[37]:= nr = Length[tabelb]
```

```
Out[37]:= 16
```

```
In[38]:= nr = Length[tabela]
```

```
Out[38]:= 16
```

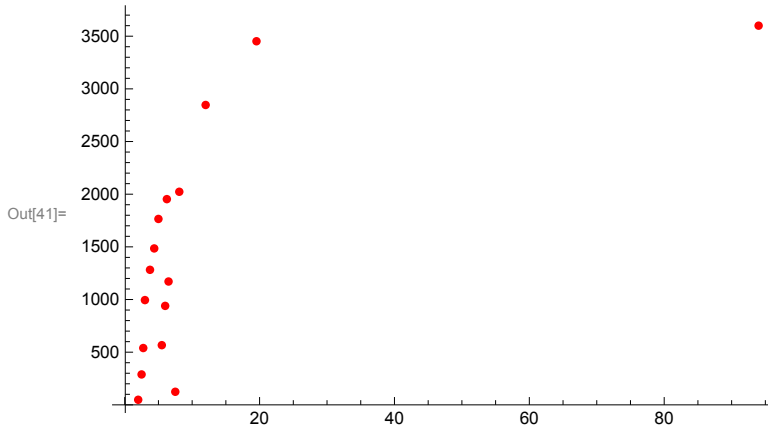
```
In[39]:= AssociationThread[tabelb → tabela]
```

```
Out[39]:= <| 2. → 48.2, 2.5 → 288.7, 2.75 → 539.4, 3. → 994.5, 3.75 → 1282.,  
4.375 → 1485., 5. → 1765., 6.25 → 1953, 7.5 → 124.1, 5.5 → 566.6,  
6. → 939.6, 6.5 → 1171, 8.093 → 2023, 12. → 2847, 19.54 → 3452, 94. → 3600 |>
```

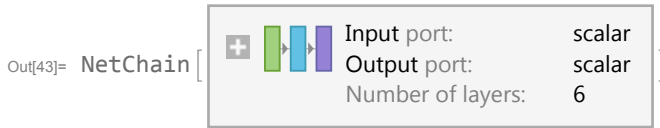
```
In[40]:= trainingset = Normal[%]
```

```
Out[40]:= {2. → 48.2, 2.5 → 288.7, 2.75 → 539.4, 3. → 994.5, 3.75 → 1282.,  
4.375 → 1485., 5. → 1765., 6.25 → 1953, 7.5 → 124.1, 5.5 → 566.6,  
6. → 939.6, 6.5 → 1171, 8.093 → 2023, 12. → 2847, 19.54 → 3452, 94. → 3600}
```

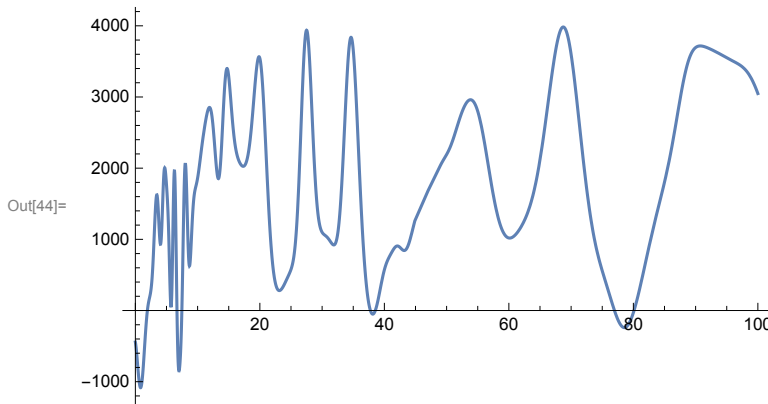
```
In[41]:= a1 = plot = ListPlot[List@@@ trainingset, PlotStyle -> Red, PlotRange -> All]
```



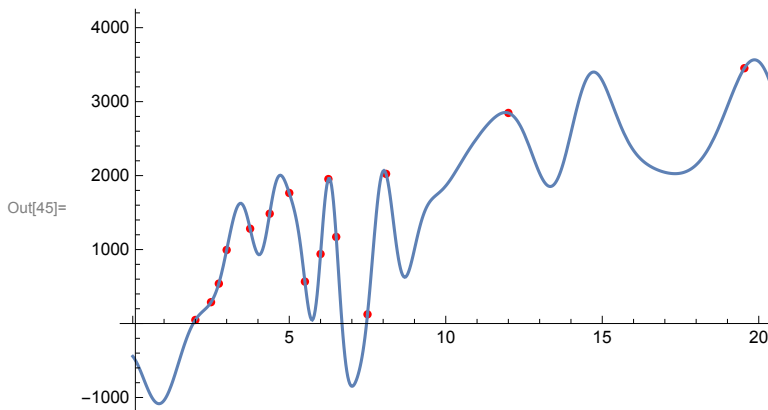
```
In[42]:= net = NetChain[{150, Sin, 150, Cos, 160, 1}, "Input" -> "Scalar", "Output" -> "Scalar"];
net1 = NetTrain[net, trainingset, Method -> "ADAM"]
```



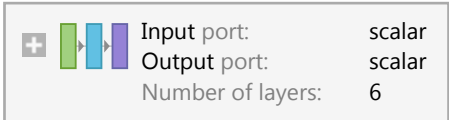
```
In[44]:= a2 = Show[Plot[net1[x], {x, 0, 100}]]
```



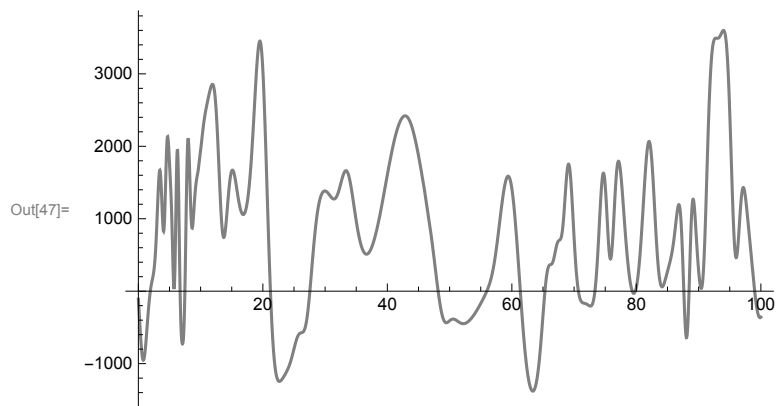
```
In[45]:= Show[a1, a2, PlotRange -> {{0, 20}, All}]
```



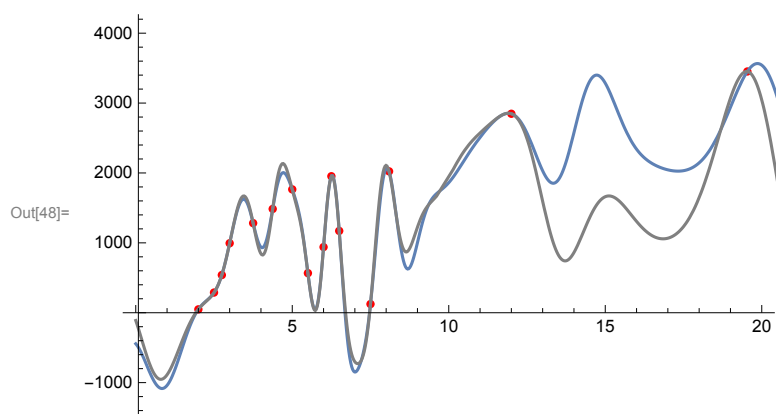

```
In[46]:= net2 = NetTrain[net, trainingset, Method -> {"ADAM", "L2Regularization" -> 0.5}]
```

Out[46]= NetChain []

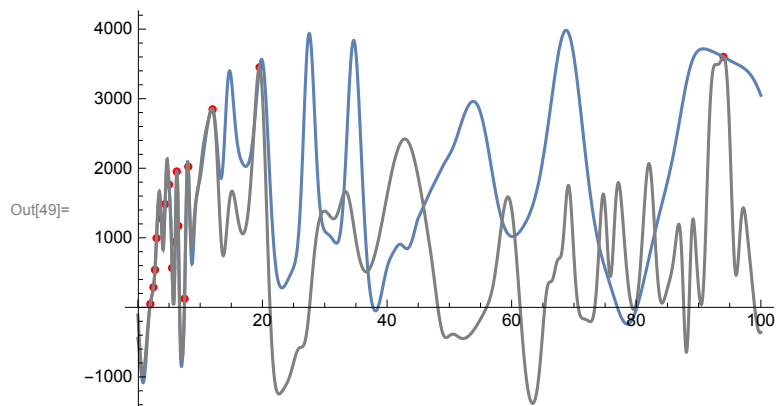
```
In[47]:= a3 = Show[Plot[net2[x], {x, 0, 100}, PlotStyle -> Gray, PlotRange -> All]]
```



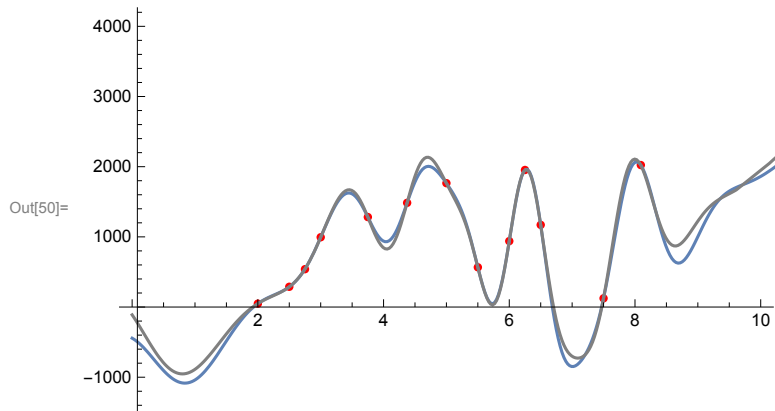
```
In[48]:= Show[a1, a2, a3, PlotRange -> {{0, 20}, All}]
```



```
In[49]:= Show[a1, a2, a3, PlotRange -> {{0, 100}, All}]
```



In[50]:= Show[a1, a2, a3, PlotRange -> {{0, 10}, All}]



Probleme propuse:

- Sa se prezica anul urmatorului cutremur major din Romania, tinand seama de catalogul ROMPLUS: pentru aceasta, se va introduce in tabelul initial lista cu cutremurele avand magnitudinea peste 6.5 avand plaje de timp diferite(de exemplu ultimele 2 secole, ultimele 3 secole, etc);
- Sa se determine eroarea minima si maxima intre observabilele initiale si cele rezultate in urma rularii programului in aceasta configuratie;
- Sa se studieze efectele modificarii dimensiunii layerelor(in acest moment dimensiunea layereului este de 150x150) asupra rezultatelor finale;
- Sa se generalizeze programul pentru un set de date fizice corespunzatoare, la alegere.

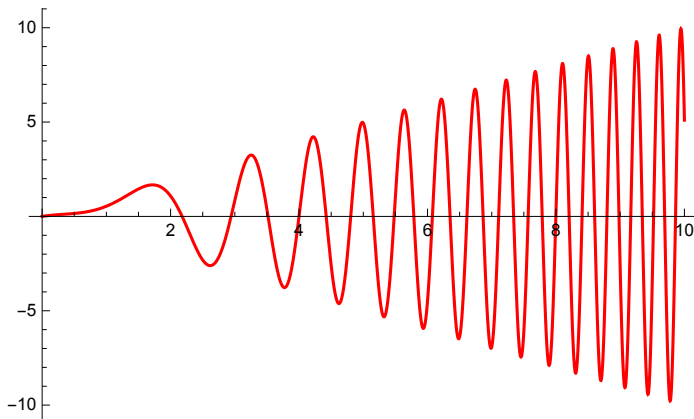
Integrare numerica folosind retele neurale [Numerical integration]

```
functia[x_] := x Cos[x^2 - x - 1]
```

```
NIntegrate[functia[x], {x, 0, 10}]
```

```
1.36749
```

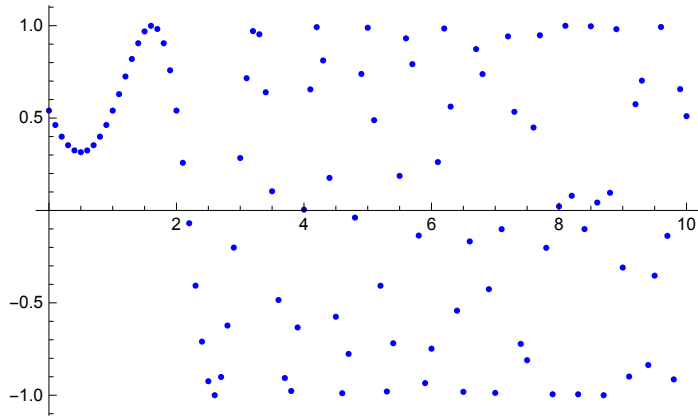
```
a2 = Plot[functia[x], {x, 0, 10}, PlotStyle -> Red, PlotRange -> All]
```



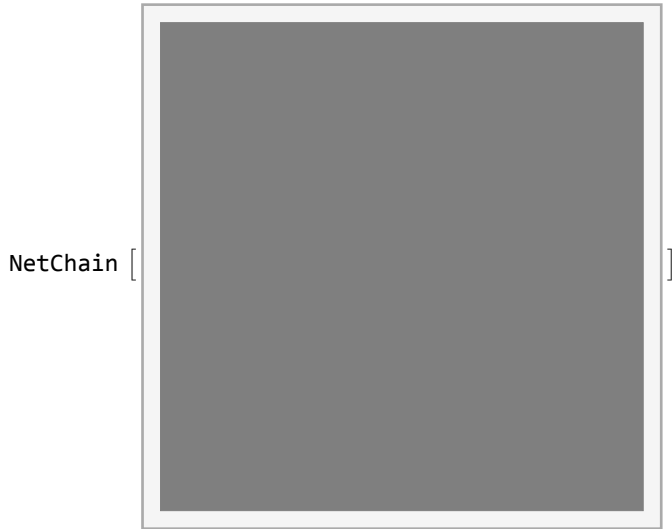
```
reguladate = Table[x -> Cos[x^2 - x - 1], {x, 0, 10, 0.1}]
```

```
{0. -> 0.540302, 0.1 -> 0.462485, 0.2 -> 0.39934, 0.3 -> 0.353019, 0.4 -> 0.324796, 0.5 -> 0.315322,  
0.6 -> 0.324796, 0.7 -> 0.353019, 0.8 -> 0.39934, 0.9 -> 0.462485, 1. -> 0.540302,  
1.1 -> 0.629412, 1.2 -> 0.724836, 1.3 -> 0.819648, 1.4 -> 0.904752, 1.5 -> 0.968912,  
1.6 -> 0.9992, 1.7 -> 0.982004, 1.8 -> 0.904752, 1.9 -> 0.758362, 2. -> 0.540302,  
2.1 -> 0.25785, 2.2 -> -0.0691484, 2.3 -> -0.407033, 2.4 -> -0.709793, 2.5 -> -0.924302,  
2.6 -> -0.999831, 2.7 -> -0.901139, 2.8 -> -0.622857, 2.9 -> -0.20101, 3. -> 0.283662,  
3.1 -> 0.71569, 3.2 -> 0.970576, 3.3 -> 0.9533, 3.4 -> 0.639603, 3.5 -> 0.103794,  
3.6 -> -0.484698, 3.7 -> -0.906964, 3.8 -> -0.976929, 3.9 -> -0.633118, 4. -> 0.0044257,  
4.1 -> 0.655184, 4.2 -> 0.992026, 4.3 -> 0.811764, 4.4 -> 0.176242, 4.5 -> -0.575187,  
4.6 -> -0.989073, 4.7 -> -0.77629, 4.8 -> -0.0387499, 4.9 -> 0.738768, 5. -> 0.988705,  
5.1 -> 0.488485, 5.2 -> -0.407439, 5.3 -> -0.979838, 5.4 -> -0.71871, 5.5 -> 0.186949,  
5.6 -> 0.931333, 5.7 -> 0.79167, 5.8 -> -0.136039, 5.9 -> -0.934361, 6. -> -0.748058,  
6.1 -> 0.261784, 6.2 -> 0.984565, 6.3 -> 0.561935, 6.4 -> -0.542388, 6.5 -> -0.981533,  
6.6 -> -0.167522, 6.7 -> 0.873178, 6.8 -> 0.737869, 6.9 -> -0.426023, 7. -> -0.987339,  
7.1 -> -0.101327, 7.2 -> 0.941986, 7.3 -> 0.533805, 7.4 -> -0.722151, 7.5 -> -0.810313,  
7.6 -> 0.448703, 7.7 -> 0.947805, 7.8 -> -0.202315, 7.9 -> -0.994708, 8. -> 0.0221268,  
8.1 -> 0.999252, 8.2 -> 0.0793805, 8.3 -> -0.994978, 8.4 -> -0.100885, 8.5 -> 0.996652,  
8.6 -> 0.0426365, 8.7 -> -0.999863, 8.8 -> 0.0956117, 8.9 -> 0.981055, 9. -> -0.309023,  
9.1 -> -0.898977, 9.2 -> 0.574974, 9.3 -> 0.702582, 9.4 -> -0.836563, 9.5 -> -0.352848,  
9.6 -> 0.992639, 9.7 -> -0.137359, 9.8 -> -0.914309, 9.9 -> 0.656525, 10. -> 0.510177}
```

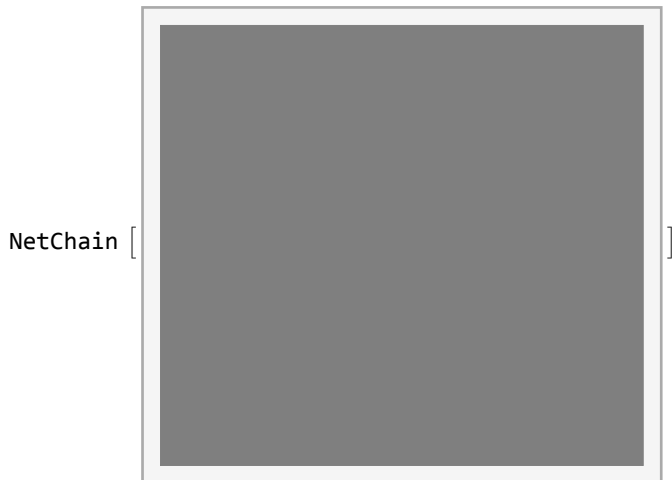
```
a1 = ListPlot[List@@@reguladate, PlotStyle -> Blue]
```



```
net = NetChain[{100, Tanh, 200, Cos, 300, Tanh, 1}, "Input" -> "Scalar", "Output" -> "Scalar"]
```



```
NetInitialize[net]
```



```
trained = NetTrain[net, reguladate]
```

```
NetChain [
```



```
trained[2.1]
```

```
0.264627
```

```
trained[30]
```

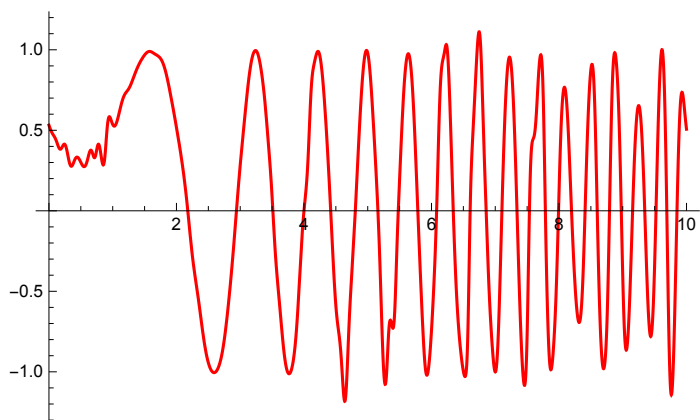
```
3.76412
```

```
functie[x_] := trained[x]
```

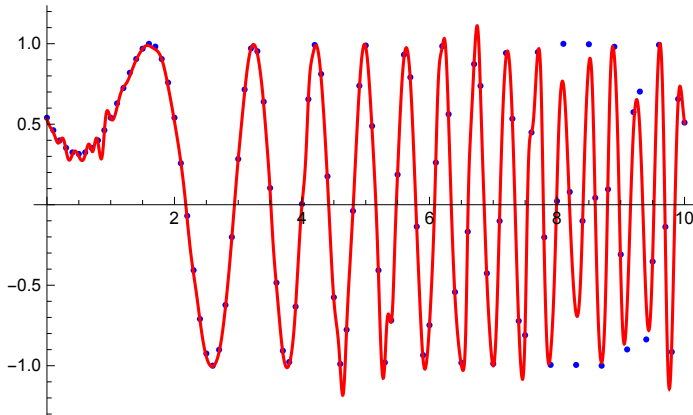
```
functie[50]
```

```
4.07751
```

```
a2 = Plot[functie[x], {x, 0, 10}, PlotStyle -> Red, PlotRange -> All]
```



Show[a1, a2, PlotRange -> All]



NIntegrate[functia[x], {x, 0, 10}]

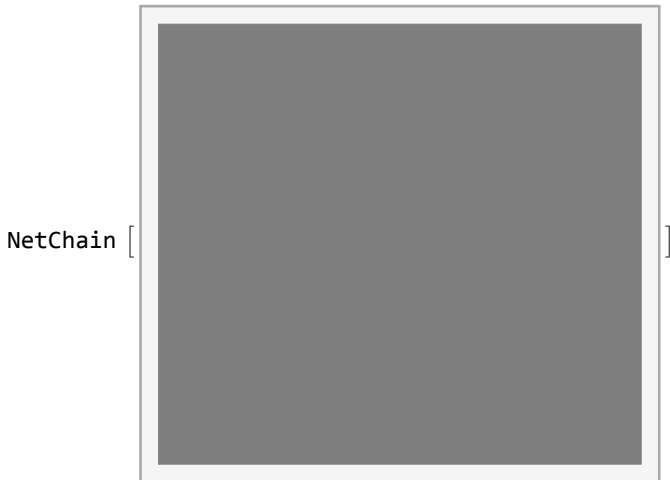
1.36749

```
min = 0;
max = 10;
pash = 0.0001;
integrala = 0;
contor = 1;
While[min < max, contor++;
  integrala = integrala + pash * functie[min + pash];
  min = min + pash;]
Print[integrala]
```

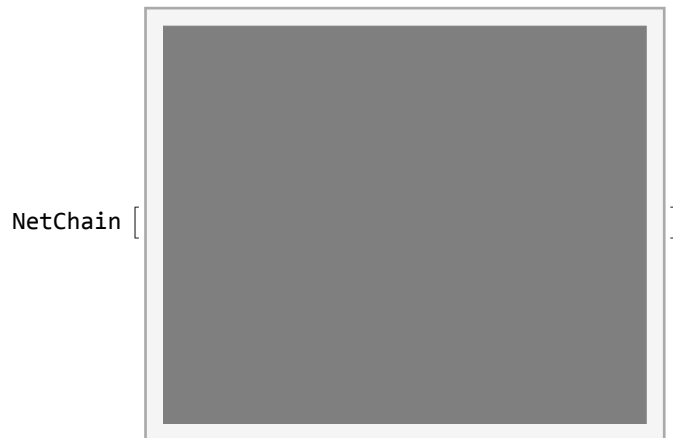
0.939837

(* constructia a unei alte retele neurale *)

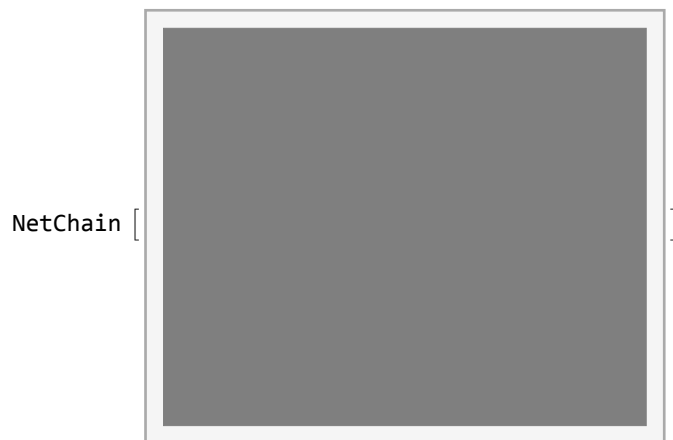
net1 = NetChain[{100, Cos, Tanh, Sin, 300, 1}, "Input" -> "Scalar", "Output" -> "Scalar"]



```
NetInitialize[net1]
```



```
trained1 = NetTrain[net1, reguladate]
```



```
trained1[2.1]
```

```
0.111908
```

```
trained1[30]
```

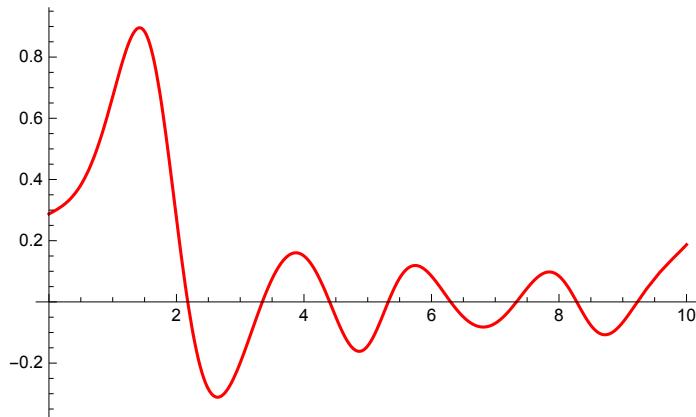
```
-13.6481
```

```
functie1[x_] := trained1[x]
```

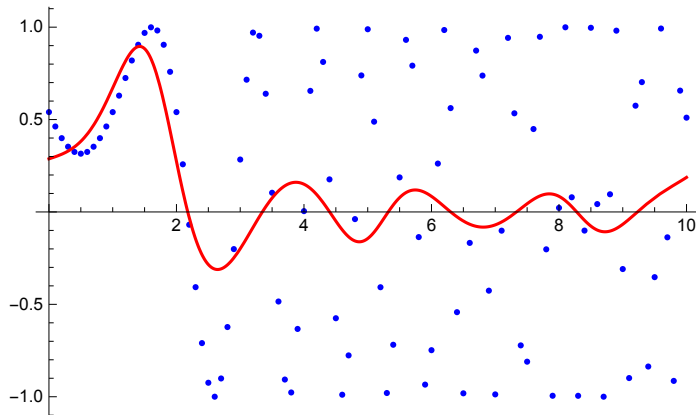
```
functie1[50]
```

```
12.0029
```

```
a2 = Plot[functie1[x], {x, 0, 10}, PlotStyle -> Red, PlotRange -> All]
```



```
Show[a1, a2, PlotRange -> All]
```



```
NIntegrate[functia[x], {x, 0, 10}]
```

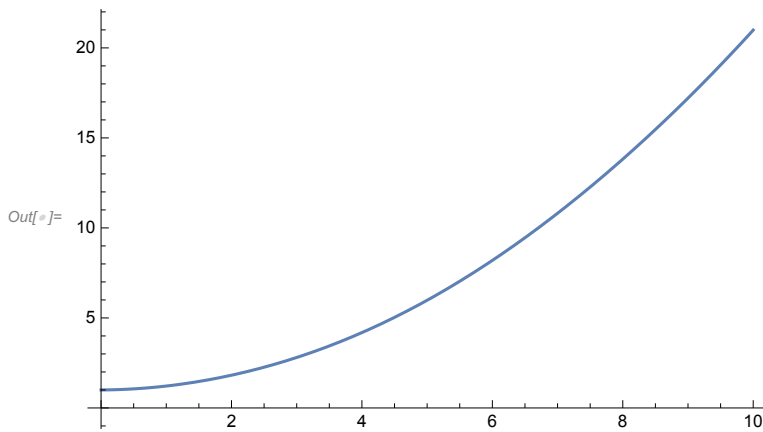
```
1.36749
```

```
min = 0;
max = 10;
pash = 0.001;
integrala = 0;
contor = 1;
While[min < max, contor++;
  integrala = integrala + pash * functie1[min + pash];
  min = min + pash;]
Print[integrala]
```

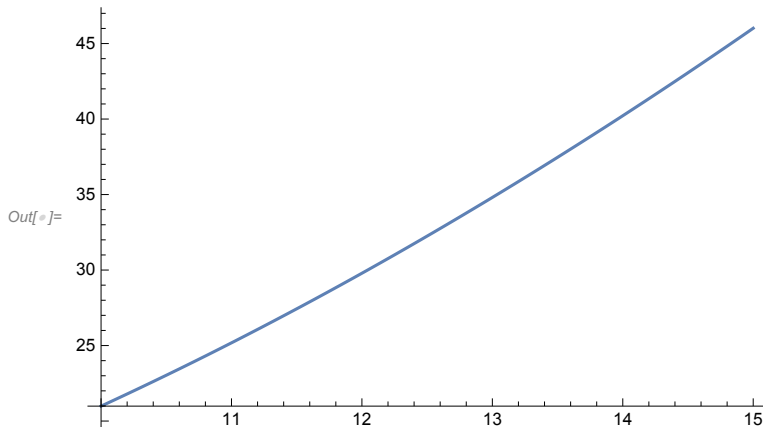
```
1.0476
```


Calculare integrale folosind rețele neurale [computing integrals using neural networks] $f : [a,b] \rightarrow \mathbb{R}$

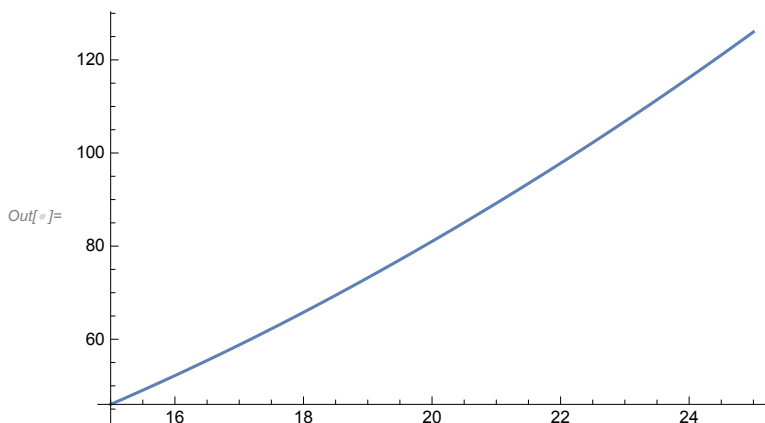
```
In[*]:= a = 0;  
b = 40;  
tabelax = Table[a + i, {i, 1, b}]  
(* puncte pe 0x in care valoarea integralei este determinata *)  
Out[*]:= {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20,  
21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40}  
  
In[*]:= functie[x_] := 0.2 x^2 + 0.02 Sin[x] + 1  
  
In[*]:= Plot[functie[x], {x, 0, 10}]
```



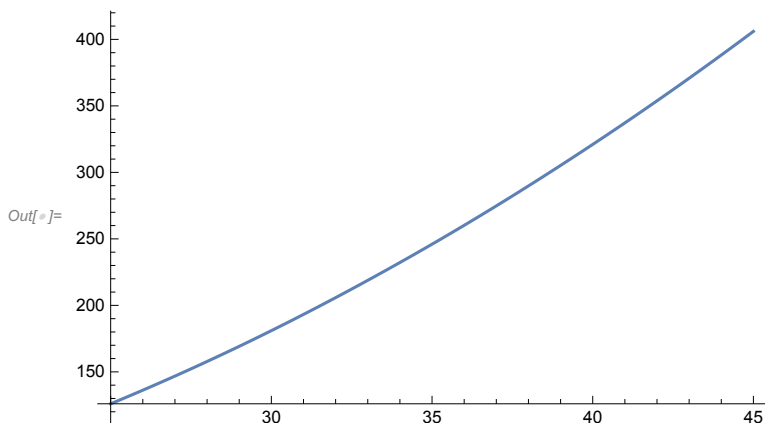
```
In[*]:= Plot[functie[x], {x, 10, 15}]
```



`In[]:= Plot[functie[x], {x, 15, 25}]`



`In[]:= Plot[functie[x], {x, 25, 45}]`



`In[]:= NIntegrate[functie[x], {x, 0, 2}]`

`Out[]:= 2.56166`

`In[]:= integrala[x_] := NIntegrate[functie[y], {y, 0, x}]`

`In[]:= integrala[1]`

`Out[]:= 1.07586`

`In[]:= integrala[2]`

`Out[]:= 2.56166`

`In[]:= tabelay = Table[integrala[i], {i, 1, b}] // Quiet
nr = Length[tabelay]`

`Out[]:= {1.07586, 2.56166, 4.8398, 8.29974, 13.3477, 20.4008, 29.8716, 42.1562, 57.6382, 76.7034,
99.7532, 127.203, 159.469, 196.951, 240.035, 289.106, 344.559, 406.807, 476.267, 553.345,
638.431, 731.907, 834.164, 945.612, 1066.67, 1197.74, 1339.23, 1491.51, 1654.97, 1830.02,
2017.07, 2216.54, 2428.82, 2654.3, 2893.37, 3146.42, 3413.87, 3696.13, 3993.61, 4306.7}`

`Out[]:= 40`

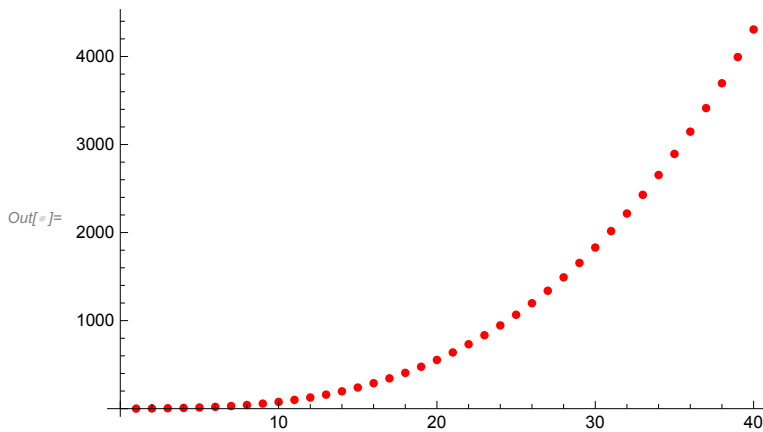
In[]:= AssociationThread[tabelax → tabelay]

Out[]:= <| 1 → 1.07586, 2 → 2.56166, 3 → 4.8398, 4 → 8.29974, 5 → 13.3477, 6 → 20.4008,
 7 → 29.8716, 8 → 42.1562, 9 → 57.6382, 10 → 76.7034, 11 → 99.7532, 12 → 127.203,
 13 → 159.469, 14 → 196.951, 15 → 240.035, 16 → 289.106, 17 → 344.559,
 18 → 406.807, 19 → 476.267, 20 → 553.345, 21 → 638.431, 22 → 731.907, 23 → 834.164,
 24 → 945.612, 25 → 1066.67, 26 → 1197.74, 27 → 1339.23, 28 → 1491.51, 29 → 1654.97,
 30 → 1830.02, 31 → 2017.07, 32 → 2216.54, 33 → 2428.82, 34 → 2654.3, 35 → 2893.37,
 36 → 3146.42, 37 → 3413.87, 38 → 3696.13, 39 → 3993.61, 40 → 4306.7 |>

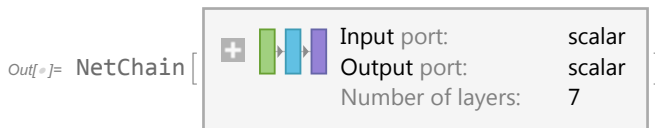
In[]:= trainingset = Normal[%]

Out[]:= {1 → 1.07586, 2 → 2.56166, 3 → 4.8398, 4 → 8.29974, 5 → 13.3477, 6 → 20.4008,
 7 → 29.8716, 8 → 42.1562, 9 → 57.6382, 10 → 76.7034, 11 → 99.7532, 12 → 127.203,
 13 → 159.469, 14 → 196.951, 15 → 240.035, 16 → 289.106, 17 → 344.559,
 18 → 406.807, 19 → 476.267, 20 → 553.345, 21 → 638.431, 22 → 731.907,
 23 → 834.164, 24 → 945.612, 25 → 1066.67, 26 → 1197.74, 27 → 1339.23, 28 → 1491.51,
 29 → 1654.97, 30 → 1830.02, 31 → 2017.07, 32 → 2216.54, 33 → 2428.82, 34 → 2654.3,
 35 → 2893.37, 36 → 3146.42, 37 → 3413.87, 38 → 3696.13, 39 → 3993.61, 40 → 4306.7}

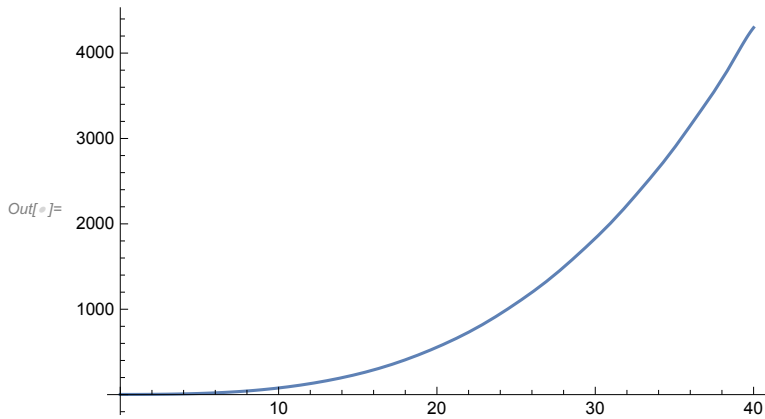
In[]:= a1 = plot = ListPlot[List @@@ trainingset, PlotStyle → Red]



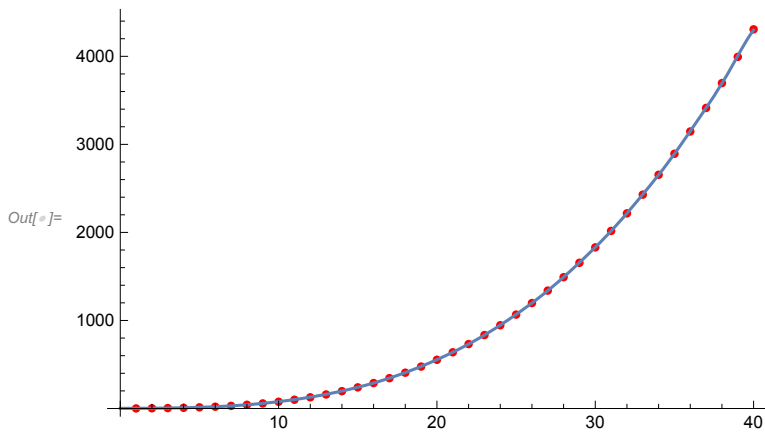
In[]:= net = NetChain[{500, Cos, Sin, 500, Cos, 500, 1}, "Input" → "Scalar", "Output" → "Scalar"];
 net1 = NetTrain[net, trainingset]



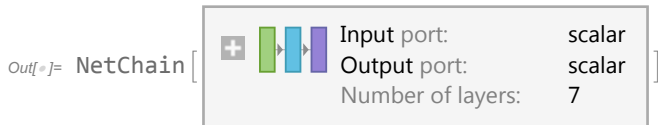
`In[]:= a2 = Show[Plot[net1[x], {x, 0, b}]]`



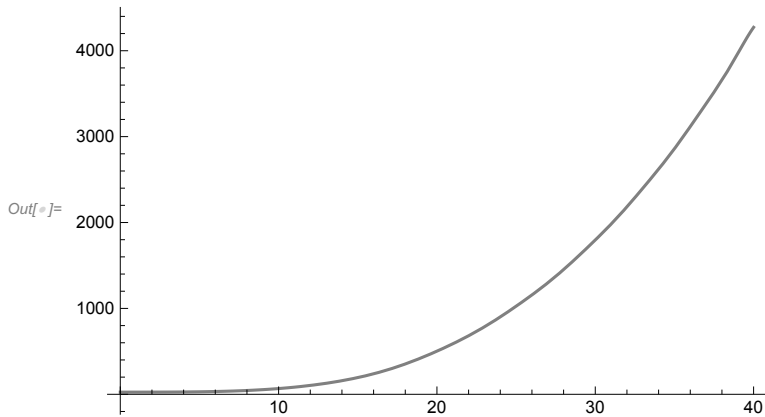
`In[]:= Show[a1, a2]`



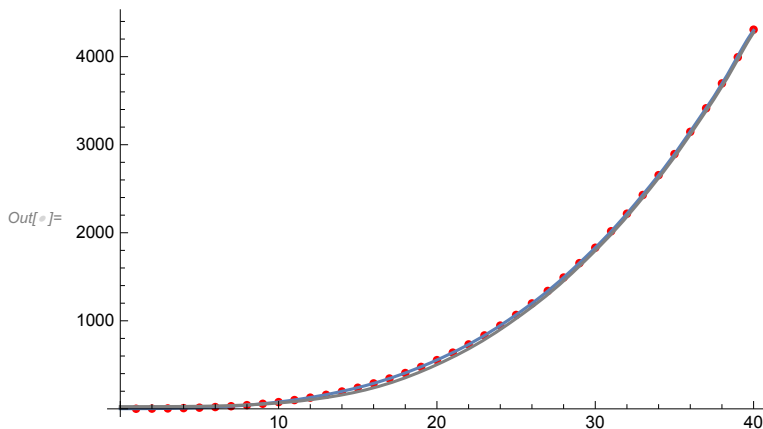
`In[]:= net2 = NetTrain[net, trainingset, Method -> {"ADAM", "L2Regularization" -> 0.005}]`



`In[]:= a3 = Show[Plot[net2[x], {x, 0, b}, PlotStyle -> Gray, PlotRange -> All]]`



```
In[*]:= Show[a1, a2, a3, PlotRange -> All]
```



```
In[*]:= valoareextinsa = 42
         integrala[valoareextinsa]
```

```
Out[*]:= 42
```

```
Out[*]:= 4981.23
```

```
In[*]:= net1[valoareextinsa]
```

```
Out[*]:= 4313.75
```

```
In[*]:= net2[valoareextinsa]
```

```
Out[*]:= 4359.81
```

```
In[*]:= eroare = net1[valoareextinsa] - integrala[valoareextinsa]
         eroare = net2[valoareextinsa] - integrala[valoareextinsa]
         diferenta = net1[valoareextinsa] - net2[valoareextinsa]
```

```
Out[*]:= -667.482
```

```
Out[*]:= -621.413
```

```
Out[*]:= -46.0693
```

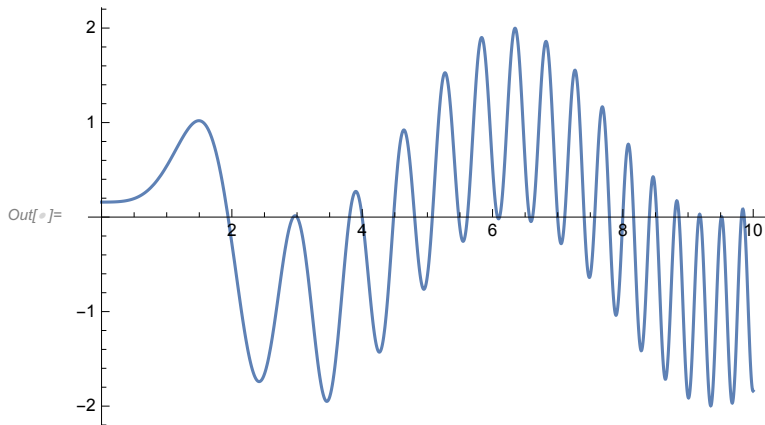
Calculare integrale folosind retele neurale [computing integrals using neural networks] $f : [a,b] \rightarrow \mathbb{R}$

```
In[*]:= a = 0;
         b = 40;
         tabelax = Table[a + i, {i, 1, b}]
         (* puncte pe Ox in care valoarea integralei este determinata *)
```

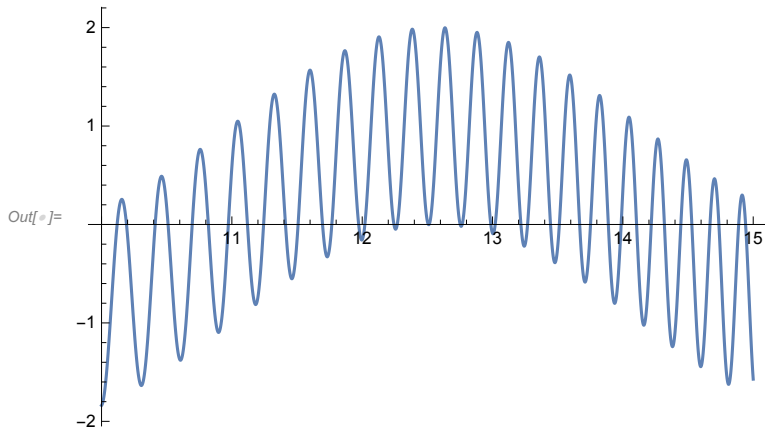
```
Out[*]:= {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20,
          21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40}
```

```
In[*]:= functie[x_] := Sin[x^2 - 1] + Cos[x]
```

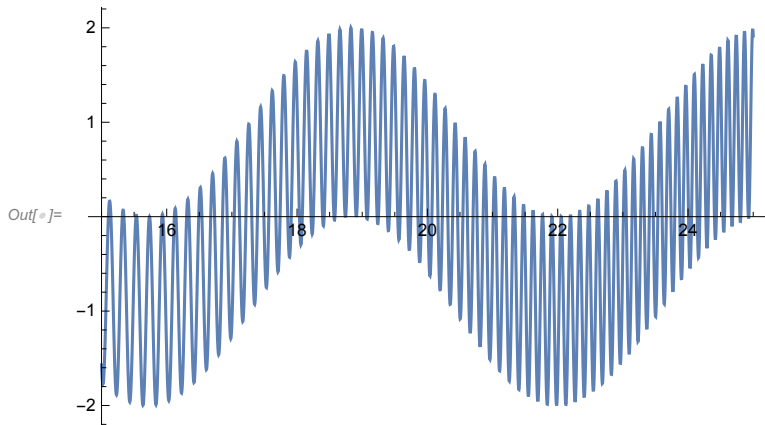
`In[]:= Plot[functie[x], {x, 0, 10}]`



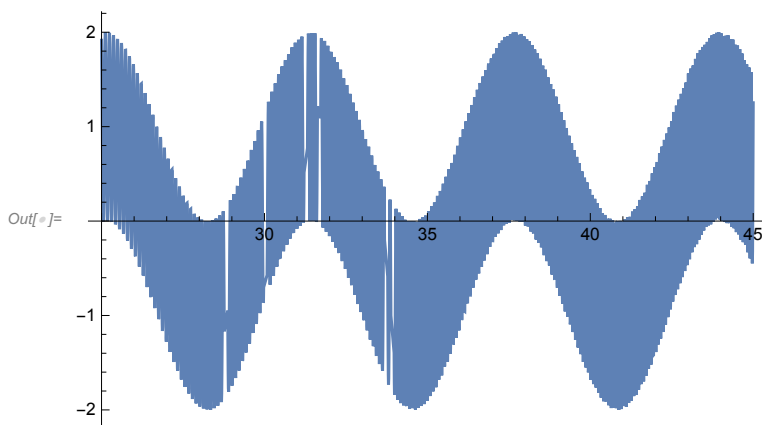
`In[]:= Plot[functie[x], {x, 10, 15}]`



`In[]:= Plot[functie[x], {x, 15, 25}]`



In[*]:= Plot[functie[x], {x, 25, 45}]



In[*]:= NIntegrate[functie[x], {x, 0, 2}]

Out[*]:= 0.955814

In[*]:= integrala[x_] := NIntegrate[functie[y], {y, 0, x}]

In[*]:= integrala[1]

Out[*]:= 0.247979

In[*]:= integrala[2]

Out[*]:= 0.955814

In[*]:= tabelay = Table[integrala[i], {i, 1, b}] // Quiet
nr = Length[tabelay]

Out[*]:= {0.247979, 0.955814, -0.0323617, -0.853345, -1.18822, -0.392386, 0.514527, 0.73894,
0.229862, -0.734492, -1.22584, -0.727554, 0.234441, 0.767015, 0.481091, -0.449655,
-1.16531, -0.916567, -0.0314217, 0.749212, 0.624484, -0.213312, -1.0562, -1.07355,
-0.313421, 0.591202, 0.755427, 0.0953296, -0.846022, -1.19136, -0.596647, 0.356453,
0.803104, 0.333768, -0.621801, -1.19145, -0.830062, 0.114653, 0.764012, 0.568852}

Out[*]:= 40

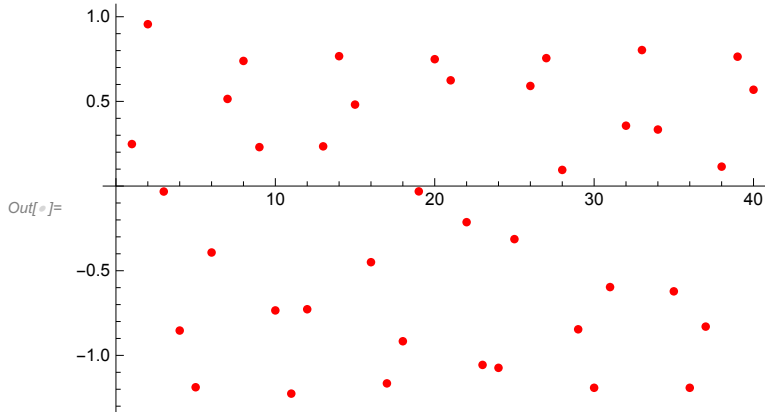
In[*]:= AssociationThread[tabelax -> tabelay]

Out[*]:= <| 1 -> 0.247979, 2 -> 0.955814, 3 -> -0.0323617, 4 -> -0.853345, 5 -> -1.18822, 6 -> -0.392386,
7 -> 0.514527, 8 -> 0.73894, 9 -> 0.229862, 10 -> -0.734492, 11 -> -1.22584, 12 -> -0.727554,
13 -> 0.234441, 14 -> 0.767015, 15 -> 0.481091, 16 -> -0.449655, 17 -> -1.16531, 18 -> -0.916567,
19 -> -0.0314217, 20 -> 0.749212, 21 -> 0.624484, 22 -> -0.213312, 23 -> -1.0562, 24 -> -1.07355,
25 -> -0.313421, 26 -> 0.591202, 27 -> 0.755427, 28 -> 0.0953296, 29 -> -0.846022,
30 -> -1.19136, 31 -> -0.596647, 32 -> 0.356453, 33 -> 0.803104, 34 -> 0.333768, 35 -> -0.621801,
36 -> -1.19145, 37 -> -0.830062, 38 -> 0.114653, 39 -> 0.764012, 40 -> 0.568852 |>

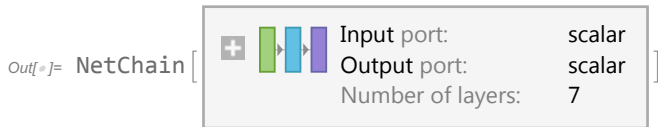
`In[]:= trainingset = Normal[%]`

`Out[]:= {1 → 0.247979, 2 → 0.955814, 3 → -0.0323617, 4 → -0.853345, 5 → -1.18822, 6 → -0.392386, 7 → 0.514527, 8 → 0.73894, 9 → 0.229862, 10 → -0.734492, 11 → -1.22584, 12 → -0.727554, 13 → 0.234441, 14 → 0.767015, 15 → 0.481091, 16 → -0.449655, 17 → -1.16531, 18 → -0.916567, 19 → -0.0314217, 20 → 0.749212, 21 → 0.624484, 22 → -0.213312, 23 → -1.0562, 24 → -1.07355, 25 → -0.313421, 26 → 0.591202, 27 → 0.755427, 28 → 0.0953296, 29 → -0.846022, 30 → -1.19136, 31 → -0.596647, 32 → 0.356453, 33 → 0.803104, 34 → 0.333768, 35 → -0.621801, 36 → -1.19145, 37 → -0.830062, 38 → 0.114653, 39 → 0.764012, 40 → 0.568852}`

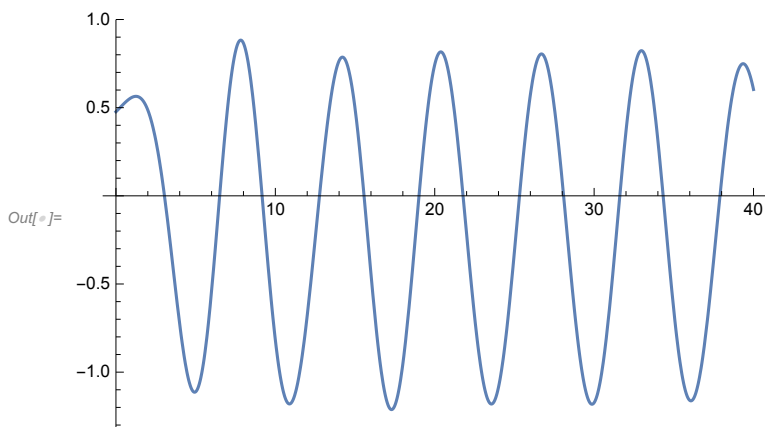
`In[]:= a1 = plot = ListPlot[List@@trainingset, PlotStyle → Red]`



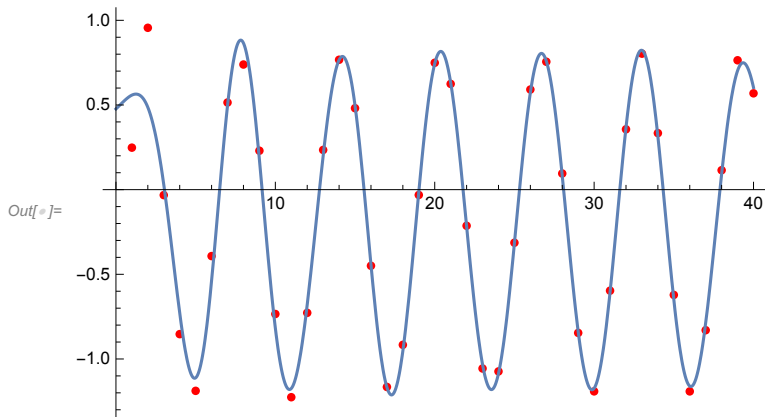
`In[]:= net = NetChain[{500, Cos, Sin, 500, Cos, 500, 1}, "Input" → "Scalar", "Output" → "Scalar"]; net1 = NetTrain[net, trainingset]`



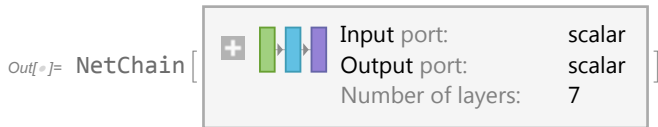
`In[]:= a2 = Show[Plot[net1[x], {x, 0, b}]]`



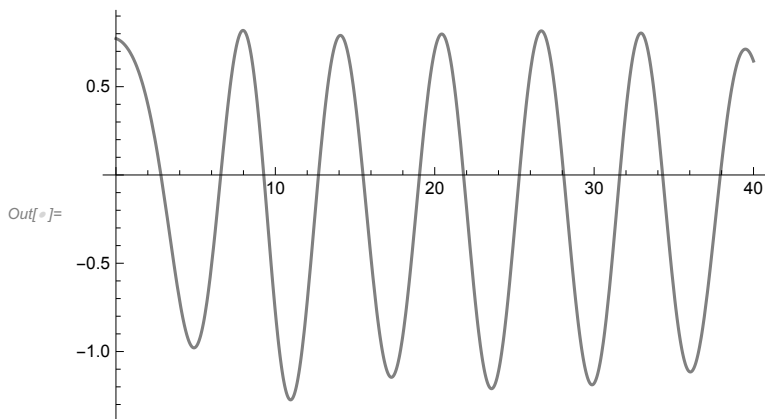
In[]:= Show[a1, a2]



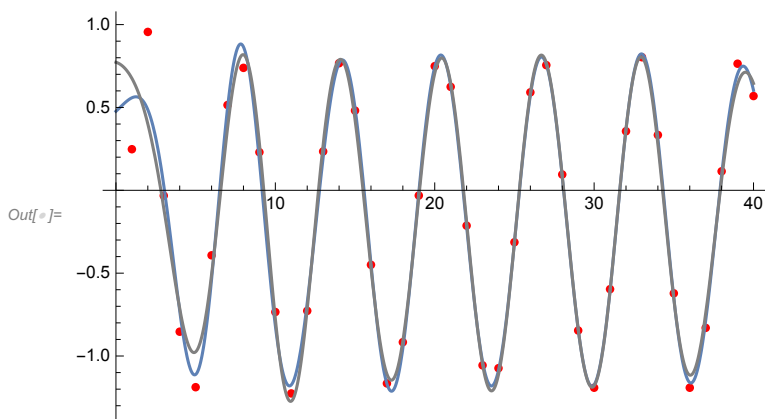
In[]:= net2 = NetTrain[net, trainingset, Method -> {"ADAM", "L2Regularization" -> 0.005}]



In[]:= a3 = Show[Plot[net2[x], {x, 0, 40}], PlotStyle -> Gray, PlotRange -> All]



In[]:= Show[a1, a2, a3, PlotRange -> All]



```
In[*]:= valoareextinsa = 42  
integrala[valoareextinsa]
```

```
Out[*]= 42
```

```
Out[*]= -1.0952
```

```
In[*]:= net1[valoareextinsa]
```

```
Out[*]= -0.509807
```

```
In[*]:= net2[valoareextinsa]
```

```
Out[*]= -0.151308
```

```
In[*]:= eroare = net1[valoareextinsa] - integrala[valoareextinsa]  
eroare = net2[valoareextinsa] - integrala[valoareextinsa]  
diferenta = net1[valoareextinsa] - net2[valoareextinsa]
```

```
Out[*]= 0.585397
```

```
Out[*]= 0.943897
```

```
Out[*]= -0.3585
```

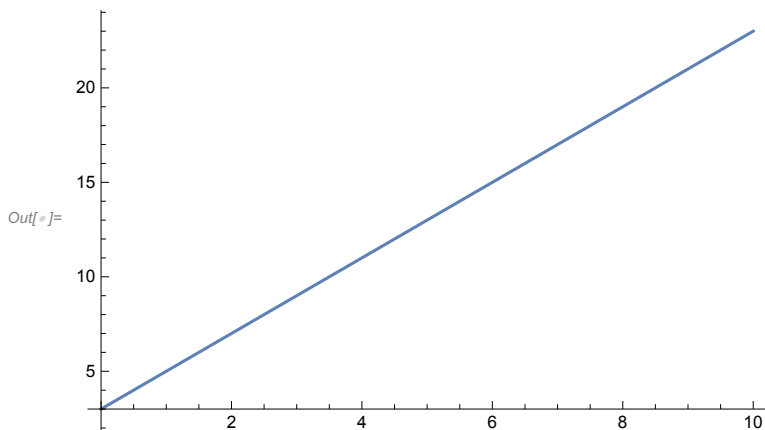
Calculare integrale folosind rețele neurale [computing integrals using neural networks] $f : [a,b] \rightarrow \mathbb{R}$

```
In[*]:= a = 0;  
b = 40;  
tabelax = Table[a + i, {i, 1, b}]  
(* puncte pe Ox in care valoarea integralei este determinata *)
```

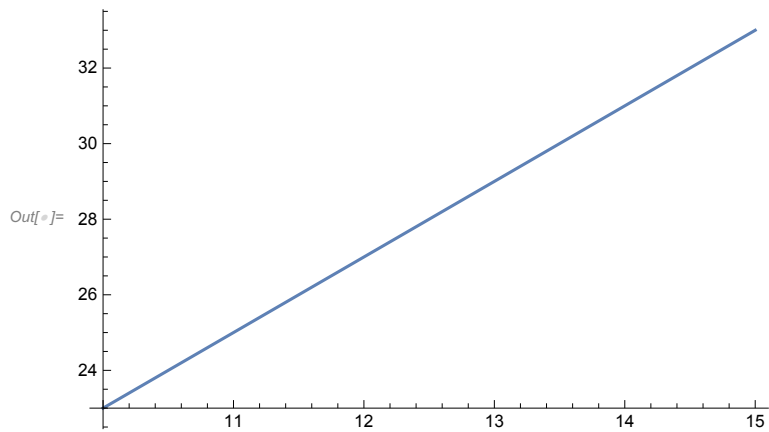
```
Out[*]= {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20,  
21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40}
```

```
In[*]:= functie[x_] := 2 * x + 3
```

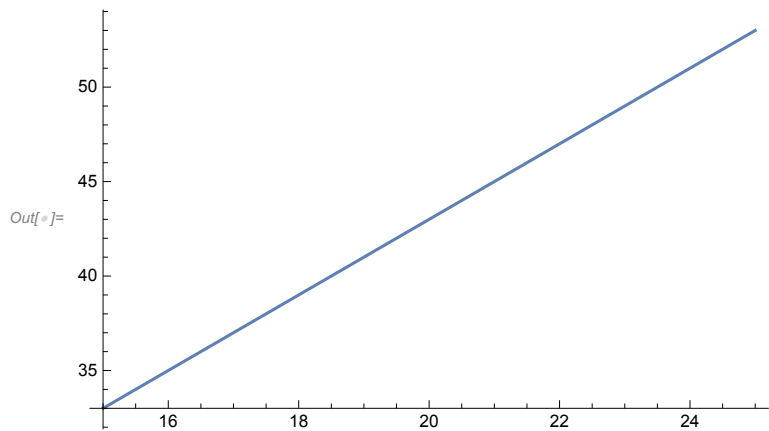
```
In[*]:= Plot[functie[x], {x, 0, 10}]
```



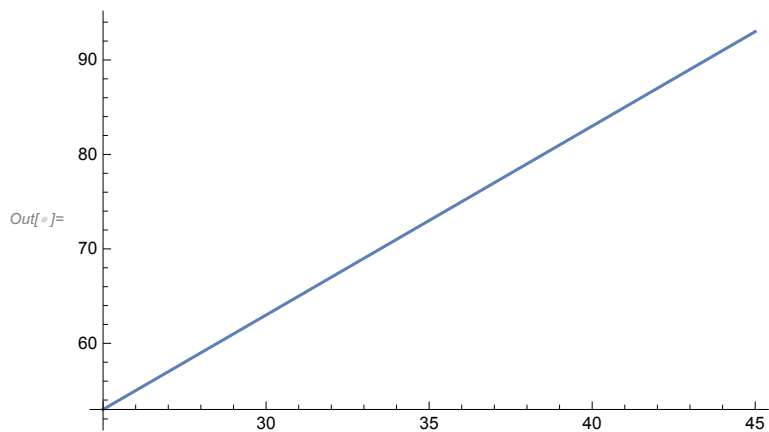
In[*]:= Plot[functie[x], {x, 10, 15}]



In[*]:= Plot[functie[x], {x, 15, 25}]



In[*]:= Plot[functie[x], {x, 25, 45}]



In[*]:= NIntegrate[functie[x], {x, 0, 2}]

Out[*]= 10.

In[*]:= integrala[x_] := NIntegrate[functie[y], {y, 0, x}]

```
In[ ]:= integrala[1]
```

```
Out[ ]:= 4.
```

```
In[ ]:= integrala[2]
```

```
Out[ ]:= 10.
```

```
In[ ]:= tabelay = Table[integrala[i], {i, 1, b}] // Quiet
nr = Length[tabelay]
```

```
Out[ ]:= {4., 10., 18., 28., 40., 54., 70., 88., 108., 130., 154., 180., 208., 238., 270.,
304., 340., 378., 418., 460., 504., 550., 598., 648., 700., 754., 810., 868.,
928., 990., 1054., 1120., 1188., 1258., 1330., 1404., 1480., 1558., 1638., 1720.}
```

```
Out[ ]:= 40
```

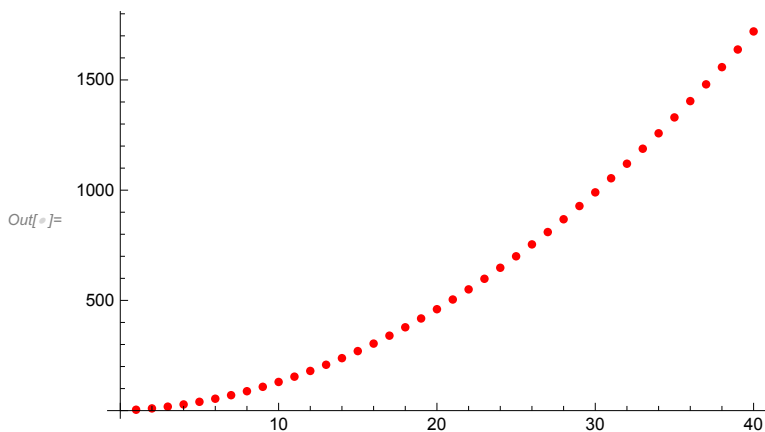
```
In[ ]:= AssociationThread[tabelax → tabelay]
```

```
Out[ ]:= <| 1 → 4., 2 → 10., 3 → 18., 4 → 28., 5 → 40., 6 → 54., 7 → 70., 8 → 88., 9 → 108., 10 → 130.,
11 → 154., 12 → 180., 13 → 208., 14 → 238., 15 → 270., 16 → 304., 17 → 340., 18 → 378.,
19 → 418., 20 → 460., 21 → 504., 22 → 550., 23 → 598., 24 → 648., 25 → 700., 26 → 754.,
27 → 810., 28 → 868., 29 → 928., 30 → 990., 31 → 1054., 32 → 1120., 33 → 1188.,
34 → 1258., 35 → 1330., 36 → 1404., 37 → 1480., 38 → 1558., 39 → 1638., 40 → 1720. |>
```

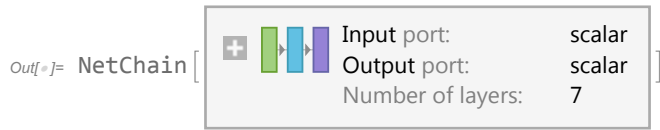
```
In[ ]:= trainingset = Normal[%]
```

```
Out[ ]:= {1 → 4., 2 → 10., 3 → 18., 4 → 28., 5 → 40., 6 → 54., 7 → 70., 8 → 88., 9 → 108., 10 → 130.,
11 → 154., 12 → 180., 13 → 208., 14 → 238., 15 → 270., 16 → 304., 17 → 340., 18 → 378.,
19 → 418., 20 → 460., 21 → 504., 22 → 550., 23 → 598., 24 → 648., 25 → 700., 26 → 754.,
27 → 810., 28 → 868., 29 → 928., 30 → 990., 31 → 1054., 32 → 1120., 33 → 1188.,
34 → 1258., 35 → 1330., 36 → 1404., 37 → 1480., 38 → 1558., 39 → 1638., 40 → 1720.}
```

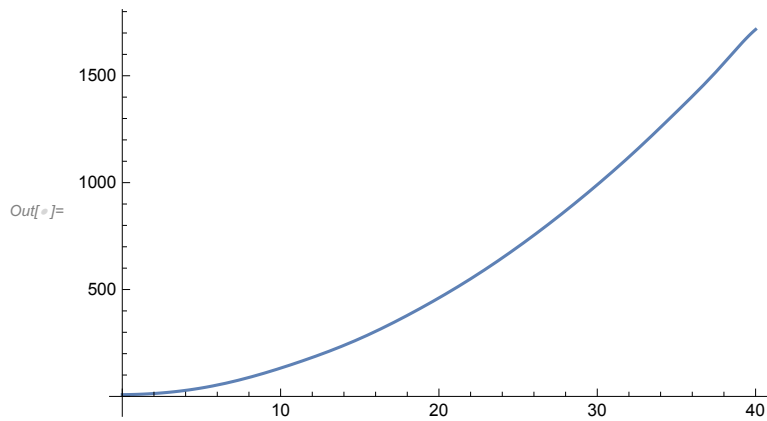
```
In[ ]:= a1 = plot = ListPlot[List@@@ trainingset, PlotStyle → Red]
```



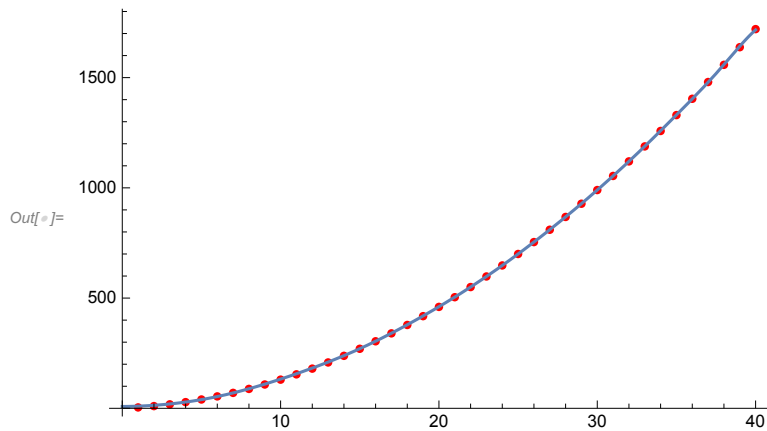
```
In[ ]:= net = NetChain[{500, Cos, Sin, 500, Cos, 500, 1}, "Input" -> "Scalar", "Output" -> "Scalar"];
net1 = NetTrain[net, trainingset]
```



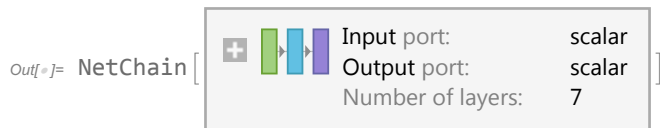
```
In[ ]:= a2 = Show[Plot[net1[x], {x, 0, b}]]
```



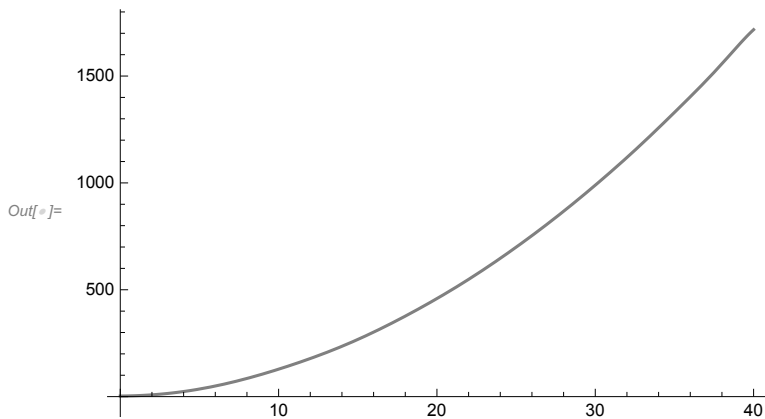
```
In[ ]:= Show[a1, a2]
```



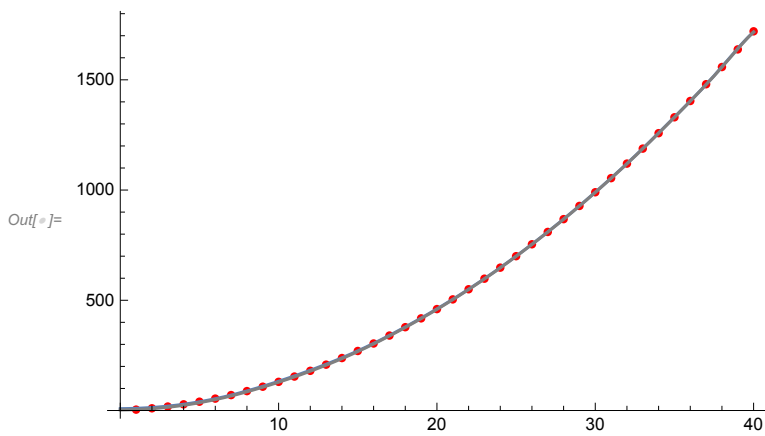
```
In[ ]:= net2 = NetTrain[net, trainingset, Method -> {"ADAM", "L2Regularization" -> 0.005}]
```



```
In[ ]:= a3 = Show[Plot[net2[x], {x, 0, b}, PlotStyle -> Gray, PlotRange -> All]]
```



```
In[ ]:= Show[a1, a2, a3, PlotRange -> All]
```



```
In[ ]:= valoareextinsa = 42
         integrala[valoareextinsa]
```

Out[]:= 42

Out[]:= 1890.

```
In[ ]:= net1[valoareextinsa]
```

Out[]:= 1767.22

```
In[ ]:= net2[valoareextinsa]
```

Out[]:= 1784.47

```
In[ ]:= eroare = net1[valoareextinsa] - integrala[valoareextinsa]
         eroare = net2[valoareextinsa] - integrala[valoareextinsa]
         diferenta = net1[valoareextinsa] - net2[valoareextinsa]
```

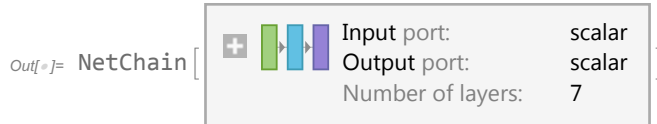
Out[]:= -122.779

Out[]:= -105.526

Out[]:= -17.2527

Extracting values from the neural network (weights)

```
In[*]:= net2
```



```
In[*]:= layer = NetExtract[net2, 1]
```



```
In[*]:= list = NetExtract[layer, "Weights"]
```

```
Out[*]:= {{-0.102763}, {-0.0143584}, {0.0409225}, {-0.049585}, {0.10163}, {-0.041967}, {-0.02348},
{0.0874468}, {-0.0797866}, {0.0899999}, {-0.051307}, {0.0467883}, {-0.0989358},
{-0.0467596}, {-0.0425351}, {-0.0226562}, {0.0407941}, {0.0491738}, {-0.0427192},
{-0.0220466}, {-0.0299469}, {-0.0181592}, {0.0475567}, {-0.0124157}, {-0.0148189},
{-0.043348}, {-0.102041}, {0.0481977}, {0.0282829}, {0.0971416}, {-0.0322321},
{0.0547048}, {-0.0693856}, {0.0400671}, {-0.041665}, {0.0426233}, {-0.0449221},
{-0.103075}, {0.0178017}, {0.02915}, {0.0399172}, {-0.0448191}, {0.0469052},
{0.0497801}, {0.0259181}, {-0.113778}, {-0.0371579}, {-0.0373261}, {0.0383},
{0.0284131}, {-0.000130791}, {0.121686}, {-0.118614}, {-0.00487848}, {-0.0277501},
{0.100258}, {0.00514206}, {-0.047081}, {-0.0387638}, {-0.0405435}, {-0.093344},
{-0.0436416}, {-0.0261161}, {0.0523322}, {0.0445878}, {0.0372183}, {0.0416256},
{0.0294763}, {0.0896625}, {-0.0631515}, {0.0336983}, {0.0407064}, {0.00464652},
{0.00328763}, {0.0471549}, {0.0437175}, {0.0433424}, {0.04}, {-0.0461373}, {0.0492424},
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```

```
In[*]:= Length[list]
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Out[*]:= 500

In[*]:= lista2 = NetExtract[layer, "Biases"]

Out[*]:= { -0.0281822, -0.0196855, -0.00689807, 0.0147499, 0.0117825, -0.00934946, -0.0186622, -0.00923297, 0.00772461, 0.00608671, 0.020322, -0.0143032, -0.0354878, 0.0153483, -0.00864944, -0.0179966, -0.00852591, -0.0125981, 0.00076665, -0.00805313, -0.012748, -0.0017412, -0.02458, -0.00264806, -0.024439, 0.00661787, -0.0297321, -0.0288279, 0.0147217, 0.00290398, -0.0082932, -0.0367339, 0.0236527, 0.00674505, 0.00538843, -0.00199101, 0.0147767, -0.0204726, 0.000620235, 0.0146997, 0.0120981, 0.000650101, -0.0494247, -0.0459984, 0.0133144, -0.031117, -0.00909922, -0.0292437, 0.015057, 0.0146606, -0.000882178, 0.0395765, -0.0243262, 0.0034637, -0.00667952, 0.0135531, 0.00573751, 0.0102371, -0.00868623, -0.00188587, 0.00824922, 0.00569867, -0.00287291, -0.0165672, 0.00429163, 0.0222529, -0.016408, 0.00374281, 0.0178375, 0.019581, 0.0114385, 0.020537, 0.00700569, -0.00354365, -0.0186108, -0.0115017, -0.00225326, 0.0083293, 0.018555, -0.0167462, -0.01092, 0.00389783, 0.0119772, 0.0172812, 0.0299635, 0.00836802, 0.000947169, 0.0131827, 0.000650238, 0.00765358, 0.0137997, -0.0495589, 0.00655638, 0.0471369, 0.0424931, 0.0146012, -0.0251473, -0.0117549, -0.00610704, -0.00627706, -0.0200592, 0.00791214, 0.0127241, -0.00111973, 0.0261102, 0.00969458, 0.0113189, -0.00501974, 0.0197437, 0.0182633, -0.0148675, -0.0113424, -0.0113594, -0.00903037, -0.000903707, -0.0348732, 0.0180781, 0.00636894, -0.0183706, -0.019111, -0.0188072, -0.00562358, 0.0124734, 0.0144972, 0.00901577, -0.00259322, 0.0147626, -0.0206078, 0.00895206, -0.0138822, 0.021203, 0.0121761, -0.000793758, -0.019407, -0.0089554, 0.0133, -0.016957, 0.00570649, 0.0201557, 0.00886757, -0.00365685, 0.00332751, 0.0414752, -0.0220729, 0.0197513, -0.00500302, 0.0463892, -0.00197303, 0.024334, -0.0192174, 0.0112613, 0.00731762, 0.00234858, -0.0278097, -0.0178654, 0.0388429, -0.0145755, 0.0160855, -0.00622801, 0.00575822, 0.0257232, 0.011494, 0.0188222, -0.00381139, -0.0217932, -0.00557627, 0.0344891, -0.00104598, -0.00728417, 0.0188681, -0.00909905, 0.0198428, -0.0134656, -0.0159648, 0.000696673, 0.010407, 0.0151656, -0.017031, 0.0266061, -0.00246222, -0.00739492, 0.0182062, 0.000331228, -0.000220572, -0.0129297, 0.00889987, 0.0475979, 0.0234306, 0.0224224, -0.0143403, -0.00783359, -0.00648215, -0.00128456, 0.0109406, -0.00304216, -0.000658777, 0.0567452, 0.00436094, -0.00671426, 0.00316186, 0.00181252, -0.0156039, -0.0104188, -0.00321519, -0.00339757, 0.00333167, 0.00879147, -0.0152759, -0.018082, 0.0121781, -0.0100065, 0.0263345, 0.0270777, 0.0101929, 0.0109459, -0.0131645, 0.00644963, 0.00326819, 0.0165089, 0.0199945, 0.014165, -0.00284093, 0.0000896522, 0.0196189, 0.00126578, 0.012736, 0.00304486, -0.00526167, -0.0143599, -0.00600246, 0.0120782, -0.00389909, -0.0205206, -0.013273, -0.0399571, 0.0022062, -0.0157853, -0.0332134, 0.0131351, -0.0303742, -0.0130632, -0.0114706, -0.025887, -0.0000845168, 0.00985183, 0.00356403, -0.00238135, -0.00122223, 0.00183256, 0.00548707, -0.0133405, 0.0235942, -0.00272027, -0.0233161, 0.00584593, 0.000389874, 0.00368989, 0.00741273, 0.0160862, 0.0363862, -0.0133517, 0.00359022, 0.0272607, 0.0214693, -0.0277781, -0.015497, 0.000212403, -0.00198895, -0.0222886, 0.0135432, 0.0451827, 0.00239665, -0.0192637, -0.0227232, -0.0174301, 0.0119595, -0.01781, 0.00273937, 0.0227879, 0.0139691, 0.00545427, -0.00933625, 0.0168454, -0.0104254, -0.00453247, -0.0160172, -0.0139931, -0.0138398, -0.0370973, 0.00235749, 0.0155262, 0.00480482, 0.00255256, 0.00623862, 0.0208697, 0.0109605, -0.00366632, 0.028114, -0.00713533, -0.008444, -0.00365845, -0.0174202, 0.00593098, 0.0119864, -0.00895509, -0.00268545, -0.00038162, -0.00733241, -0.00589152, -0.0204339, -0.00536019, -0.0488419, 0.0131999, 0.00449242, -0.0360168, -0.00808571, 0.00565411, -0.0129351, -0.0187869, -0.00164187, -0.00641281, -0.000582586, 0.0109066, 0.0203139, -0.0124317, 0.0184301, -0.0222602, -0.0208772, -0.00715911, 0.014199, 0.0209706, 0.0124695, -0.0115838,

```

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```

```
In[*]:= % // Length
```

```
Out[*]:= 500
```

```
In[*]:= NetExtract[layer, "Input"]
```

```
Out[*]:= 1
```

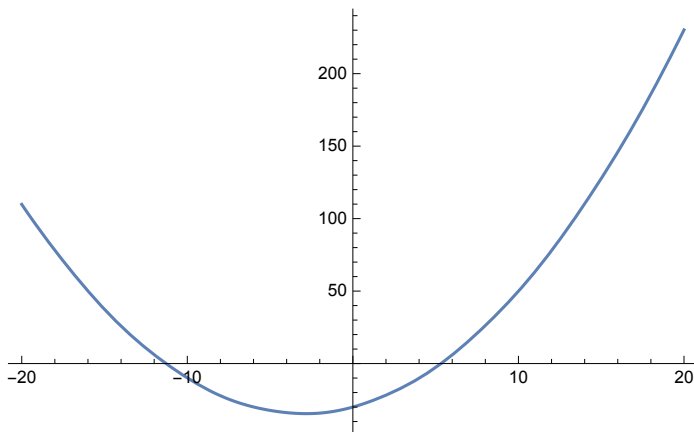
```
In[*]:= NetExtract[layer, "Output"]
```

```
Out[*]:= 500
```

Rezolvare ecuatii algebrice prin retele neurale [Solving algebraic equations using neural networks] $f : [a,b] \rightarrow \mathbb{R}$, $f(x)=0$.

```
a = -20;  
b = 20;  
tabelax = Table[a + i, {i, 1, 2 * b}]  
nr = Length[tabelax]  
(* puncte pe Ox in care valoarea functiei este determinata *)  
{-19, -18, -17, -16, -15, -14, -13, -12, -11, -10, -9, -8, -7, -6, -5, -4, -3,  
-2, -1, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20}  
40
```

```
functie[x_] := 0.5 x^2 + 0.2 Sin[x] + 3 x - 30  
Plot[functie[x], {x, a, b}]
```



```
NSolve[functie[x] == 0, x, Reals]
```

```
{{x -> -11.2835}, {x -> 5.32628}}
```

```
tabelay = Table[functie[tabelax[[i]]], {i, 1, 2 * b}]
```

```
nr = Length[tabelay]
```

```
{93.47, 78.1502, 63.6923, 50.0576, 37.3699, 25.8019, 15.416, 6.10731,  
-2.3, -9.8912, -16.5824, -22.1979, -26.6314, -29.9441, -32.3082, -33.8486,  
-34.5282, -34.1819, -32.6683, -30., -26.3317, -21.8181, -16.4718,  
-10.1514, -2.69178, 5.94412, 15.6314, 26.1979, 37.5824, 49.8912, 63.3,  
77.8927, 93.584, 110.198, 127.63, 145.942, 165.308, 185.85, 207.53, 230.183}
```

```
40
```

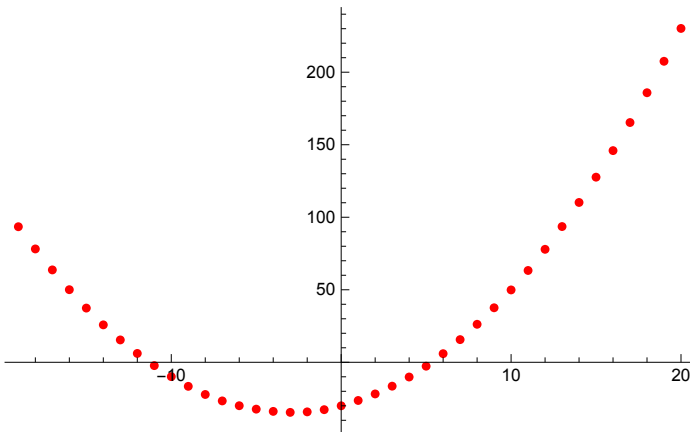
AssociationThread[tabelax → tabelay]

```
<|-19 → 93.47, -18 → 78.1502, -17 → 63.6923, -16 → 50.0576, -15 → 37.3699,
-14 → 25.8019, -13 → 15.416, -12 → 6.10731, -11 → -2.3, -10 → -9.8912, -9 → -16.5824,
-8 → -22.1979, -7 → -26.6314, -6 → -29.9441, -5 → -32.3082, -4 → -33.8486,
-3 → -34.5282, -2 → -34.1819, -1 → -32.6683, 0 → -30., 1 → -26.3317, 2 → -21.8181,
3 → -16.4718, 4 → -10.1514, 5 → -2.69178, 6 → 5.94412, 7 → 15.6314, 8 → 26.1979,
9 → 37.5824, 10 → 49.8912, 11 → 63.3, 12 → 77.8927, 13 → 93.584, 14 → 110.198,
15 → 127.63, 16 → 145.942, 17 → 165.308, 18 → 185.85, 19 → 207.53, 20 → 230.183 |>
```

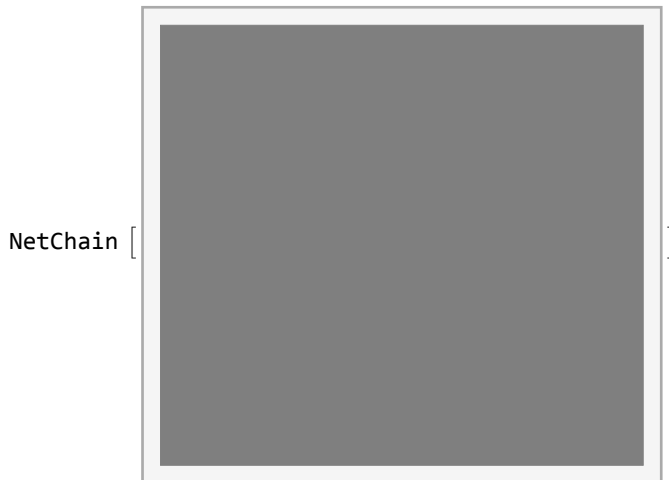
trainingset = Normal[%]

```
{-19 → 93.47, -18 → 78.1502, -17 → 63.6923, -16 → 50.0576, -15 → 37.3699,
-14 → 25.8019, -13 → 15.416, -12 → 6.10731, -11 → -2.3, -10 → -9.8912, -9 → -16.5824,
-8 → -22.1979, -7 → -26.6314, -6 → -29.9441, -5 → -32.3082, -4 → -33.8486,
-3 → -34.5282, -2 → -34.1819, -1 → -32.6683, 0 → -30., 1 → -26.3317, 2 → -21.8181,
3 → -16.4718, 4 → -10.1514, 5 → -2.69178, 6 → 5.94412, 7 → 15.6314, 8 → 26.1979,
9 → 37.5824, 10 → 49.8912, 11 → 63.3, 12 → 77.8927, 13 → 93.584, 14 → 110.198,
15 → 127.63, 16 → 145.942, 17 → 165.308, 18 → 185.85, 19 → 207.53, 20 → 230.183}
```

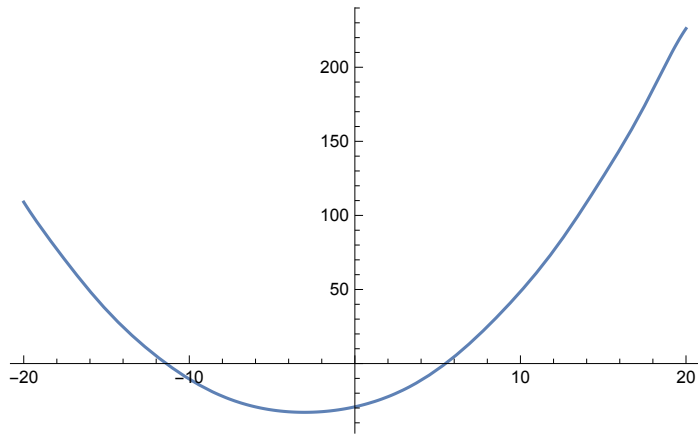
a1 = plot = ListPlot[List@@@trainingset, PlotStyle → Red]



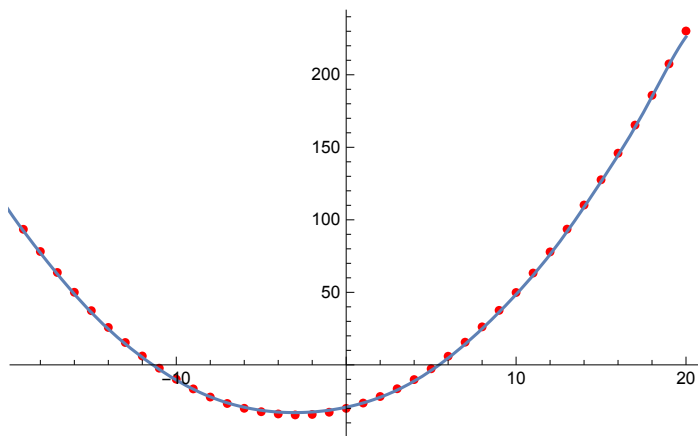
```
net = NetChain[{500, Cos, Sin, 500, Cos, 500, 1}, "Input" → "Scalar", "Output" → "Scalar"];
net1 = NetTrain[net, trainingset]
```



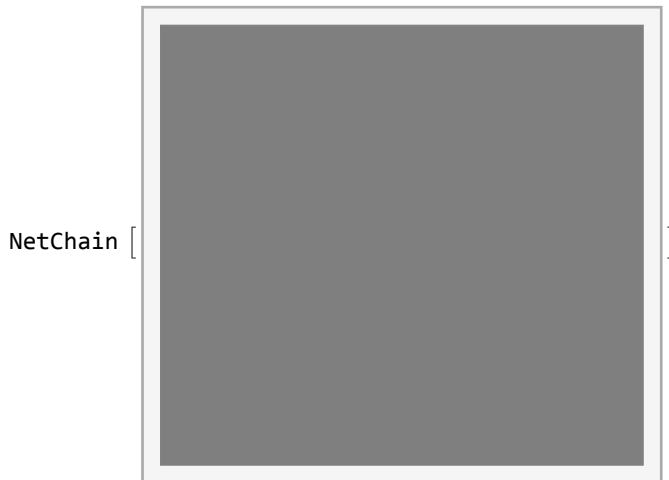
```
a2 = Show[Plot[net1[x], {x, a, b}]]
```



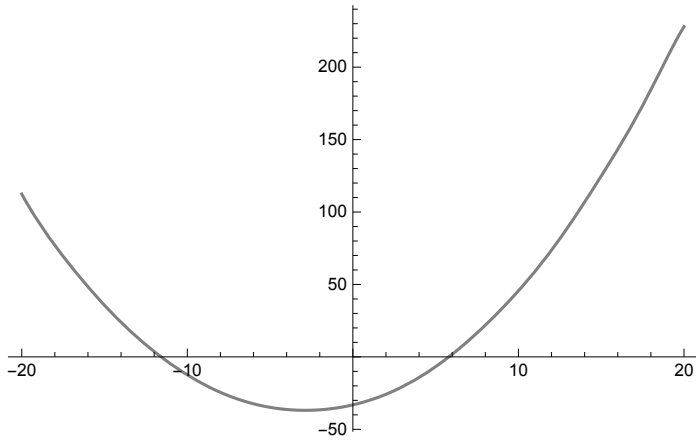
```
Show[a1, a2]
```



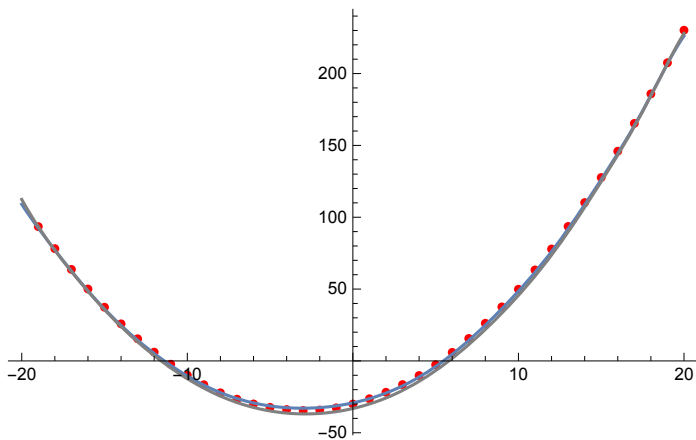
```
net2 = NetTrain[net, trainingset, Method -> {"ADAM", "L2Regularization" -> 0.005}]
```



```
a3 = Show[Plot[net2[x], {x, a, b}, PlotStyle -> Gray, PlotRange -> All]]
```



```
Show[a1, a2, a3, PlotRange -> All]
```



(* determinare solutii folosind rezultatele retelei neurale *)

```
epsilon = 0.001;
deplasament = 0.0001;
valoare = a;
While[valoare ≤ b, functieval = net1[valoare];
  If[Abs[functieval] < epsilon, Print["Solutie=", valoare]];
  valoare = valoare + deplasament;]
```

Solutie=-11.3926

Solutie=-11.3925

Solutie=5.478

Solutie=5.4781

```
epsilon = 0.001;
deplasament = 0.0001;
valoare = a;
While[valoare ≤ b, functieval = net2[valoare];
  If[Abs[functieval] < epsilon, Print["Solutie=", valoare]];
  valoare = valoare + deplasament;]
```

Solutie=-11.5863

Solutie=-11.5862

Solutie=5.804

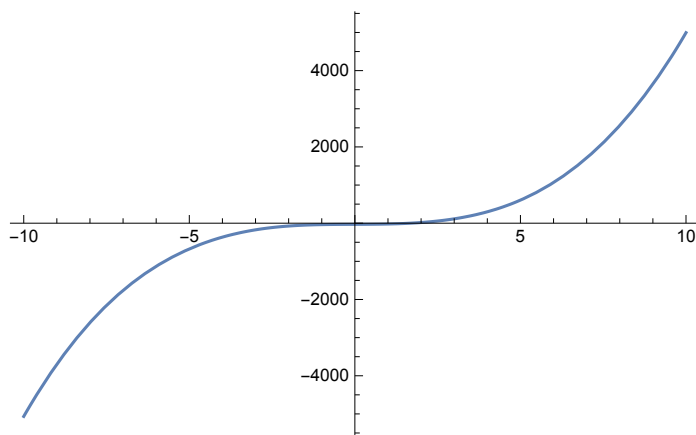
Solutie=5.8041

Rezolvare ecuatiei algebrice prin retele neurale [Solving algebraic equations using neural networks] $f : [a,b] \rightarrow \mathbb{R}$, $f(x)=0$.

```
a = -10;
b = 10;
tabelax = Table[a + i, {i, 1, 2 * b}]
nr = Length[tabelax]
(* puncte pe Ox in care valoarea functiei este determinata *)
{-9, -8, -7, -6, -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10}

20
```

```
functie[x_] := 5 x^3 + x Sin[x] + 3 x - 30
Plot[functie[x], {x, a, b}]
```



```
NSolve[functie[x] == 0, x, Reals]
```

```
{{x -> 1.6709}}
```

```
tabelay = Table[functie[tabelax[[i]]], {i, 1, 2 * b}]
nr = Length[tabelay]
```

```
{-3702 + 9 Sin[9], -2614 + 8 Sin[8], -1766 + 7 Sin[7], -1128 + 6 Sin[6],
-670 + 5 Sin[5], -362 + 4 Sin[4], -174 + 3 Sin[3], -76 + 2 Sin[2], -38 + Sin[1],
-30, -22 + Sin[1], 16 + 2 Sin[2], 114 + 3 Sin[3], 302 + 4 Sin[4], 610 + 5 Sin[5],
1068 + 6 Sin[6], 1706 + 7 Sin[7], 2554 + 8 Sin[8], 3642 + 9 Sin[9], 5000 + 10 Sin[10]}
```

20

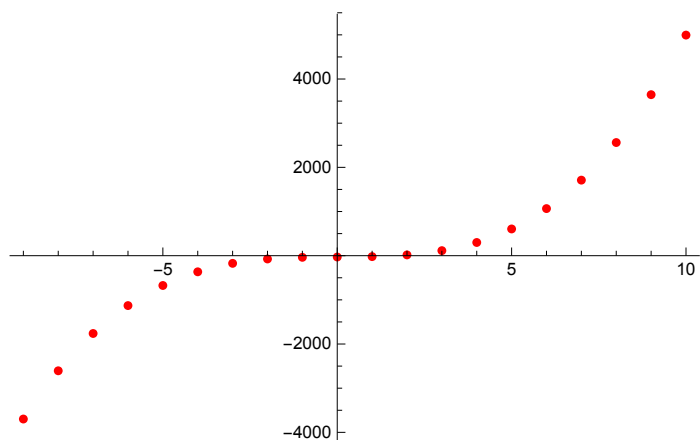
AssociationThread[tabelax → tabelay]

```
<|-9 → -3702 + 9 Sin[9], -8 → -2614 + 8 Sin[8], -7 → -1766 + 7 Sin[7],
-6 → -1128 + 6 Sin[6], -5 → -670 + 5 Sin[5], -4 → -362 + 4 Sin[4], -3 → -174 + 3 Sin[3],
-2 → -76 + 2 Sin[2], -1 → -38 + Sin[1], 0 → -30, 1 → -22 + Sin[1], 2 → 16 + 2 Sin[2],
3 → 114 + 3 Sin[3], 4 → 302 + 4 Sin[4], 5 → 610 + 5 Sin[5], 6 → 1068 + 6 Sin[6],
7 → 1706 + 7 Sin[7], 8 → 2554 + 8 Sin[8], 9 → 3642 + 9 Sin[9], 10 → 5000 + 10 Sin[10] |>
```

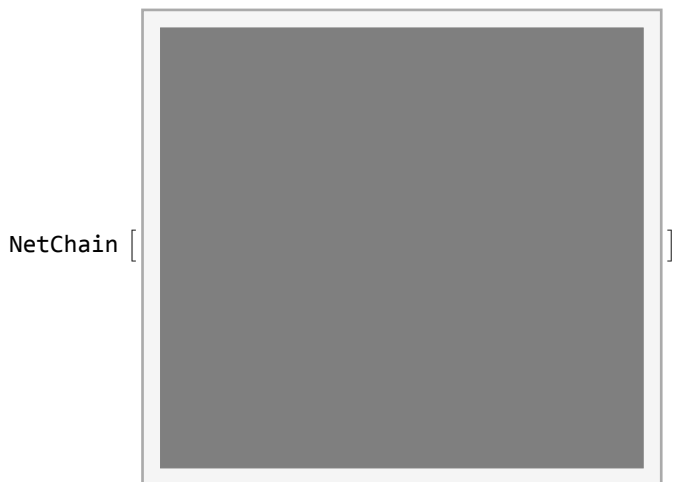
trainingset = Normal[%]

```
{-9 → -3702 + 9 Sin[9], -8 → -2614 + 8 Sin[8], -7 → -1766 + 7 Sin[7],
-6 → -1128 + 6 Sin[6], -5 → -670 + 5 Sin[5], -4 → -362 + 4 Sin[4], -3 → -174 + 3 Sin[3],
-2 → -76 + 2 Sin[2], -1 → -38 + Sin[1], 0 → -30, 1 → -22 + Sin[1], 2 → 16 + 2 Sin[2],
3 → 114 + 3 Sin[3], 4 → 302 + 4 Sin[4], 5 → 610 + 5 Sin[5], 6 → 1068 + 6 Sin[6],
7 → 1706 + 7 Sin[7], 8 → 2554 + 8 Sin[8], 9 → 3642 + 9 Sin[9], 10 → 5000 + 10 Sin[10]}
```

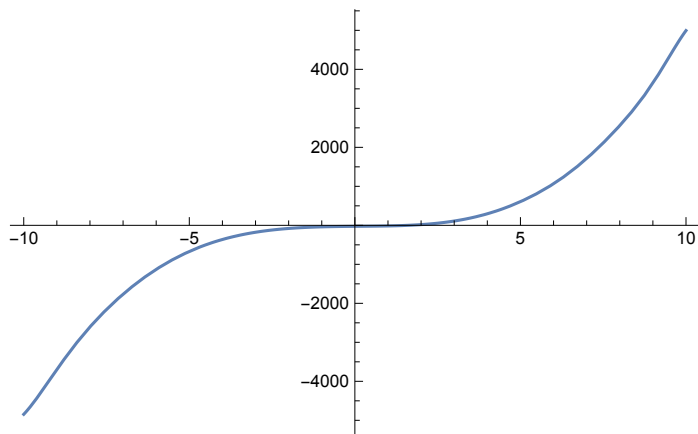
a1 = plot = ListPlot[List@@@trainingset, PlotStyle → Red]



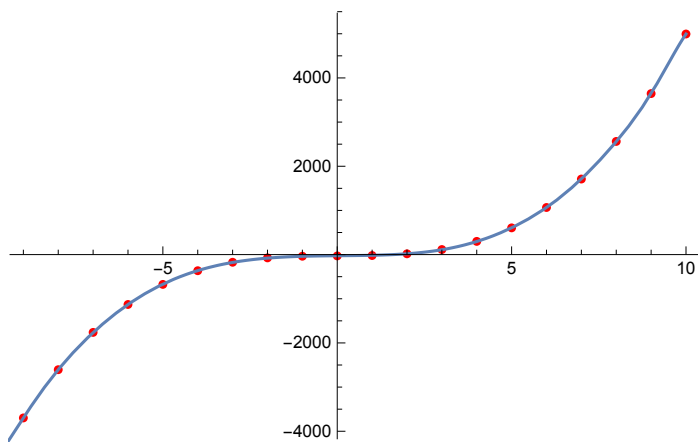
```
net = NetChain[{500, Cos, Sin, 500, Cos, 500, 1}, "Input" → "Scalar", "Output" → "Scalar"];
net1 = NetTrain[net, trainingset]
```



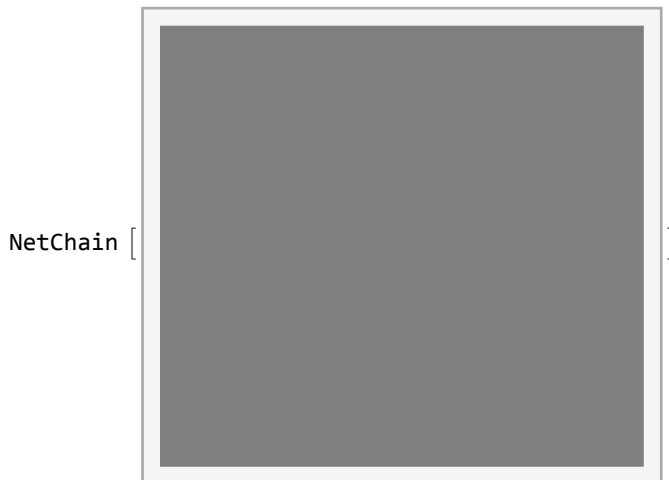

```
a2 = Show[Plot[net1[x], {x, a, b}]]
```



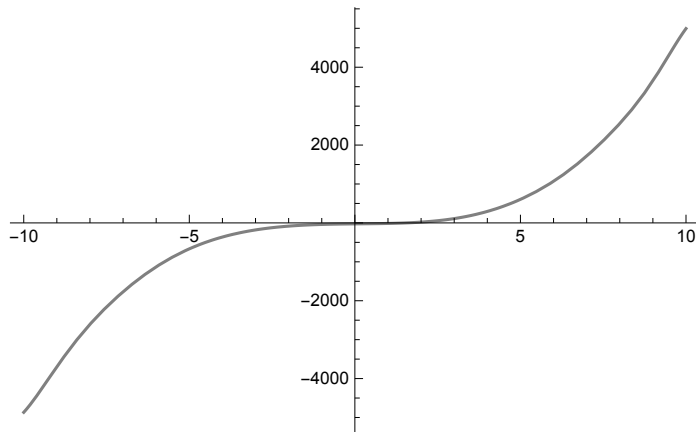
```
Show[a1, a2]
```



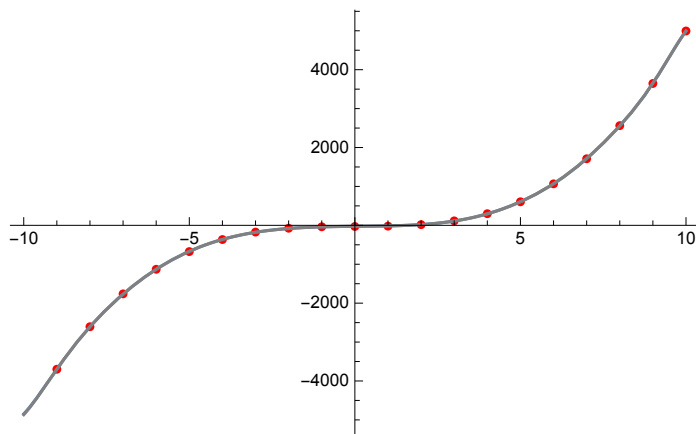
```
net2 = NetTrain[net, trainingset, Method -> {"ADAM", "L2Regularization" -> 0.005}]
```



```
a3 = Show[Plot[net2[x], {x, a, b}, PlotStyle -> Gray, PlotRange -> All]]
```



```
Show[a1, a2, a3, PlotRange -> All]
```



(* determinare solutii folosind rezultatele retelei neurale *)

```
epsilon = 0.001;
deplasament = 0.0001;
valoare = a;
While[valoare ≤ b, functieval = net1[valoare];
  If[Abs[functieval] < epsilon, Print["Solutie=", valoare]];
  valoare = valoare + deplasament;]
```

Solutie=1.5967

```
epsilon = 0.001;
deplasament = 0.00001;
an = -3;
bn = 3;
valoare = an;
While[valoare ≤ bn, functieval = net2[valoare];
  If[Abs[functieval] < epsilon, Print["Solutie=", valoare]];
  valoare = valoare + deplasament;]
```

Solutie=1.54822

Solutie=1.54823

Solutie=1.54824

Solutie=1.54825

Solutie=1.54826

Solutie=1.54827

[Earthquakes localization and prediction using (<https://web.infp.ro/#/romplus>) => Export as json]

```
SetDirectory[NotebookDirectory[]];
```

```
Directory[]
```

```
C:\Users\Mihai\Desktop\master\2018-2019 semestrul II\Metode  
  computationale moderne in fizica\Machine learning\Laborator 2\exercitiu11
```

```
FileNames[]
```

```
{quakes.json, Untitled-1.nb, Untitled-1.pdf}
```

```
tabel = Import["quakes.json"]
```

```
{count -> 256,  
 results -> {{id -> 5c3c5780715d9b592f327b70, depth -> 150., nmg -> Null, lon -> 26.6, az -> 0.,  
  smin -> 0., rms -> Null, dt -> 1022-05-12 00:00:00, dtErr -> 0., smaj -> 0., qual -> D, nst ->  
  Null, magnitudes -> {mdErr -> 0., ml -> 0., mw -> 6.5, mlErr -> 0., mwErr -> 0., md -> 0.},  
  depthType -> Null, depthErr -> 0., nph -> Null, gap -> Null, type -> romplus, lat -> 45.7},  
  ... 254 ... , {id -> 5c3c57ce715d9b592f32e841, depth -> 147.8, nmg -> 67,  
  lon -> 26.4068, az -> 12., smin -> 1., rms -> 0.5, ... 6 ... , depthType -> Null,  
  depthErr -> 1.6, nph -> 115, gap -> 22, type -> romplus, lat -> 45.6079}}}}
```

large output

show less

show more

show all

set size limit...

```
tabel[[1]][[1]]
```

```
count
```

```
tabel[[1]][[2]]
```

```
256
```

```
tabel[[2]][[2]]
```

```
{{id -> 5c3c5780715d9b592f327b70, depth -> 150., nmg -> Null, lon -> 26.6, az -> 0., smin -> 0.,  
  rms -> Null, dt -> 1022-05-12 00:00:00, dtErr -> 0., smaj -> 0., qual -> D, nst -> Null,  
  magnitudes -> {mdErr -> 0., ml -> 0., mw -> 6.5, mlErr -> 0., mwErr -> 0., md -> 0.},  
  depthType -> Null, depthErr -> 0., nph -> Null, gap -> Null, type -> romplus, lat -> 45.7},  
 {id -> 5c3c5780715d9b592f327b71, depth -> 150., ... 15 ... , type -> romplus, lat -> 45.7},  
 ... 252 ... , { ... 1 ... }, {id -> 5c3c57ce715d9b592f32e841, depth -> 147.8, nmg -> 67,  
  lon -> 26.4068, az -> 12., smin -> 1., rms -> 0.5, ... 6 ... , depthType -> Null,  
  depthErr -> 1.6, nph -> 115, gap -> 22, type -> romplus, lat -> 45.6079}}
```

large output

show less

show more

show all

set size limit...

```
tabel[[2]][[2]][[2]]
```

```
{id → 5c3c5780715d9b592f327b71, depth → 150., nmg → Null, lon → 26.6, az → 0., smin → 0.,
rms → Null, dt → 1038-08-15 00:00:00, dtErr → 0., smaj → 0., qual → D, nst → Null,
magnitudes → {mdErr → 0., ml → 0., mw → 7.3, mlErr → 0., mwErr → 0., md → 0.},
depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

```
nr = Length[tabel[[2]][[2]]]
```

```
256
```

```
For[i = 1, i ≤ nr, i++, Print[i]; Print[tabel[[2]][[2]][[i]]]
```

```
1
```

```
{id → 5c3c5780715d9b592f327b70, depth → 150., nmg → Null, lon → 26.6, az → 0.,
smin → 0., rms → Null, dt → 1022-05-12 00:00:00, dtErr → 0., smaj → 0., qual → D,
nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.5, mlErr → 0., mwErr → 0., md → 0.},
depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

```
2
```

```
{id → 5c3c5780715d9b592f327b71, depth → 150., nmg → Null, lon → 26.6, az → 0.,
smin → 0., rms → Null, dt → 1038-08-15 00:00:00, dtErr → 0., smaj → 0., qual → D,
nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.3, mlErr → 0., mwErr → 0., md → 0.},
depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

```
3
```

```
{id → 5c3c5780715d9b592f327b72, depth → 150., nmg → Null, lon → 26.6, az → 0.,
smin → 0., rms → Null, dt → 1091-01-01 00:00:00, dtErr → 0., smaj → 0., qual → D,
nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.1, mlErr → 0., mwErr → 0., md → 0.},
depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

```
4
```

```
{id → 5c3c5780715d9b592f327b73, depth → 150., nmg → Null, lon → 26.6, az → 0.,
smin → 0., rms → Null, dt → 1107-02-12 03:00:00, dtErr → 0., smaj → 0., qual → D,
nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.1, mlErr → 0., mwErr → 0., md → 0.},
depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

```
5
```

```
{id → 5c3c5780715d9b592f327b74, depth → 150., nmg → Null, lon → 26.6, az → 0.,
smin → 0., rms → Null, dt → 1122-10-01 00:00:00, dtErr → 0., smaj → 0., qual → D,
nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.2, mlErr → 0., mwErr → 0., md → 0.},
depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

```
6
```

```
{id → 5c3c5780715d9b592f327b75, depth → 150., nmg → Null, lon → 26.6, az → 0.,
smin → 0., rms → Null, dt → 1126-08-08 00:00:00, dtErr → 0., smaj → 0., qual → D,
nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.1, mlErr → 0., mwErr → 0., md → 0.},
depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

```
7
```

```
{id → 5c3c5780715d9b592f327b76, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1170-04-01 00:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.3, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

8

```
{id → 5c3c5780715d9b592f327b77, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1196-02-13 07:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

9

```
{id → 5c3c5780715d9b592f327b79, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1230-05-10 07:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.3, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

10

```
{id → 5c3c5780715d9b592f327b7a, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1258-02-07 13:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

11

```
{id → 5c3c5780715d9b592f327b7b, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1327-01-01 00:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.3, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

12

```
{id → 5c3c5780715d9b592f327b7d, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1446-10-10 04:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

13

```
{id → 5c3c5780715d9b592f327b7e, depth → 110., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1471-08-29 10:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

14

```
{id → 5c3c5780715d9b592f327b7f, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1473-08-29 00:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.3, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

15

```
{id → 5c3c5780715d9b592f327b80, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1516-11-24 12:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

16

```
{id → 5c3c5780715d9b592f327b82, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1523-06-09 00:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

17

```
{id → 5c3c5780715d9b592f327b84, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1543-01-01 00:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

18

```
{id → 5c3c5780715d9b592f327b85, depth → 110., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1545-07-19 08:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

19

```
{id → 5c3c5780715d9b592f327b87, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1552-08-21 02:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

20

```
{id → 5c3c5780715d9b592f327b8a, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1571-05-10 00:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

21

```
{id → 5c3c5780715d9b592f327b8b, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1578-04-01 00:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

22

```
{id → 5c3c5780715d9b592f327b8c, depth → 100., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1590-04-30 00:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.3, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

23

```
{id → 5c3c5780715d9b592f327b8e, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1595-04-21 10:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

24

```
{id → 5c3c5780715d9b592f327b8f, depth → 120., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1598-11-22 02:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

25

```
{id → 5c3c5780715d9b592f327b90, depth → 100., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1598-12-28 00:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.7, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

26

```
{id → 5c3c5780715d9b592f327b91, depth → 100., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1599-03-04 00:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

27

```
{id → 5c3c5780715d9b592f327b92, depth → 100., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1599-05-29 02:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.9, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

28

```
{id → 5c3c5780715d9b592f327b94, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1604-05-03 02:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.8, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

29

```
{id → 5c3c5780715d9b592f327b95, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1605-12-24 15:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

30

```
{id → 5c3c5780715d9b592f327b96, depth → 120., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1606-01-13 01:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.8, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

31


```
{id → 5c3c5780715d9b592f327b97, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1620-11-08 13:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

32

```
{id → 5c3c5780715d9b592f327b99, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1637-02-01 01:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

33

```
{id → 5c3c5780715d9b592f327b9b, depth → 100., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1650-04-19 00:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

34

```
{id → 5c3c5780715d9b592f327b9d, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1666-02-01 00:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

35

```
{id → 5c3c5780715d9b592f327b9e, depth → 110., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1679-08-09 01:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

36

```
{id → 5c3c5780715d9b592f327b9f, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1681-08-19 00:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

37

```
{id → 5c3c5780715d9b592f327ba0, depth → 140., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1681-10-16 00:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.4, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

38

```
{id → 5c3c5780715d9b592f327ba1, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1681-10-18 00:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.4, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

39

```
{id → 5c3c5780715d9b592f327ba2, depth → 110., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1681-12-27 04:30:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.9, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

40

```
{id → 5c3c5780715d9b592f327ba3, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1701-06-12 00:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

41

```
{id → 5c3c5780715d9b592f327ba4, depth → 120., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1711-10-11 00:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

42

```
{id → 5c3c5780715d9b592f327ba5, depth → 100., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1730-04-06 04:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

43

```
{id → 5c3c5780715d9b592f327ba7, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1738-06-11 10:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.7, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

44

```
{id → 5c3c5780715d9b592f327ba8, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1740-04-05 18:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.3, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

45

```
{id → 5c3c5780715d9b592f327baa, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1778-01-18 00:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.5}
```

46

```
{id → 5c3c5780715d9b592f327bb0, depth → 120., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1787-01-18 00:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

47

```
{id → 5c3c5780715d9b592f327bb1, depth → 100., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1787-03-16 00:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.9, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

48

```
{id → 5c3c5780715d9b592f327bb2, depth → 100., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1789-03-26 00:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.9, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

49

```
{id → 5c3c5780715d9b592f327bb3, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1790-04-06 19:29:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

50

```
{id → 5c3c5780715d9b592f327bb4, depth → 100., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1793-11-26 18:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.9, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

51

```
{id → 5c3c5780715d9b592f327bb7, depth → 100., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1798-03-14 07:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.9, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

52

```
{id → 5c3c5780715d9b592f327bb9, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1802-10-26 10:55:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.9, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

53

```
{id → 5c3c5780715d9b592f327bbe, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1812-03-05 12:30:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

54

```
{id → 5c3c5780715d9b592f327bbf, depth → 120., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1813-02-01 00:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.9, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

55

```
{id → 5c3c5780715d9b592f327bc0, depth → 120., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1817-09-30 07:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.9, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

56

```
{id → 5c3c5780715d9b592f327bc1, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1821-02-10 00:30:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.6, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

57

```
{id → 5c3c5780715d9b592f327bc2, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1821-09-29 00:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

58

```
{id → 5c3c5780715d9b592f327bc3, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1821-11-17 13:45:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

59

```
{id → 5c3c5780715d9b592f327bc6, depth → 120., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1823-02-09 16:50:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.9, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

60

```
{id → 5c3c5780715d9b592f327bc8, depth → 140., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1827-10-14 18:45:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.9, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

61

```
{id → 5c3c5780715d9b592f327bc9, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1829-11-26 01:40:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.3, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.8}
```

62

```
{id → 5c3c5780715d9b592f327bcf, depth → 100., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1831-08-03 00:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

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```
{id → 5c3c5780715d9b592f327bd2, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1835-04-21 20:30:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

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```
{id → 5c3c5780715d9b592f327bd3, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1838-01-23 18:45:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

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```
{id → 5c3c5780715d9b592f327bd6, depth → 100., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1843-09-10 00:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.9, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

66

```
{id → 5c3c5780715d9b592f327bd7, depth → 110., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1844-03-06 19:10:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

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```
{id → 5c3c5780715d9b592f327bda, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1848-01-01 00:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

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```
{id → 5c3c5780715d9b592f327bdb, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1854-10-28 12:15:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

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```
{id → 5c3c5780715d9b592f327bdf, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1862-10-16 01:10:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

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```
{id → 5c3c5780715d9b592f327be1, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1868-11-13 07:45:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.8, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

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```
{id → 5c3c5780715d9b592f327be2, depth → 135., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1868-11-27 20:30:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

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```
{id → 5c3c5781715d9b592f327bfe, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1880-12-25 14:30:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.8, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

73

```
{id → 5c3c5781715d9b592f327c0c, depth → 100., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1888-08-19 04:56:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

74

```
{id → 5c3c5781715d9b592f327c11, depth → 120., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1893-05-01 17:18:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.2, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

75

```
{id → 5c3c5781715d9b592f327c13, depth → 100., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1893-08-17 14:45:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

76

```
{id → 5c3c5781715d9b592f327c14, depth → 99.9, nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1893-09-10 03:40:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → f, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

77

```
{id → 5c3c5781715d9b592f327c19, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1894-03-04 06:35:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

78

```
{id → 5c3c5781715d9b592f327c1c, depth → 100., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1894-03-17 20:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.4, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

79

```
{id → 5c3c5781715d9b592f327c1d, depth → 110., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1894-03-18 00:50:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

80

```
{id → 5c3c5781715d9b592f327c23, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1894-08-31 12:20:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

81

```
{id → 5c3c5781715d9b592f327c2a, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1895-02-05 15:04:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.4, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

82

```
{id → 5c3c5781715d9b592f327c2d, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1895-11-19 07:44:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

83

```
{id → 5c3c5781715d9b592f327c31, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1896-03-11 23:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.6, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

84

```
{id → 5c3c5781715d9b592f327c35, depth → 100., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1896-11-24 18:50:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

85

```
{id → 5c3c5781715d9b592f327c37, depth → 100., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1897-01-17 08:50:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

86

```
{id → 5c3c5781715d9b592f327c3b, depth → 100., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1897-07-20 07:20:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

87

```
{id → 5c3c5781715d9b592f327c3c, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1897-09-24 14:26:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.4, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

88

```
{id → 5c3c5781715d9b592f327c4c, depth → 100., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1899-12-20 19:28:36, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.4, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

89

```
{id → 5c3c5781715d9b592f327c59, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1901-09-23 18:11:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.7, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

90

```
{id → 5c3c5781715d9b592f327c5e, depth → 100., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1902-03-11 20:14:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.9, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

91

```
{id → 5c3c5781715d9b592f327c68, depth → 120., nmg → Null, lon → 26.8, az → 0.,
  smin → 0., rms → Null, dt → 1903-06-08 15:08:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.9, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.5}
```

92

```
{id → 5c3c5781715d9b592f327c92, depth → 125., nmg → Null, lon → 26.5, az → 0.,
  smin → 0., rms → Null, dt → 1908-10-06 21:40:00, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.5}
```

93

```
{id → 5c3c5781715d9b592f327caf, depth → 90., nmg → Null, lon → 27.2, az → 0.,
  smin → 0., rms → Null, dt → 1912-05-25 18:01:54, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.7, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

94

```
{id → 5c3c5781715d9b592f327cb0, depth → 100., nmg → Null, lon → 27.2, az → 0.,
  smin → 0., rms → Null, dt → 1912-05-25 20:15:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

95


```
{id → 5c3c5781715d9b592f327cb1, depth → 130., nmg → Null, lon → 27.2, az → 0.,
  smin → 0., rms → Null, dt → 1912-05-25 21:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.8, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

96

```
{id → 5c3c5781715d9b592f327cb6, depth → 100., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1912-06-07 01:58:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.9, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

97

```
{id → 5c3c5781715d9b592f327cc0, depth → 120., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1913-03-14 03:40:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.9, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

98

```
{id → 5c3c5781715d9b592f327cc5, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1913-07-23 22:03:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.7, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

99

```
{id → 5c3c5781715d9b592f327cc7, depth → 100., nmg → Null, lon → 26.8, az → 0.,
  smin → 0., rms → Null, dt → 1914-07-14 03:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.7, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

100

```
{id → 5c3c5781715d9b592f327cc8, depth → 80., nmg → Null, lon → 26.3, az → 0.,
  smin → 0., rms → Null, dt → 1914-07-31 18:23:12, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.7, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.9}
```

101

```
{id → 5c3c5781715d9b592f327cc9, depth → 100., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1914-08-26 15:09:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.4, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

102

```
{id → 5c3c5781715d9b592f327cca, depth → 120., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1914-10-26 02:59:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.4, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

103

```
{id → 5c3c5781715d9b592f327cd9, depth → 130., nmg → Null, lon → 26.5, az → 0.,
  smin → 0., rms → Null, dt → 1917-03-15 20:42:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.9, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 46.}
```

104

```
{id → 5c3c5781715d9b592f327cda, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1917-05-19 21:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.9, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

105

```
{id → 5c3c5781715d9b592f327cdb, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1917-07-11 03:23:55, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.9, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

106

```
{id → 5c3c5781715d9b592f327cdc, depth → 120., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1918-02-25 02:07:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.9, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

107

```
{id → 5c3c5781715d9b592f327cdd, depth → 100., nmg → Null, lon → 26.8, az → 0.,
  smin → 0., rms → Null, dt → 1919-04-18 06:20:05, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

108

```
{id → 5c3c5781715d9b592f327cdf, depth → 120., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1919-08-09 14:38:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

109

```
{id → 5c3c5781715d9b592f327ce0, depth → 100., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1921-10-22 05:13:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.3, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

110

```
{id → 5c3c5781715d9b592f327ce9, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1925-12-25 02:37:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

111

```
{id → 5c3c5781715d9b592f327cee, depth → 120., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1927-07-24 20:17:05, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.9, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

112

```
{id → 5c3c5781715d9b592f327cf1, depth → 120., nmg → Null, lon → 26.5, az → 0.,
  smin → 0., rms → Null, dt → 1928-03-30 09:38:57, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.9}
```

113

```
{id → 5c3c5781715d9b592f327cf2, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1928-11-23 04:23:12, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.7, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

114

```
{id → 5c3c5781715d9b592f327cf3, depth → 100., nmg → Null, lon → 26.5, az → 0.,
  smin → 0., rms → Null, dt → 1929-05-20 12:17:56, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.8}
```

115

```
{id → 5c3c5781715d9b592f327cf7, depth → 120., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1932-03-13 02:53:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.7, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

116

```
{id → 5c3c5781715d9b592f327cf8, depth → 120., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1932-05-27 10:42:15, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

117

```
{id → 5c3c5781715d9b592f327cf9, depth → 120., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1932-09-07 18:36:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.8, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

118

```
{id → 5c3c5781715d9b592f327cfb, depth → 140., nmg → Null, lon → 26.2, az → 0.,
  smin → 0., rms → Null, dt → 1934-02-02 19:59:13, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.2}
```

119

```
{id → 5c3c5781715d9b592f327cfc, depth → 90., nmg → Null, lon → 26.5, az → 0.,
  smin → 0., rms → Null, dt → 1934-03-29 20:06:51, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.6, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.8}
```

120

```
{id → 5c3c5781715d9b592f327cfd, depth → 99.9, nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1934-12-29 00:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → f, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

121

```
{id → 5c3c5781715d9b592f327cfe, depth → 99.9, nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1935-02-03 22:48:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → f, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

122

```
{id → 5c3c5781715d9b592f327cff, depth → 140., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1935-07-13 00:03:46, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.3}
```

123

```
{id → 5c3c5781715d9b592f327d00, depth → 99.9, nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1935-07-13 00:06:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.2, mlErr → 0., mwErr → 0., md → 0.},
  depthType → f, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

124

```
{id → 5c3c5781715d9b592f327d02, depth → 130., nmg → Null, lon → 26.7, az → 0.,
  smin → 0., rms → Null, dt → 1935-09-05 06:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.8}
```

125

```
{id → 5c3c5781715d9b592f327d04, depth → 99.9, nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1936-05-14 12:50:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → f, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

126

```
{id → 5c3c5781715d9b592f327d05, depth → 140., nmg → Null, lon → 26.3, az → 0.,
  smin → 0., rms → Null, dt → 1936-05-17 17:38:02, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.3}
```

127

```
{id → 5c3c5781715d9b592f327d08, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1936-10-31 15:52:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

128

```
{id → 5c3c5781715d9b592f327d0a, depth → 99.9, nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1937-01-26 14:34:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.4, mlErr → 0., mwErr → 0., md → 0.},
  depthType → f, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

129

```
{id → 5c3c5781715d9b592f327d11, depth → 120., nmg → Null, lon → 26.7, az → 0.,
  smin → 0., rms → Null, dt → 1938-07-13 20:15:17, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.9}
```

130

```
{id → 5c3c5781715d9b592f327d1d, depth → 120., nmg → Null, lon → 26.7, az → 0.,
  smin → 0., rms → Null, dt → 1939-09-05 06:02:00, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.2, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.9}
```

131

```
{id → 5c3c5781715d9b592f327d1f, depth → 150., nmg → Null, lon → 26.7, az → 0.,
  smin → 0., rms → Null, dt → 1940-02-10 18:14:10, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.2, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

132

```
{id → 5c3c5781715d9b592f327d20, depth → 130., nmg → Null, lon → 26.7, az → 0.,
  smin → 0., rms → Null, dt → 1940-02-14 19:30:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

133

```
{id → 5c3c5781715d9b592f327d23, depth → 115., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1940-06-24 09:57:27, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.9, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.9}
```

134

```
{id → 5c3c5781715d9b592f327d27, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1940-10-03 15:04:50, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.6}
```

135

```
{id → 5c3c5781715d9b592f327d28, depth → 100., nmg → Null, lon → 26.8, az → 0.,
  smin → 0., rms → Null, dt → 1940-10-21 22:14:02, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

136

```
{id → 5c3c5781715d9b592f327d29, depth → 125., nmg → Null, lon → 26.4, az → 0.,
  smin → 0., rms → Null, dt → 1940-10-22 06:37:00, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.8}
```

137

```
{id → 5c3c5781715d9b592f327d2a, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1940-10-22 22:14:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

138

```
{id → 5c3c5781715d9b592f327d2b, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1940-11-06 19:58:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

139

```
{id → 5c3c5781715d9b592f327d2d, depth → 145., nmg → Null, lon → 26.2, az → 0.,
  smin → 0., rms → Null, dt → 1940-11-08 12:00:44, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.9, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.5}
```

140

```
{id → 5c3c5781715d9b592f327d2e, depth → 150., nmg → Null, lon → 26.7, az → 0.,
  smin → 0., rms → Null, dt → 1940-11-10 01:39:07, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.7, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.8}
```

141

```
{id → 5c3c5781715d9b592f327d32, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1940-11-10 13:28:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

142

```
{id → 5c3c5781715d9b592f327d34, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1940-11-10 16:41:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

143

```
{id → 5c3c5781715d9b592f327d37, depth → 130., nmg → Null, lon → 26.8, az → 0.,
  smin → 0., rms → Null, dt → 1940-11-11 06:34:16, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.9, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 46.}
```

144

```
{id → 5c3c5781715d9b592f327d3b, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1940-11-13 16:51:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.2, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

145

```
{id → 5c3c5781715d9b592f327d3d, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1940-11-14 14:37:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.3, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

146

```
{id → 5c3c5781715d9b592f327d40, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1940-11-16 22:31:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

147

```
{id → 5c3c5781715d9b592f327d41, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1940-11-17 06:01:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

148

```
{id → 5c3c5781715d9b592f327d42, depth → 110., nmg → Null, lon → 26.5, az → 0.,
  smin → 0., rms → Null, dt → 1940-11-19 20:27:12, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.7, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 46.}
```

149

```
{id → 5c3c5781715d9b592f327d48, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1940-11-22 02:30:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

150

```
{id → 5c3c5781715d9b592f327d4a, depth → 150., nmg → Null, lon → 26.8, az → 0.,
  smin → 0., rms → Null, dt → 1940-11-23 14:49:53, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.7, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.8}
```

151

```
{id → 5c3c5782715d9b592f327d4e, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1940-11-27 08:13:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

152

```
{id → 5c3c5782715d9b592f327d4f, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1940-12-01 17:19:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

153

```
{id → 5c3c5782715d9b592f327d51, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1940-12-10 01:35:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.3, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

154

```
{id → 5c3c5782715d9b592f327d57, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1941-01-29 07:04:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

155

```
{id → 5c3c5782715d9b592f327d5d, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1941-03-16 06:50:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

156

```
{id → 5c3c5782715d9b592f327d5e, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1941-04-04 19:27:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

157

```
{id → 5c3c5782715d9b592f327d62, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1941-06-27 02:55:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

158

```
{id → 5c3c5782715d9b592f327d68, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1941-09-05 08:23:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

159


```
{id → 5c3c5782715d9b592f327d6c, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1941-12-10 07:23:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.3, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

160

```
{id → 5c3c5782715d9b592f327d6e, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1942-03-17 00:24:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

161

```
{id → 5c3c5782715d9b592f327d70, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1942-04-27 10:59:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.2, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

162

```
{id → 5c3c5782715d9b592f327d71, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1942-05-05 04:58:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

163

```
{id → 5c3c5782715d9b592f327d73, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1942-07-29 19:19:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.4, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

164

```
{id → 5c3c5782715d9b592f327d7a, depth → 140., nmg → Null, lon → 26.5, az → 0.,
  smin → 0., rms → Null, dt → 1942-09-20 05:37:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.3, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

165

```
{id → 5c3c5782715d9b592f327d7c, depth → 125., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1942-10-03 12:43:03, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

166

```
{id → 5c3c5782715d9b592f327d88, depth → 100., nmg → Null, lon → 27.1, az → 0.,
  smin → 0., rms → Null, dt → 1943-04-28 19:46:50, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.9, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.8}
```

167

```
{id → 5c3c5782715d9b592f327d89, depth → 120., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1943-05-18 18:34:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

168

```
{id → 5c3c5782715d9b592f327d94, depth → 130., nmg → Null, lon → 26.8, az → 0.,
  smin → 0., rms → Null, dt → 1943-07-10 02:50:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.3, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.8}
```

169

```
{id → 5c3c5782715d9b592f327da6, depth → 150., nmg → Null, lon → 26.5, az → 0.,
  smin → 0., rms → Null, dt → 1943-12-22 15:35:20, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.8}
```

170

```
{id → 5c3c5782715d9b592f327daa, depth → 100., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1944-02-25 16:59:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.6, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

171

```
{id → 5c3c5782715d9b592f327dac, depth → 130., nmg → Null, lon → 26.5, az → 0.,
  smin → 0., rms → Null, dt → 1944-03-12 21:19:13, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.8}
```

172

```
{id → 5c3c5782715d9b592f327db9, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1944-09-08 06:18:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

173

```
{id → 5c3c5782715d9b592f327dc1, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1945-02-20 03:42:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

174

```
{id → 5c3c5782715d9b592f327dc3, depth → 125., nmg → Null, lon → 26.4, az → 0.,
  smin → 0., rms → Null, dt → 1945-03-12 20:51:46, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.6}
```

175

```
{id → 5c3c5782715d9b592f327dcf, depth → 80., nmg → Null, lon → 26.5, az → 0.,
  smin → 0., rms → Null, dt → 1945-09-07 15:48:26, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.8, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.9}
```

176

```
{id → 5c3c5782715d9b592f327dd0, depth → 100., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1945-09-14 17:22:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

177

```
{id → 5c3c5782715d9b592f327dd5, depth → 80., nmg → Null, lon → 26.8, az → 0.,
  smin → 0., rms → Null, dt → 1945-12-09 06:08:45, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

178

```
{id → 5c3c5782715d9b592f327dd6, depth → 130., nmg → Null, lon → 26.8, az → 0.,
  smin → 0., rms → Null, dt → 1945-12-17 22:36:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

179

```
{id → 5c3c5782715d9b592f327ddd, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1946-10-03 07:17:09, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.3, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

180

```
{id → 5c3c5782715d9b592f327dde, depth → 140., nmg → Null, lon → 26.3, az → 0.,
  smin → 0., rms → Null, dt → 1946-11-03 18:47:01, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.6}
```

181

```
{id → 5c3c5782715d9b592f327ddf, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1946-11-15 01:11:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

182

```
{id → 5c3c5782715d9b592f327de3, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1947-03-13 14:03:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.4, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

183

```
{id → 5c3c5782715d9b592f327de6, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1947-08-30 03:54:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

184

```
{id → 5c3c5782715d9b592f327de7, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1947-10-17 13:25:20, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.8, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

185

```
{id → 5c3c5782715d9b592f327de8, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1947-11-22 23:07:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.2, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

186

```
{id → 5c3c5782715d9b592f327deb, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1948-01-28 02:05:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.3, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

187

```
{id → 5c3c5782715d9b592f327dec, depth → 150., nmg → Null, lon → 26.7, az → 0.,
  smin → 0., rms → Null, dt → 1948-03-13 21:06:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.7, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.9}
```

188

```
{id → 5c3c5782715d9b592f327def, depth → 150., nmg → Null, lon → 26.7, az → 0.,
  smin → 0., rms → Null, dt → 1948-04-24 12:29:31, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.2, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.9}
```

189

```
{id → 5c3c5782715d9b592f327df0, depth → 130., nmg → Null, lon → 26.7, az → 0.,
  smin → 0., rms → Null, dt → 1948-04-29 00:33:40, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.4, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.9}
```

190

```
{id → 5c3c5782715d9b592f327df2, depth → 130., nmg → Null, lon → 26.5, az → 0.,
  smin → 0., rms → Null, dt → 1948-05-29 04:48:55, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6.3, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.8}
```

191

```
{id → 5c3c5782715d9b592f327df4, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1948-07-29 08:57:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.3, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

192

```
{id → 5c3c5782715d9b592f327df5, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1948-08-09 07:45:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

193

```
{id → 5c3c5782715d9b592f327df7, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1948-12-22 04:18:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.2, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

194

```
{id → 5c3c5782715d9b592f327dfc, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1949-11-25 03:17:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.2, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

195

```
{id → 5c3c5782715d9b592f327dfe, depth → 135., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1949-12-26 03:36:10, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.7, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

196

```
{id → 5c3c5782715d9b592f327dff, depth → 120., nmg → Null, lon → 26.3, az → 0.,
  smin → 0., rms → Null, dt → 1950-01-16 04:25:10, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.7, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.6}
```

197

```
{id → 5c3c5782715d9b592f327e01, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1950-02-17 18:04:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

198

```
{id → 5c3c5782715d9b592f327e02, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1950-03-20 17:29:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

199

```
{id → 5c3c5782715d9b592f327e05, depth → 99.9, nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1950-04-30 00:00:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → f, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

200

```
{id → 5c3c5782715d9b592f327e08, depth → 100., nmg → Null, lon → 27.1, az → 0.,
  smin → 0., rms → Null, dt → 1950-07-14 06:29:57, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

201

```
{id → 5c3c5782715d9b592f327e09, depth → 130., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1950-07-25 07:25:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

202

```
{id → 5c3c5782715d9b592f327e0c, depth → 150., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1951-03-18 11:32:30, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.3, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.8}
```

203

```
{id → 5c3c5782715d9b592f327e1e, depth → 135., nmg → Null, lon → 26.7, az → 0.,
  smin → 0., rms → Null, dt → 1952-07-16 03:57:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.6}
```

204

```
{id → 5c3c5782715d9b592f327e21, depth → 150., nmg → Null, lon → 26.5, az → 0.,
  smin → 0., rms → Null, dt → 1952-08-03 16:36:14, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.6}
```

205

```
{id → 5c3c5782715d9b592f327e27, depth → 135., nmg → Null, lon → 26.7, az → 0.,
  smin → 0., rms → Null, dt → 1953-02-22 17:58:30, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.2, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.6}
```

206

```
{id → 5c3c5782715d9b592f327e2a, depth → 135., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1953-05-09 02:59:17, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.6}
```

207

```
{id → 5c3c5782715d9b592f327e2b, depth → 140., nmg → Null, lon → 27.3, az → 0.,
  smin → 0., rms → Null, dt → 1953-05-17 02:33:54, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.4, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.3}
```

208

```
{id → 5c3c5782715d9b592f327e35, depth → 120., nmg → Null, lon → 26.8, az → 0.,
  smin → 0., rms → Null, dt → 1954-04-13 10:06:35, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.3, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

209

```
{id → 5c3c5782715d9b592f327e36, depth → 150., nmg → Null, lon → 26.3, az → 0.,
  smin → 0., rms → Null, dt → 1954-05-09 09:25:00, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.6}
```

210

```
{id → 5c3c5782715d9b592f327e3e, depth → 120., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1954-10-21 12:03:36, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.6}
```

211

```
{id → 5c3c5782715d9b592f327e48, depth → 135., nmg → Null, lon → 26.3, az → 0.,
  smin → 0., rms → Null, dt → 1955-05-01 21:22:52, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.8, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.5}
```

212

```
{id → 5c3c5782715d9b592f327e54, depth → 150., nmg → Null, lon → 26.4, az → 0.,
  smin → 0., rms → Null, dt → 1955-11-14 17:52:30, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

213

```
{id → 5c3c5782715d9b592f327e58, depth → 150., nmg → Null, lon → 26.4, az → 0.,
  smin → 0., rms → Null, dt → 1955-12-27 08:11:38, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

214

```
{id → 5c3c5782715d9b592f327e61, depth → 100., nmg → Null, lon → 26.9, az → 0.,
  smin → 0., rms → Null, dt → 1956-05-07 03:54:12, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

215

```
{id → 5c3c5782715d9b592f327e81, depth → 150., nmg → Null, lon → 26.8, az → 0.,
  smin → 0., rms → Null, dt → 1958-06-25 07:22:12, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.7}
```

216

```
{id → 5c3c5782715d9b592f327e93, depth → 135., nmg → Null, lon → 26.5, az → 0.,
  smin → 0., rms → Null, dt → 1959-06-26 13:44:40, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.3, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.8}
```

217

```
{id → 5c3c5782715d9b592f327e95, depth → 150., nmg → Null, lon → 26.3, az → 0.,
  smin → 0., rms → Null, dt → 1959-06-30 07:24:34, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.2, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.5}
```

218

```
{id → 5c3c5782715d9b592f327e99, depth → 150., nmg → Null, lon → 26.8, az → 0.,
  smin → 0., rms → Null, dt → 1959-08-19 15:32:03, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.5, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.9}
```

219

```
{id → 5c3c5782715d9b592f327ea3, depth → 150., nmg → Null, lon → 26.4, az → 0.,
  smin → 0., rms → Null, dt → 1959-11-10 18:02:32, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.3, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.5}
```

220

```
{id → 5c3c5782715d9b592f327ea7, depth → 150., nmg → Null, lon → 26.5, az → 0.,
  smin → 0., rms → Null, dt → 1960-01-05 06:07:30, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.6}
```

221

```
{id → 5c3c5782715d9b592f327ea8, depth → 140., nmg → Null, lon → 26.2, az → 0.,
  smin → 0., rms → Null, dt → 1960-01-26 20:27:04, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.7, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.8}
```

222

```
{id → 5c3c5783715d9b592f327ebd, depth → 150., nmg → Null, lon → 27., az → 0.,
  smin → 0., rms → Null, dt → 1961-06-11 17:06:15, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 46.}
```

223


```
{id → 5c3c5783715d9b592f327ebf, depth → 100., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1961-06-29 18:08:48, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.5}
```

224

```
{id → 5c3c5783715d9b592f327ec5, depth → 100., nmg → Null, lon → 26.7, az → 0.,
  smin → 0., rms → Null, dt → 1961-11-18 03:18:44, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.5}
```

225

```
{id → 5c3c5783715d9b592f327ec7, depth → 145., nmg → Null, lon → 26.4, az → 0.,
  smin → 0., rms → Null, dt → 1962-02-27 21:34:10, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.2, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → 16, gap → Null, type → romplus, lat → 45.7}
```

226

```
{id → 5c3c5783715d9b592f327ece, depth → 108., nmg → Null, lon → 26., az → 0.,
  smin → 0., rms → Null, dt → 1962-08-30 07:46:27, dtErr → 0., smaj → 0., qual → D,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.3, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → 13, gap → Null, type → romplus, lat → 45.5}
```

227

```
{id → 5c3c5783715d9b592f327ecf, depth → 129., nmg → Null, lon → 26.7, az → 0.,
  smin → 0., rms → Null, dt → 1962-11-09 02:14:47, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → 24, gap → Null, type → romplus, lat → 45.7}
```

228

```
{id → 5c3c5783715d9b592f327ed1, depth → 117., nmg → Null, lon → 26.7, az → 0.,
  smin → 0., rms → Null, dt → 1963-01-14 18:33:24, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.8, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → 48, gap → Null, type → romplus, lat → 45.9}
```

229

```
{id → 5c3c5783715d9b592f327ed9, depth → 128., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1965-01-10 02:52:23, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.8, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → 34, gap → Null, type → romplus, lat → 45.8}
```

230

```
{id → 5c3c5783715d9b592f327edb, depth → 84., nmg → Null, lon → 26.9, az → 0.,
  smin → 0., rms → Null, dt → 1965-05-11 22:35:59, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → 21, gap → Null, type → romplus, lat → 45.9}
```

231

```
{id → 5c3c5783715d9b592f327ee6, depth → 140., nmg → Null, lon → 26.5, az → 0.,
  smin → 0., rms → Null, dt → 1966-10-02 11:21:44, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.9, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → 95, gap → Null, type → romplus, lat → 45.7}
```

232

```
{id → 5c3c5783715d9b592f327ee7, depth → 140., nmg → Null, lon → 26.4, az → 0.,
  smin → 0., rms → Null, dt → 1966-10-15 06:59:18, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → 59, gap → Null, type → romplus, lat → 45.6}
```

233

```
{id → 5c3c5783715d9b592f327ee9, depth → 150., nmg → Null, lon → 26.4, az → 0.,
  smin → 0., rms → Null, dt → 1966-12-14 14:49:59, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.2, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → 88, gap → Null, type → romplus, lat → 45.7}
```

234

```
{id → 5c3c5783715d9b592f327ef7, depth → 122., nmg → Null, lon → 26.4, az → 0.,
  smin → 0., rms → Null, dt → 1968-02-09 13:22:53, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → 23, gap → Null, type → romplus, lat → 45.6}
```

235

```
{id → 5c3c5783715d9b592f327efb, depth → 123., nmg → Null, lon → 26.57, az → 0.,
  smin → 0., rms → Null, dt → 1968-10-20 23:15:04, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → 52, gap → Null, type → romplus, lat → 45.73}
```

236

```
{id → 5c3c5783715d9b592f327efe, depth → 135., nmg → Null, lon → 26.42, az → 0.,
  smin → 0., rms → Null, dt → 1969-01-15 08:46:29, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → 34, gap → Null, type → romplus, lat → 45.56}
```

237

```
{id → 5c3c5783715d9b592f327f41, depth → 129., nmg → Null, lon → 26.74, az → 0.,
  smin → 0., rms → Null, dt → 1975-12-27 18:32:21, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.3, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → 42, gap → Null, type → romplus, lat → 45.75}
```

238

```
{id → 5c3c5783715d9b592f327f50, depth → 146., nmg → Null, lon → 26.49, az → 0.,
  smin → 0., rms → Null, dt → 1976-10-01 17:50:43, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 6., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → 29, gap → Null, type → romplus, lat → 45.68}
```

239

```
{id → 5c3c5783715d9b592f327f58, depth → 94., nmg → Null, lon → 26.76, az → 0.,
  smin → 0., rms → Null, dt → 1977-03-04 19:21:54, dtErr → 0., smaj → 0., qual → B,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 7.4, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → Null, gap → Null, type → romplus, lat → 45.77}
```

240

```
{id → 5c3c5783715d9b592f327fdd, depth → 136.4, nmg → Null, lon → 26.46, az → 0.,
  smin → 0., rms → Null, dt → 1978-01-01 07:40:14, dtErr → 0., smaj → 0., qual → B,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → 12, gap → Null, type → romplus, lat → 45.72}
```

241

```
{id → 5c3c5784715d9b592f32808b, depth → 120., nmg → Null, lon → 26.33, az → 0.,
  smin → 0., rms → Null, dt → 1979-05-31 07:20:06, dtErr → 0., smaj → 0., qual → B,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.3, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → 79, gap → Null, type → romplus, lat → 45.55}
```

242

```
{id → 5c3c5784715d9b592f3280ed, depth → 141., nmg → Null, lon → 26.6, az → 0.,
  smin → 0., rms → Null, dt → 1980-01-14 15:07:54, dtErr → 0., smaj → 0., qual → B,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → 81, gap → Null, type → romplus, lat → 45.78}
```

243

```
{id → 5c3c5785715d9b592f3282b1, depth → 149.8, nmg → Null, lon → 26.64, az → 0.,
  smin → 0., rms → Null, dt → 1983-01-25 07:34:50, dtErr → 0., smaj → 0., qual → C,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.6, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → 9, gap → Null, type → romplus, lat → 45.75}
```

244

```
{id → 5c3c5788715d9b592f3285cc, depth → 118.6, nmg → Null, lon → 26.77, az → 0.,
  smin → 0., rms → Null, dt → 1985-08-01 11:17:35, dtErr → 0., smaj → 0., qual → B,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.2, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → 20, gap → Null, type → romplus, lat → 45.79}
```

245

```
{id → 5c3c5788715d9b592f3285cd, depth → 93.5, nmg → Null, lon → 26.62, az → 0.,
  smin → 0., rms → Null, dt → 1985-08-01 14:35:04, dtErr → 0., smaj → 0., qual → B,
  nst → Null, magnitudes → {mdErr → 0., ml → 0., mw → 5.8, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → 21, gap → Null, type → romplus, lat → 45.73}
```

246

```
{id → 5c3c5789715d9b592f3287b9, depth → 131.4, nmg → Null, lon → 26.49, az → 0.,
  smin → 0., rms → Null, dt → 1986-08-30 21:28:37, dtErr → 0., smaj → 0., qual → A,
  nst → 15, magnitudes → {mdErr → 0., ml → 0., mw → 7.1, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 0., nph → 16, gap → Null, type → romplus, lat → 45.52}
```

247

```
{id → 5c3c578b715d9b592f328ad4, depth → 90.9, nmg → Null, lon → 26.89, az → 0.,
  smin → 0., rms → 0.2, dt → 1990-05-30 10:40:06, dtErr → 0.6, smaj → 0., qual → A,
  nst → 12, magnitudes → {mdErr → 0., ml → 0., mw → 6.9, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 6.4, npH → 14, gap → 88, type → romplus, lat → 45.83}
```

248

```
{id → 5c3c578b715d9b592f328b11, depth → 86.9, nmg → 9, lon → 26.91, az → 0.,
  smin → 0., rms → 0.27, dt → 1990-05-31 00:17:47, dtErr → 0.6, smaj → 0., qual → A,
  nst → 10, magnitudes → {mdErr → 0., ml → 0., mw → 6.4, mlErr → 0., mwErr → 0.1, md → 0.},
  depthType → Null, depthErr → 7.2, npH → 13, gap → 109, type → romplus, lat → 45.85}
```

249

```
{id → 5c3c5793715d9b592f329548, depth → 143.4, nmg → 17, lon → 26.64, az → 0.,
  smin → 0., rms → 0.45, dt → 2000-04-06 00:10:38, dtErr → 0.7, smaj → 0., qual → D,
  nst → 17, magnitudes → {mdErr → 0., ml → 0., mw → 5., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 6.8, npH → 34, gap → 60, type → romplus, lat → 45.75}
```

250

```
{id → 5c3c5796715d9b592f329980, depth → 105.4, nmg → Null, lon → 26.63, az → 0.,
  smin → 0., rms → 0.79, dt → 2004-10-27 20:34:36, dtErr → 1.1, smaj → 0., qual → Null,
  nst → 41, magnitudes → {mdErr → 0., ml → 0., mw → 6., mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 11., npH → 70, gap → 42, type → romplus, lat → 45.84}
```

251

```
{id → 5c3c5797715d9b592f329b37, depth → 148.5, nmg → 6, lon → 26.53, az → 0.,
  smin → 0., rms → 0.39, dt → 2005-05-14 01:53:21, dtErr → 0.5, smaj → 0., qual → Null,
  nst → 18, magnitudes → {mdErr → 0., ml → 0., mw → 5.5, mlErr → 0., mwErr → 0.4, md → 0.},
  depthType → Null, depthErr → 5.7, npH → 33, gap → 72, type → romplus, lat → 45.64}
```

252

```
{id → 5c3c57a1715d9b592f32a9c2, depth → 109.6, nmg → 2, lon → 26.62, az → 0.,
  smin → 0., rms → 0.51, dt → 2009-04-25 17:18:48, dtErr → 0.6, smaj → 0., qual → D,
  nst → 38, magnitudes → {mdErr → 0., ml → 0., mw → 5.4, mlErr → 0., mwErr → 0., md → 0.},
  depthType → Null, depthErr → 7.6, npH → 57, gap → 28, type → romplus, lat → 45.68}
```

253

```
{id → 5c3c57b4715d9b592f32c423, depth → 135.1, nmg → 6, lon → 26.58, az → 0.,
  smin → 0., rms → 0.51, dt → 2013-10-06 01:37:21, dtErr → 0.3, smaj → 0., qual → D,
  nst → 70, magnitudes → {mdErr → 0., ml → 0., mw → 5.2, mlErr → 0., mwErr → 0.1, md → 0.},
  depthType → Null, depthErr → 3.8, npH → 117, gap → 23, type → romplus, lat → 45.67}
```

254

```
{id → 5c3c57c6715d9b592f32dca2, depth → 92., nmg → 60, lon → 26.6181, az → 26.,
  smin → 1.2, rms → 0.76, dt → 2016-09-23 23:11:20, dtErr → 0.19, smaj → 1.6, qual → C,
  nst → 90, magnitudes → {mdErr → 0., ml → 5.8, mw → 5.5, mlErr → 0.5, mwErr → 0.4, md → 0.},
  depthType → Null, depthErr → 2.3, npH → 140, gap → 14, type → romplus, lat → 45.7148}
```

255

```
{id → 5c3c57c7715d9b592f32de12, depth → 96.9, nmg → 80, lon → 26.5987, az → 19.,
  smin → 1.1, rms → 0.65, dt → 2016-12-27 23:20:55, dtErr → 0.16, smaj → 1.5, qual → C,
  nst → 89, magnitudes → {mdErr → 0., ml → 5.8, mw → 5.6, mlErr → 0.5, mwErr → 0.4, md → 0.},
  depthType → Null, depthErr → 1.9, npH → 135, gap → 18, type → romplus, lat → 45.7139}
```

256

```
{id → 5c3c57ce715d9b592f32e841, depth → 147.8, nmg → 67, lon → 26.4068, az → 12.,
  smin → 1., rms → 0.5, dt → 2018-10-28 00:38:11, dtErr → 0.18, smaj → 1.5, qual → C,
  nst → 71, magnitudes → {mdErr → 0., ml → 5.8, mw → 5.5, mlErr → 0.5, mwErr → 0.7, md → 0.},
  depthType → Null, depthErr → 1.6, npH → 115, gap → 22, type → romplus, lat → 45.6079}
```

```
For[i = 1, i ≤ nr, i++, Print[i]; Print[tabel[[2]][[2]][[i]][[8]][[2]]]]
```

1

1022-05-12 00:00:00

2

1038-08-15 00:00:00

3

1091-01-01 00:00:00

4

1107-02-12 03:00:00

5

1122-10-01 00:00:00

6

1126-08-08 00:00:00

7

1170-04-01 00:00:00

8

1196-02-13 07:00:00

9

1230-05-10 07:00:00

10

1258-02-07 13:00:00

11

1327-01-01 00:00:00

12

1446-10-10 04:00:00

13

1471-08-29 10:00:00

14

1473-08-29 00:00:00

15

1516-11-24 12:00:00

16

1523-06-09 00:00:00

17

1543-01-01 00:00:00

18

1545-07-19 08:00:00

19

1552-08-21 02:00:00

20

1571-05-10 00:00:00

21

1578-04-01 00:00:00

22

1590-04-30 00:00:00

23

1595-04-21 10:00:00

24

1598-11-22 02:00:00

25

1598-12-28 00:00:00

26

1599-03-04 00:00:00

27

1599-05-29 02:00:00

28

1604-05-03 02:00:00

29

1605-12-24 15:00:00

30

1606-01-13 01:00:00

31

1620-11-08 13:00:00

32

1637-02-01 01:00:00

33

1650-04-19 00:00:00

34

1666-02-01 00:00:00

35

1679-08-09 01:00:00

36

1681-08-19 00:00:00

37

1681-10-16 00:00:00

38

1681-10-18 00:00:00

39

1681-12-27 04:30:00

40

1701-06-12 00:00:00

41

1711-10-11 00:00:00

42

1730-04-06 04:00:00

43

1738-06-11 10:00:00

44

1740-04-05 18:00:00

45

1778-01-18 00:00:00

46

1787-01-18 00:00:00

47

1787-03-16 00:00:00

48

1789-03-26 00:00:00

49

1790-04-06 19:29:00

50

1793-11-26 18:00:00

51

1798-03-14 07:00:00

52

1802-10-26 10:55:00

53

1812-03-05 12:30:00

54

1813-02-01 00:00:00

55

1817-09-30 07:00:00

56

1821-02-10 00:30:00

57

1821-09-29 00:00:00

58

1821-11-17 13:45:00

59

1823-02-09 16:50:00

60

1827-10-14 18:45:00

61

1829-11-26 01:40:00

62

1831-08-03 00:00:00

63

1835-04-21 20:30:00

64

1838-01-23 18:45:00

65

1843-09-10 00:00:00

66

1844-03-06 19:10:00

67

1848-01-01 00:00:00

68

1854-10-28 12:15:00

69

1862-10-16 01:10:00

70

1868-11-13 07:45:00

71

1868-11-27 20:30:00

72

1880-12-25 14:30:00

73

1888-08-19 04:56:00

74

1893-05-01 17:18:00

75

1893-08-17 14:45:00

76

1893-09-10 03:40:00

77

1894-03-04 06:35:00

78

1894-03-17 20:00:00

79

1894-03-18 00:50:00

80

1894-08-31 12:20:00

81

1895-02-05 15:04:00

82

1895-11-19 07:44:00

83

1896-03-11 23:00:00

84

1896-11-24 18:50:00

85

1897-01-17 08:50:00

86

1897-07-20 07:20:00

87

1897-09-24 14:26:00

88

1899-12-20 19:28:36

89

1901-09-23 18:11:00

90

1902-03-11 20:14:00

91

1903-06-08 15:08:00

92

1908-10-06 21:40:00

93

1912-05-25 18:01:54

94

1912-05-25 20:15:00

95

1912-05-25 21:00:00

96

1912-06-07 01:58:00

97

1913-03-14 03:40:00

98

1913-07-23 22:03:00

99

1914-07-14 03:00:00

100

1914-07-31 18:23:12

101

1914-08-26 15:09:00

102

1914-10-26 02:59:00

103

1917-03-15 20:42:00

104

1917-05-19 21:00:00

105

1917-07-11 03:23:55

106

1918-02-25 02:07:00

107

1919-04-18 06:20:05

108

1919-08-09 14:38:00

109

1921-10-22 05:13:00

110

1925-12-25 02:37:00

111

1927-07-24 20:17:05

112

1928-03-30 09:38:57

113

1928-11-23 04:23:12

114

1929-05-20 12:17:56

115

1932-03-13 02:53:00

116

1932-05-27 10:42:15

117

1932-09-07 18:36:00

118

1934-02-02 19:59:13

119

1934-03-29 20:06:51

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1934-12-29 00:00:00

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1935-02-03 22:48:00

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1935-07-13 00:03:46

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1935-07-13 00:06:00

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1935-09-05 06:00:00

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1936-05-14 12:50:00

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1936-05-17 17:38:02

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1936-10-31 15:52:00

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1937-01-26 14:34:00

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1938-07-13 20:15:17

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1939-09-05 06:02:00

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1940-02-10 18:14:10

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1940-02-14 19:30:00

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1940-06-24 09:57:27

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1940-10-03 15:04:50

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1940-10-21 22:14:02

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1940-10-22 06:37:00

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1940-10-22 22:14:00

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1940-11-06 19:58:00

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1940-11-08 12:00:44

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1940-11-10 01:39:07

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1940-11-10 13:28:00

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1940-11-10 16:41:00

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1940-11-11 06:34:16

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1940-11-13 16:51:00

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1940-11-14 14:37:00

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1940-11-16 22:31:00

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1940-11-17 06:01:00

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1940-11-19 20:27:12

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1940-11-22 02:30:00

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1940-11-23 14:49:53

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1940-11-27 08:13:00

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1940-12-01 17:19:00

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1940-12-10 01:35:00

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1941-01-29 07:04:00

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1941-03-16 06:50:00

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1941-04-04 19:27:00

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1941-06-27 02:55:00

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1941-09-05 08:23:00

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1941-12-10 07:23:00

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1942-03-17 00:24:00

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1942-04-27 10:59:00

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1942-05-05 04:58:00

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1942-07-29 19:19:00

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1942-09-20 05:37:00

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1942-10-03 12:43:03

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1943-04-28 19:46:50

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1943-05-18 18:34:00

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1943-07-10 02:50:00

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1943-12-22 15:35:20

170

1944-02-25 16:59:00

171

1944-03-12 21:19:13

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1944-09-08 06:18:00

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1945-02-20 03:42:00

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1945-03-12 20:51:46

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1945-09-07 15:48:26

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1945-09-14 17:22:00

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1945-12-09 06:08:45

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1945-12-17 22:36:00

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1946-10-03 07:17:09

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1946-11-03 18:47:01

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1946-11-15 01:11:00

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1947-03-13 14:03:00

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1947-08-30 03:54:00

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1947-10-17 13:25:20

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1947-11-22 23:07:00

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1948-01-28 02:05:00

187

1948-03-13 21:06:00

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1948-04-24 12:29:31

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1948-04-29 00:33:40

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1948-05-29 04:48:55

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1948-07-29 08:57:00

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1948-08-09 07:45:00

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1948-12-22 04:18:00

194

1949-11-25 03:17:00

195

1949-12-26 03:36:10

196

1950-01-16 04:25:10

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1950-02-17 18:04:00

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1950-03-20 17:29:00

199

1950-04-30 00:00:00

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1950-07-14 06:29:57

201

1950-07-25 07:25:00

202

1951-03-18 11:32:30

203

1952-07-16 03:57:00

204

1952-08-03 16:36:14

205

1953-02-22 17:58:30

206

1953-05-09 02:59:17

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1953-05-17 02:33:54

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1954-04-13 10:06:35

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1954-05-09 09:25:00

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1954-10-21 12:03:36

211

1955-05-01 21:22:52

212

1955-11-14 17:52:30

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1955-12-27 08:11:38

214

1956-05-07 03:54:12

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1958-06-25 07:22:12

216

1959-06-26 13:44:40

217

1959-06-30 07:24:34

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1959-08-19 15:32:03

219

1959-11-10 18:02:32

220

1960-01-05 06:07:30

221

1960-01-26 20:27:04

222

1961-06-11 17:06:15

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1961-06-29 18:08:48

224

1961-11-18 03:18:44

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1962-02-27 21:34:10

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1962-08-30 07:46:27

227

1962-11-09 02:14:47

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1963-01-14 18:33:24

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1965-01-10 02:52:23

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1965-05-11 22:35:59

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1966-10-02 11:21:44

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1966-10-15 06:59:18

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1966-12-14 14:49:59

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1968-02-09 13:22:53

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1968-10-20 23:15:04

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1969-01-15 08:46:29

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1975-12-27 18:32:21

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1976-10-01 17:50:43

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1977-03-04 19:21:54

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1978-01-01 07:40:14

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1979-05-31 07:20:06

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1980-01-14 15:07:54

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1983-01-25 07:34:50

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1985-08-01 11:17:35

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1985-08-01 14:35:04

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1986-08-30 21:28:37

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1990-05-30 10:40:06

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1990-05-31 00:17:47

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2000-04-06 00:10:38

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2004-10-27 20:34:36

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2005-05-14 01:53:21

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2009-04-25 17:18:48

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2013-10-06 01:37:21

254

2016-09-23 23:11:20

255

2016-12-27 23:20:55

256

2018-10-28 00:38:11

string = "1962-08-30 07:46:27"

1962-08-30 07:46:27

StringTake[string, 4]

1962

For[i = 1, i ≤ nr, i++, Print[i];

Print[StringTake[tabel[[2]][[2]][[i]][[8]][[2]], 4]]]

1

1022

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1122

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2018

```
tabelox = Table[ToExpression[StringTake[tabel[[2]][[2]][[i]][[8]][[2]], 4]], {i, 1, nr}]
```

```
{1022, 1038, 1091, 1107, 1122, 1126, 1170, 1196, 1230, 1258, 1327, 1446, 1471, 1473, 1516,
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 1901, 1902, 1903, 1908, 1912, 1912, 1912, 1912, 1913, 1913, 1914, 1914, 1914, 1914,
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 1958, 1959, 1959, 1959, 1959, 1960, 1960, 1961, 1961, 1961, 1962, 1962, 1962, 1963,
 1965, 1965, 1966, 1966, 1966, 1968, 1968, 1969, 1975, 1976, 1977, 1978, 1979, 1980,
 1983, 1985, 1985, 1986, 1990, 1990, 2000, 2004, 2005, 2009, 2013, 2016, 2016, 2018}
```

```
For[i = 1, i ≤ nr, i++, Print[i];
```

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Print[tabel[[2]][[2]][[i]][[13]][[2]][[3]][[2]]]]
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tabeloyyy = Table[tabel[[2]][[2]][[i]][[13]][[2]][[3]][[2]], {i, 1, nr}]

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AssociationThread[tabelox → tabeloyyy]

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1196 → 7.5, 1230 → 7.3, 1258 → 7.1, 1327 → 7.3, 1446 → 7.5, 1471 → 7.5, 1473 → 7.3,
1516 → 7.5, 1523 → 6.5, 1543 → 7.1, 1545 → 7.1, 1552 → 6.5, 1571 → 7.1, 1578 → 6.5,
1590 → 7.3, 1595 → 7.1, 1598 → 5.7, 1599 → 5.9, 1604 → 6.8, 1605 → 7.1, 1606 → 6.8,
1620 → 7.5, 1637 → 7.1, 1650 → 6.5, 1666 → 6.1, 1679 → 7.5, 1681 → 5.9, 1701 → 7.1,
1711 → 6.5, 1730 → 6.1, 1738 → 7.7, 1740 → 7.3, 1778 → 6.5, 1787 → 5.9, 1789 → 5.9,
1790 → 7.1, 1793 → 5.9, 1798 → 5.9, 1802 → 7.9, 1812 → 6.5, 1813 → 5.9, 1817 → 5.9,
1821 → 6.5, 1823 → 5.9, 1827 → 5.9, 1829 → 7.3, 1831 → 6.1, 1835 → 6.5, 1838 → 7.5,
1843 → 5.9, 1844 → 6., 1848 → 6.5, 1854 → 6.5, 1862 → 6.5, 1868 → 6.5, 1880 → 6.8,
1888 → 6.5, 1893 → 6.5, 1894 → 7.1, 1895 → 5.1, 1896 → 6.1, 1897 → 5.4, 1899 → 5.4,
1901 → 5.7, 1902 → 5.9, 1903 → 5.9, 1908 → 7.1, 1912 → 5.9, 1913 → 5.7, 1914 → 5.4,
1917 → 5.9, 1918 → 5.9, 1919 → 6., 1921 → 5.3, 1925 → 6.1, 1927 → 5.9, 1928 → 5.7,
1929 → 6., 1932 → 5.8, 1934 → 5., 1935 → 6., 1936 → 5., 1937 → 5.4, 1938 → 6., 1939 → 6.2,
1940 → 5.3, 1941 → 5.3, 1942 → 5., 1943 → 5.1, 1944 → 5., 1945 → 5., 1946 → 5.1,
1947 → 5.2, 1948 → 5.2, 1949 → 5.7, 1950 → 5., 1951 → 5.3, 1952 → 5.5, 1953 → 5.4,
1954 → 5., 1955 → 5., 1956 → 5., 1958 → 5., 1959 → 5.3, 1960 → 5.7, 1961 → 5.1, 1962 → 5.1,
1963 → 5.8, 1965 → 5., 1966 → 5.2, 1968 → 5., 1969 → 5., 1975 → 5.3, 1976 → 6., 1977 → 7.4,
1978 → 5.1, 1979 → 5.3, 1980 → 5.1, 1983 → 5.6, 1985 → 5.8, 1986 → 7.1, 1990 → 6.4,
2000 → 5., 2004 → 6., 2005 → 5.5, 2009 → 5.4, 2013 → 5.2, 2016 → 5.6, 2018 → 5.5 |>

```



trainingset = Normal[%]

```

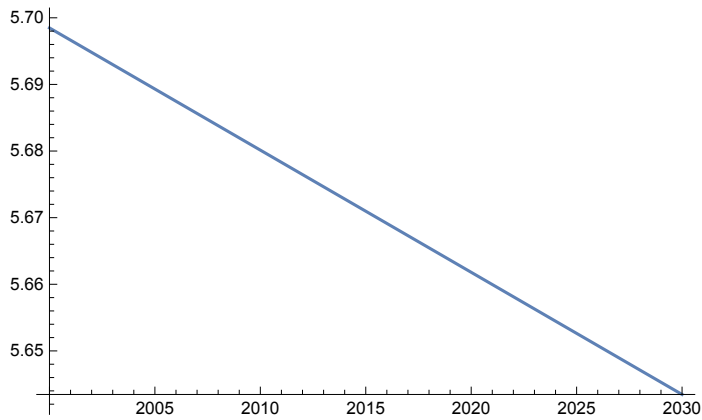
{1022 → 6.5, 1038 → 7.3, 1091 → 7.1, 1107 → 7.1, 1122 → 6.2, 1126 → 7.1, 1170 → 7.3,
1196 → 7.5, 1230 → 7.3, 1258 → 7.1, 1327 → 7.3, 1446 → 7.5, 1471 → 7.5, 1473 → 7.3,
1516 → 7.5, 1523 → 6.5, 1543 → 7.1, 1545 → 7.1, 1552 → 6.5, 1571 → 7.1, 1578 → 6.5,
1590 → 7.3, 1595 → 7.1, 1598 → 5.7, 1599 → 5.9, 1604 → 6.8, 1605 → 7.1, 1606 → 6.8,
1620 → 7.5, 1637 → 7.1, 1650 → 6.5, 1666 → 6.1, 1679 → 7.5, 1681 → 5.9, 1701 → 7.1,
1711 → 6.5, 1730 → 6.1, 1738 → 7.7, 1740 → 7.3, 1778 → 6.5, 1787 → 5.9, 1789 → 5.9,
1790 → 7.1, 1793 → 5.9, 1798 → 5.9, 1802 → 7.9, 1812 → 6.5, 1813 → 5.9, 1817 → 5.9,
1821 → 6.5, 1823 → 5.9, 1827 → 5.9, 1829 → 7.3, 1831 → 6.1, 1835 → 6.5, 1838 → 7.5,
1843 → 5.9, 1844 → 6., 1848 → 6.5, 1854 → 6.5, 1862 → 6.5, 1868 → 6.5, 1880 → 6.8,
1888 → 6.5, 1893 → 6.5, 1894 → 7.1, 1895 → 5.1, 1896 → 6.1, 1897 → 5.4, 1899 → 5.4,
1901 → 5.7, 1902 → 5.9, 1903 → 5.9, 1908 → 7.1, 1912 → 5.9, 1913 → 5.7, 1914 → 5.4,
1917 → 5.9, 1918 → 5.9, 1919 → 6., 1921 → 5.3, 1925 → 6.1, 1927 → 5.9, 1928 → 5.7,
1929 → 6., 1932 → 5.8, 1934 → 5., 1935 → 6., 1936 → 5., 1937 → 5.4, 1938 → 6., 1939 → 6.2,
1940 → 5.3, 1941 → 5.3, 1942 → 5., 1943 → 5.1, 1944 → 5., 1945 → 5., 1946 → 5.1,
1947 → 5.2, 1948 → 5.2, 1949 → 5.7, 1950 → 5., 1951 → 5.3, 1952 → 5.5, 1953 → 5.4,
1954 → 5., 1955 → 5., 1956 → 5., 1958 → 5., 1959 → 5.3, 1960 → 5.7, 1961 → 5.1, 1962 → 5.1,
1963 → 5.8, 1965 → 5., 1966 → 5.2, 1968 → 5., 1969 → 5., 1975 → 5.3, 1976 → 6., 1977 → 7.4,
1978 → 5.1, 1979 → 5.3, 1980 → 5.1, 1983 → 5.6, 1985 → 5.8, 1986 → 7.1, 1990 → 6.4,
2000 → 5., 2004 → 6., 2005 → 5.5, 2009 → 5.4, 2013 → 5.2, 2016 → 5.6, 2018 → 5.5}

```



```
p = Predict[trainingset, Method -> "NeuralNetwork"]
p[2020]
f[x_] := p[x]
Plot[f[x], {x, 2000, 2030}]
```

PredictorFunction [  Input type: Numerical
Method: NeuralNetwork]

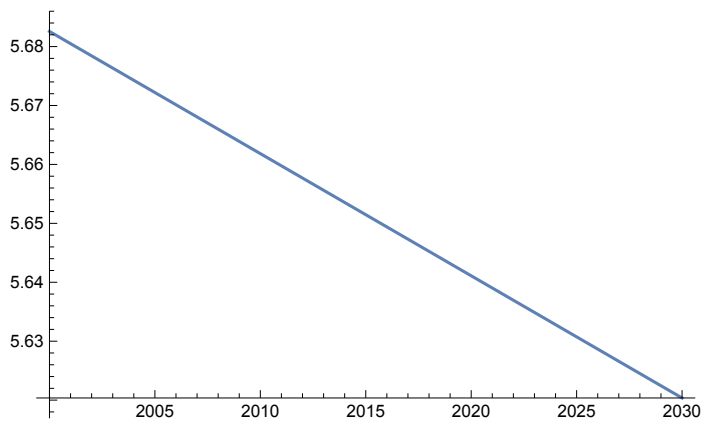
5.6618





```
p = Predict[trainingset, Method -> "LinearRegression"]
p[15.5]
f[x_] := p[x]
Plot[f[x], {x, 2000, 2030}]
```

PredictorFunction [  Input type: Numerical
Method: LinearRegression]

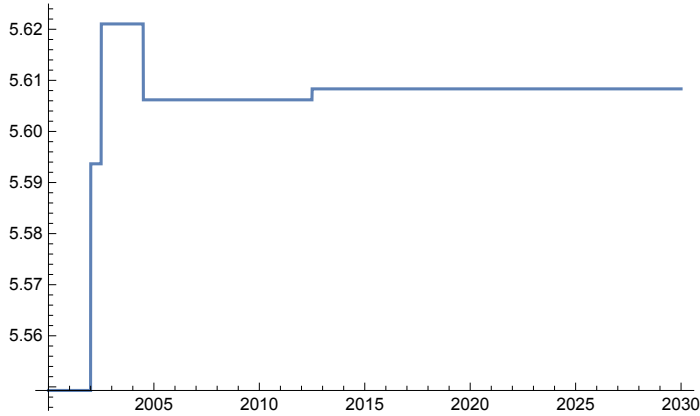
9.79741





```
p = Predict[trainingset, Method -> "RandomForest"]  
p[15.5]  
f[x_] := p[x]  
Plot[f[x], {x, 2000, 2030}, PlotRange -> All]
```

PredictorFunction [  Input type: Numerical
Method: RandomForest]

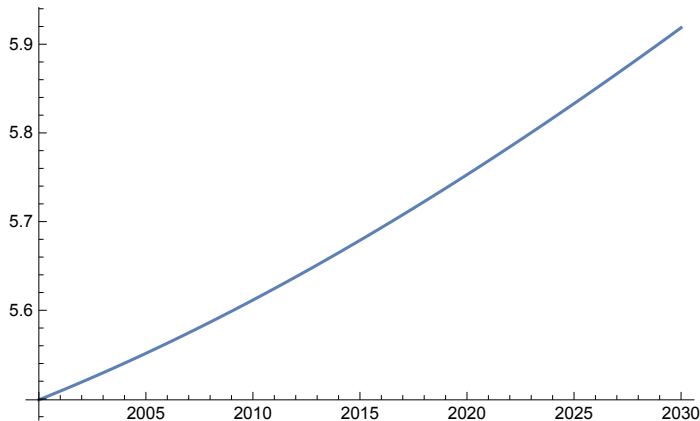
6.76498



```
p = Predict[trainingset, Method -> "GaussianProcess"]  
p[15.5]  
f[x_] := p[x]  
Plot[f[x], {x, 2000, 2030}]
```

PredictorFunction [  Input type: Numerical
Method: GaussianProcess]

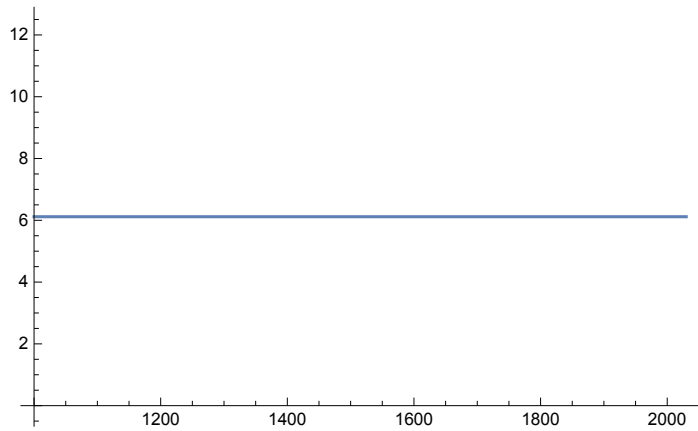
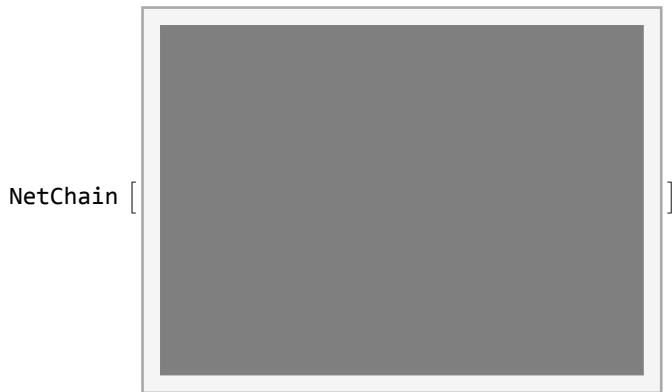
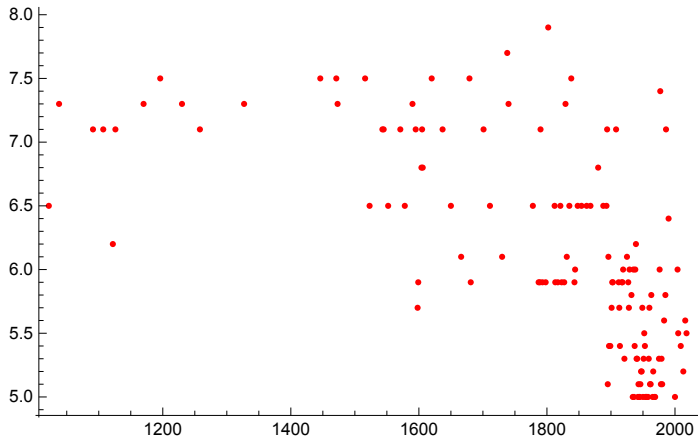
6.11544

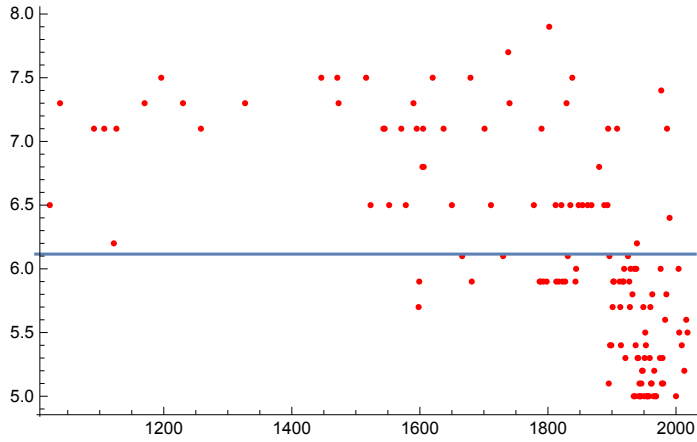


```

a1 = plot = ListPlot[List@@@ trainingset, PlotStyle -> Red, PlotRange -> All]
net = NetChain[{150, Tanh, 150, Tanh, 1}, "Input" -> "Scalar", "Output" -> "Scalar"];
net1 = NetTrain[net, trainingset, Method -> "ADAM"]
a2 = Show[Plot[net1[x], {x, 1000, 2030}]]
Show[a1, a2]

```

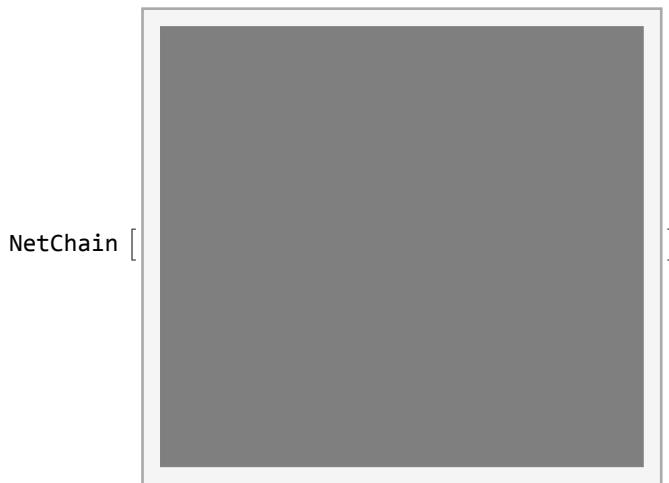
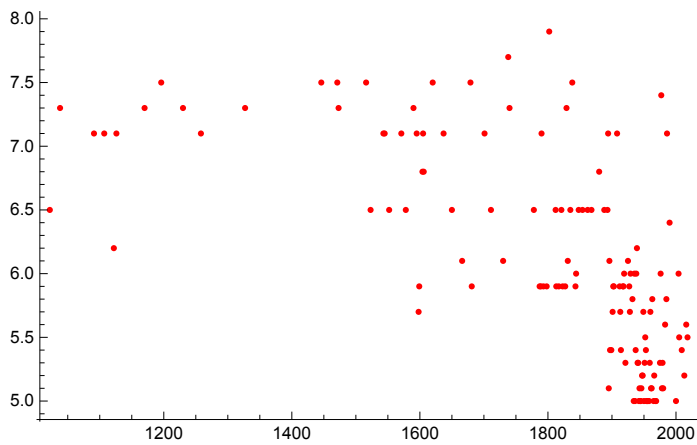


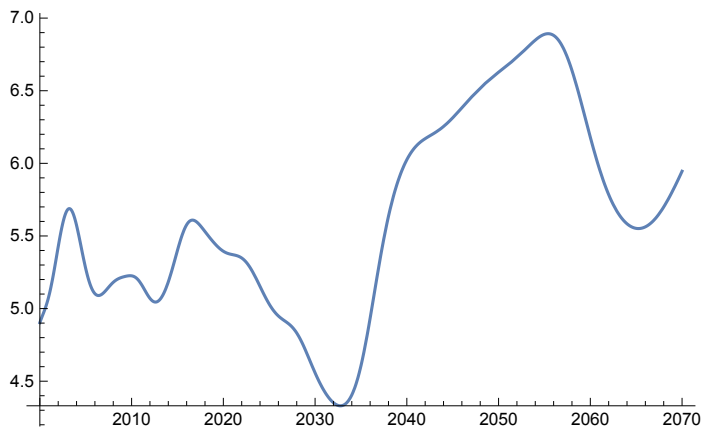
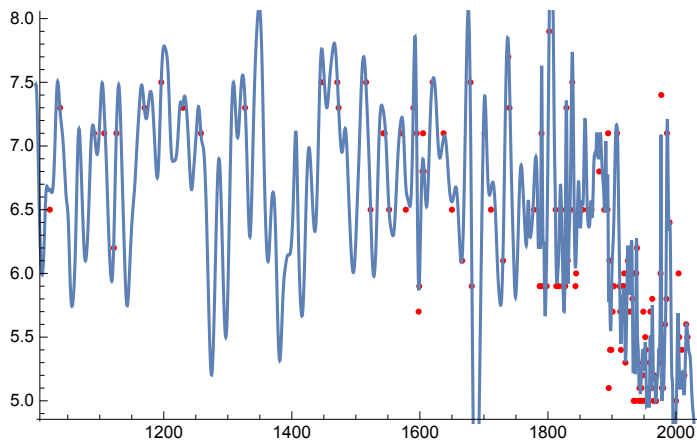
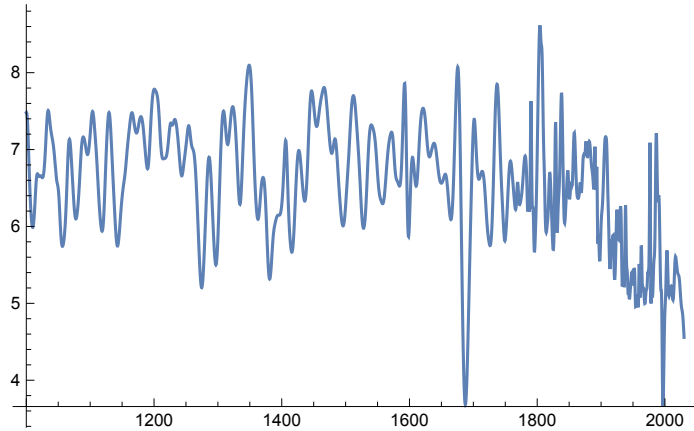


```

a1 = plot = ListPlot[List@@@trainingset, PlotStyle -> Red, PlotRange -> All]
net = NetChain[{150, Sin, 300, Cos, 150, Exp, 1}, "Input" -> "Scalar", "Output" -> "Scalar"];
net1 = NetTrain[net, trainingset, Method -> "ADAM"]
a2 = Show[Plot[net1[x], {x, 1000, 2030}]]
Show[a1, a2]
a3 = Show[Plot[net1[x], {x, 2000, 2070}]]

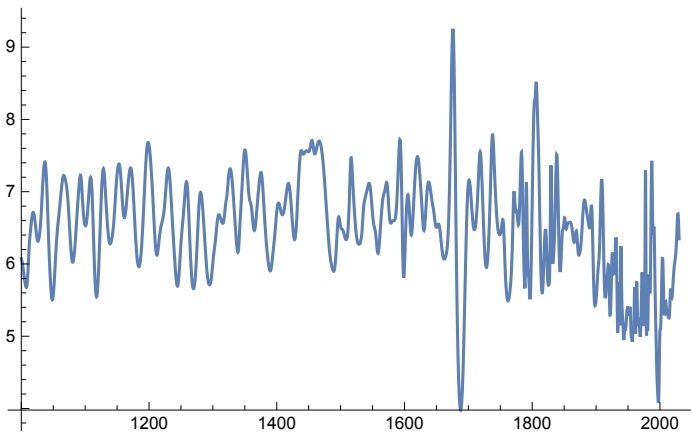
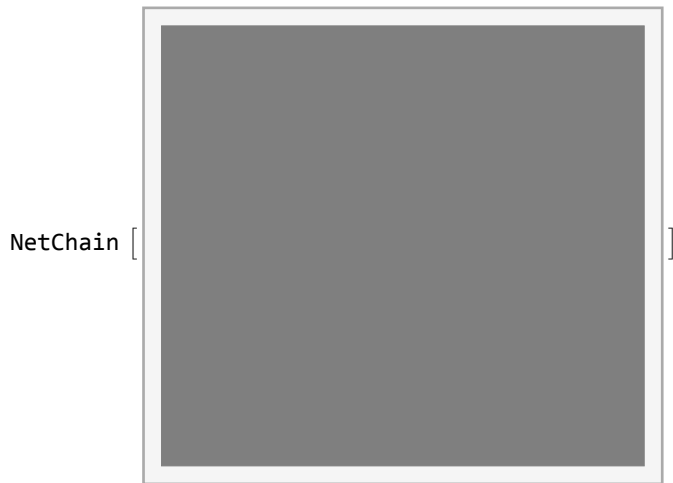
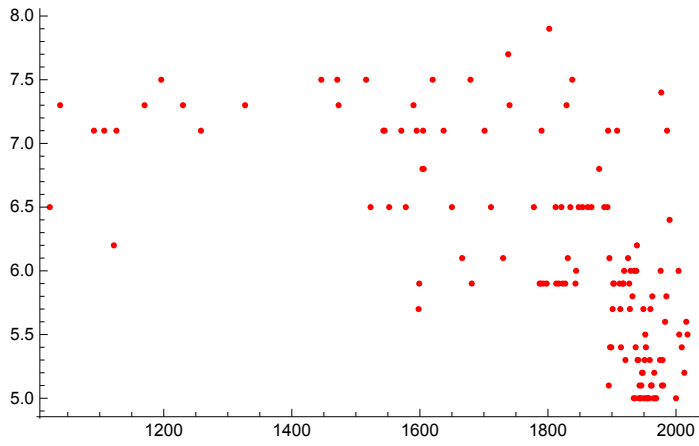
```

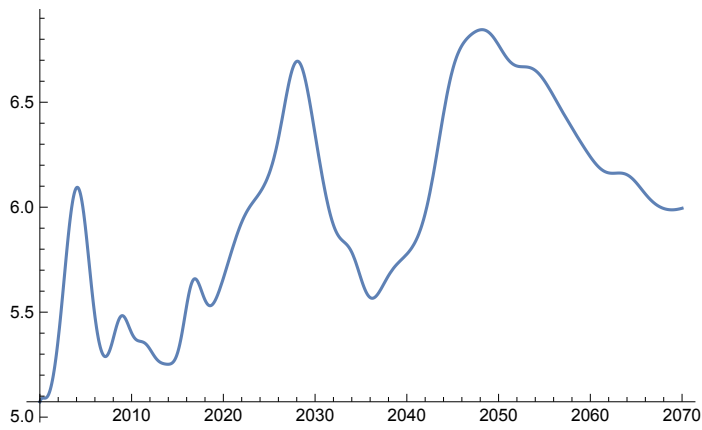
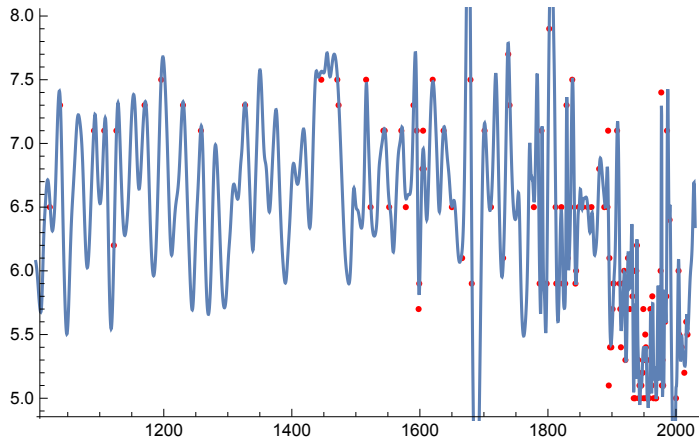




```

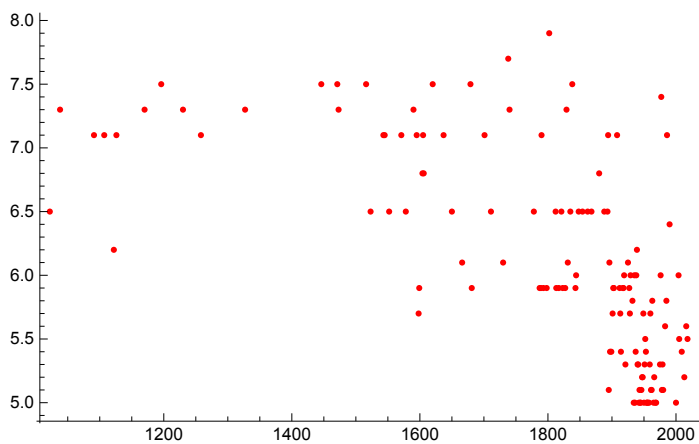
a1 = plot = ListPlot[List @@@ trainingset, PlotStyle -> Red, PlotRange -> All]
net = NetChain[{150, Sin, 300, Cos, 150, Exp, 1}, "Input" -> "Scalar", "Output" -> "Scalar"];
net1 = NetTrain[net, trainingset, Method -> Automatic]
a2 = Show[Plot[net1[x], {x, 1000, 2030}], PlotRange -> All]
Show[a1, a2]
a3 = Show[Plot[net1[x], {x, 2000, 2070}]]
    
```

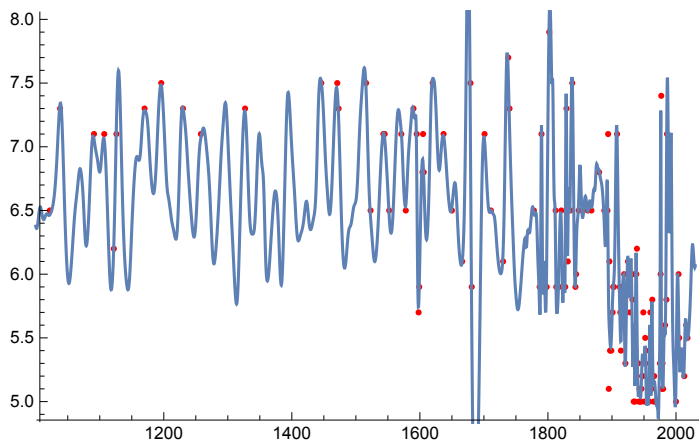
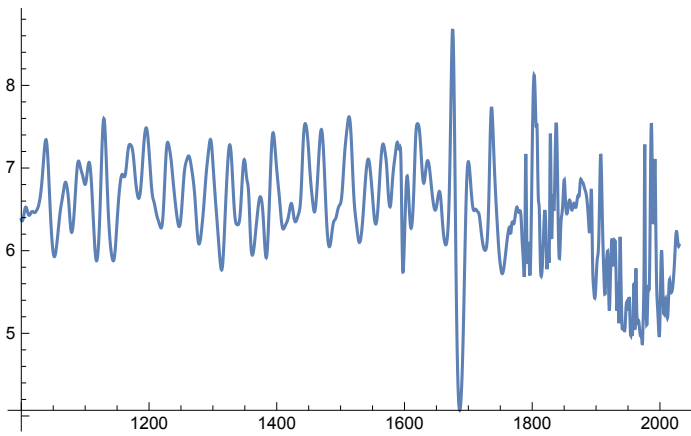
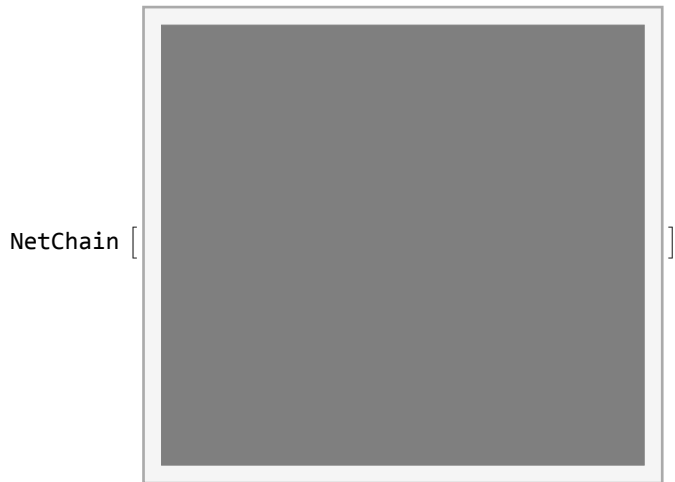


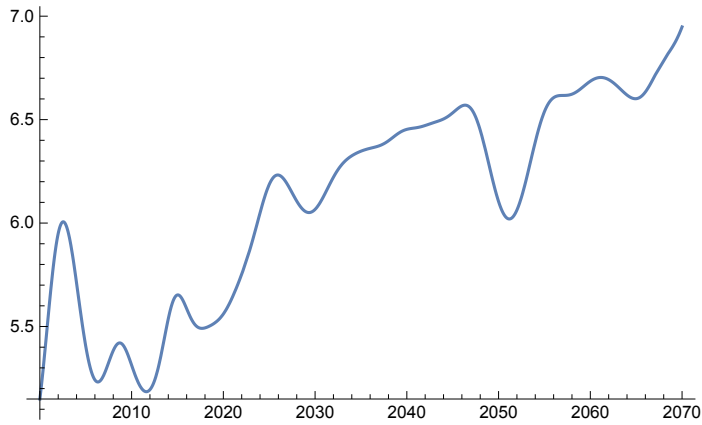


```

a1 = plot = ListPlot[List@@@trainingset, PlotStyle -> Red, PlotRange -> All]
net = NetChain[{150, Sin, 300, Cos, 150, Exp, 1}, "Input" -> "Scalar", "Output" -> "Scalar"];
net1 = NetTrain[net, trainingset, Method -> Automatic]
a2 = Show[Plot[net1[x], {x, 1000, 2030}], PlotRange -> All]
Show[a1, a2]
a3 = Show[Plot[net1[x], {x, 2000, 2070}]]
    
```







? *Layer

▼ System`

AggregationLayer	DotLayer	LongShortTermMemoryLayer	SequenceMostLayer
BasicRecurrentLayer	DotPlusLayer	MeanAbsoluteLossLayer	SequenceRestLayer
BatchNormalizationLayer	DropoutLayer	MeanSquaredLossLayer	SequenceReverseLayer
CatenateLayer	ElementwiseLayer	PaddingLayer	SoftmaxLayer
ConstantArrayLayer	EmbeddingLayer	PartLayer	SpatialTransformationLayer
ConstantPlusLayer	FlattenLayer	PoolingLayer	SummationLayer
ConstantTimesLayer	GatedRecurrentLayer	ReplicateLayer	ThreadingLayer
ContrastiveLossLayer	ImageAugmentationLayer	ReshapeLayer	TotalLayer
ConvolutionLayer	InstanceNormalizationLayer	ResizeLayer	TransposeLayer
CrossEntropyLossLayer	LinearLayer	SequenceAttentionLayer	UnitVectorLayer
DeconvolutionLayer	LocalResponseNormalizationLayer	SequenceLastLayer	

Neural networks - fitting unidimensional functions - Example 1

```
data =  
  Table[x → Sin[x^3 - 1] + x^2 + RandomVariate[NormalDistribution[0, 1.15]], {x, -3, 3, .2}]  
{-3. → 11.9013, -2.8 → 8.64984, -2.6 → 8.57659, -2.4 → 6.3142, -2.2 → 6.15326,  
 -2. → 0.935989, -1.8 → 1.46992, -1.6 → 3.59723, -1.4 → 1.06316, -1.2 → 0.209442,  
 -1. → 2.52901, -0.8 → -0.829896, -0.6 → -1.71323, -0.4 → 0.204014, -0.2 → -1.46723,  
 0. → 0.331214, 0.2 → -0.502939, 0.4 → -3.25727, 0.6 → -1.63866, 0.8 → -1.08093,  
 1. → -0.756198, 1.2 → 3.17516, 1.4 → 3.48946, 1.6 → 2.80594, 1.8 → 0.444296,  
 2. → 3.42802, 2.2 → 4.0835, 2.4 → 6.48153, 2.6 → 4.37417, 2.8 → 8.35008, 3. → 11.0417}
```

```
Length[data]
```

```
31
```

```
data[[1]][[1]]
```

```
-3.
```

```
data[[1]][[2]]
```

```
11.9013
```

```
List@data
```

```
{{-3. → 11.9013, -2.8 → 8.64984, -2.6 → 8.57659, -2.4 → 6.3142, -2.2 → 6.15326,  
 -2. → 0.935989, -1.8 → 1.46992, -1.6 → 3.59723, -1.4 → 1.06316, -1.2 → 0.209442,  
 -1. → 2.52901, -0.8 → -0.829896, -0.6 → -1.71323, -0.4 → 0.204014, -0.2 → -1.46723,  
 0. → 0.331214, 0.2 → -0.502939, 0.4 → -3.25727, 0.6 → -1.63866, 0.8 → -1.08093,  
 1. → -0.756198, 1.2 → 3.17516, 1.4 → 3.48946, 1.6 → 2.80594, 1.8 → 0.444296,  
 2. → 3.42802, 2.2 → 4.0835, 2.4 → 6.48153, 2.6 → 4.37417, 2.8 → 8.35008, 3. → 11.0417}}
```

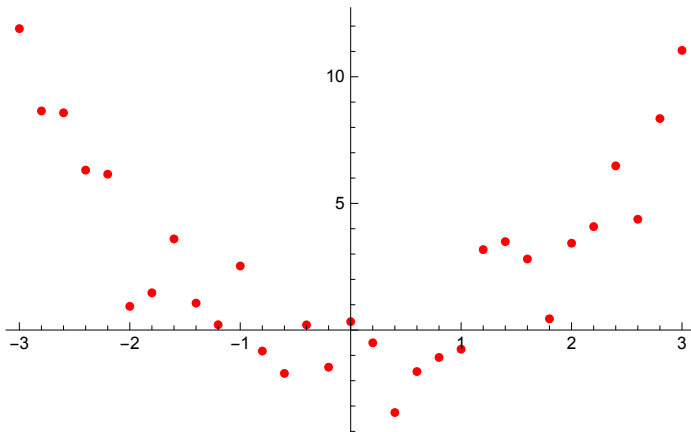
```
List@@data
```

```
{-3. → 11.9013, -2.8 → 8.64984, -2.6 → 8.57659, -2.4 → 6.3142, -2.2 → 6.15326,  
 -2. → 0.935989, -1.8 → 1.46992, -1.6 → 3.59723, -1.4 → 1.06316, -1.2 → 0.209442,  
 -1. → 2.52901, -0.8 → -0.829896, -0.6 → -1.71323, -0.4 → 0.204014, -0.2 → -1.46723,  
 0. → 0.331214, 0.2 → -0.502939, 0.4 → -3.25727, 0.6 → -1.63866, 0.8 → -1.08093,  
 1. → -0.756198, 1.2 → 3.17516, 1.4 → 3.48946, 1.6 → 2.80594, 1.8 → 0.444296,  
 2. → 3.42802, 2.2 → 4.0835, 2.4 → 6.48153, 2.6 → 4.37417, 2.8 → 8.35008, 3. → 11.0417}
```

```
List@@@data
```

```
{{-3., 11.9013}, {-2.8, 8.64984}, {-2.6, 8.57659}, {-2.4, 6.3142}, {-2.2, 6.15326},  
 {-2., 0.935989}, {-1.8, 1.46992}, {-1.6, 3.59723}, {-1.4, 1.06316}, {-1.2, 0.209442},  
 {-1., 2.52901}, {-0.8, -0.829896}, {-0.6, -1.71323}, {-0.4, 0.204014}, {-0.2, -1.46723},  
 {0., 0.331214}, {0.2, -0.502939}, {0.4, -3.25727}, {0.6, -1.63866}, {0.8, -1.08093},  
 {1., -0.756198}, {1.2, 3.17516}, {1.4, 3.48946}, {1.6, 2.80594}, {1.8, 0.444296},  
 {2., 3.42802}, {2.2, 4.0835}, {2.4, 6.48153}, {2.6, 4.37417}, {2.8, 8.35008}, {3., 11.0417}}
```

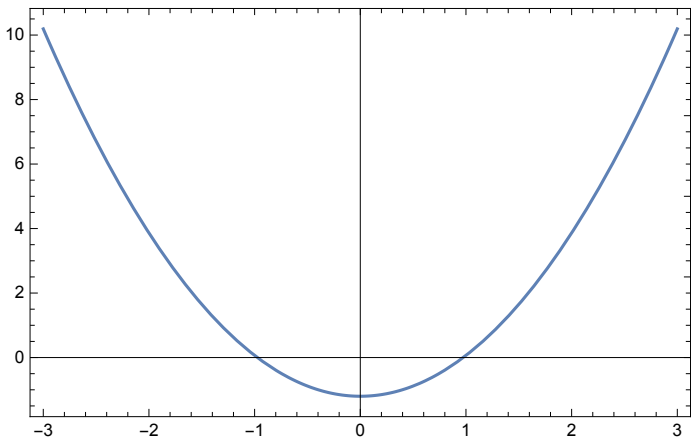
```
a1 = plot = ListPlot[List @@@ data, PlotStyle -> Red]
```



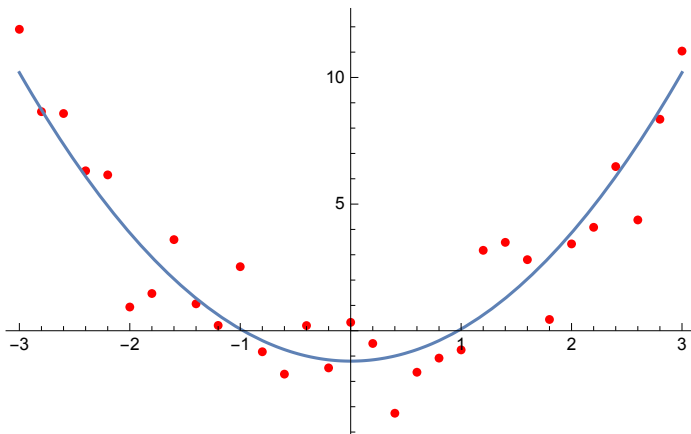
```
n1m = NonlinearModelFit[List @@@ data, a x^2 + b, {a, b}, x]
```

```
FittedModel[-1.19987 + 1.26571 x^2]
```

```
a2 = Show[Plot[n1m[x], {x, -3, 3}], Frame -> True]
```



```
Show[a1, a2]
```



```
net = NetChain[{150, Tanh, 150, Tanh, 1}, "Input" -> "Scalar", "Output" -> "Scalar"]
net1 = NetTrain[net, data, Method -> "ADAM"]
```

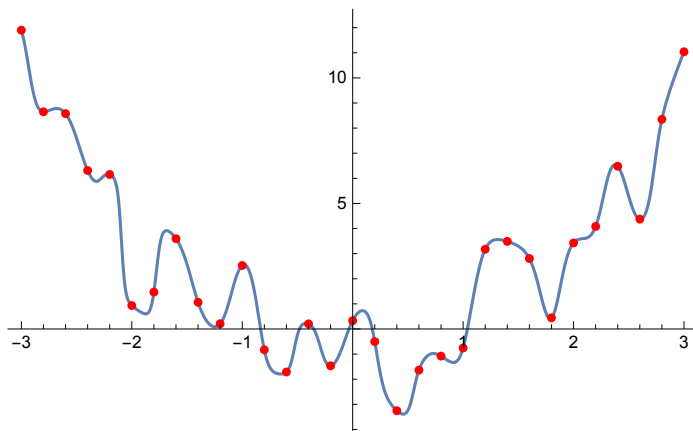
```
NetChain [  ]
```



```
NetChain [  ]
```



```
Show[Plot[net1[x], {x, -3, 3}], plot]
```



```
data = RandomSample[data];
{train, test} = TakeDrop[data, 24];
net2 = NetTrain[net, train, ValidationSet -> test]
```

```
NetChain [  ]
```

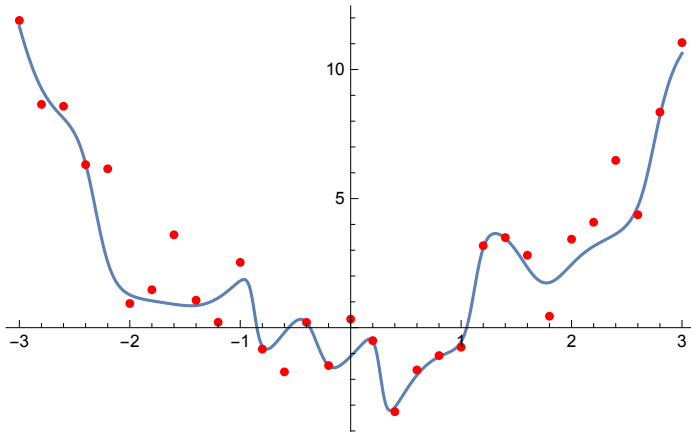


```
net2 = NetTrain[net, train, ValidationSet -> test]
```

```
NetChain [  ]
```



```
Show[Plot[net2[x], {x, -3, 3}], plot]
```

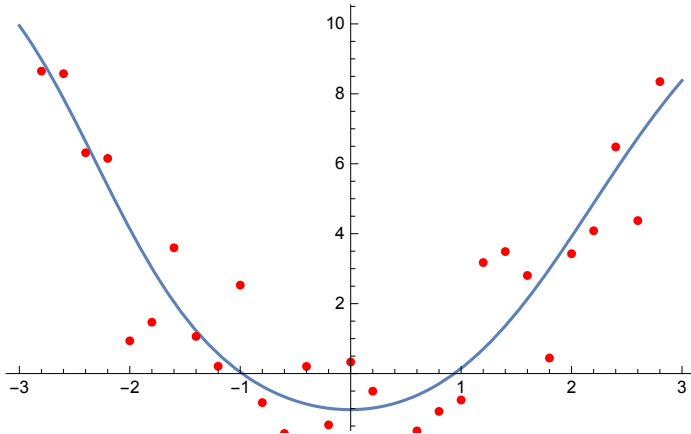


```
net3 = NetTrain[net, data, Method -> {"ADAM", "L2Regularization" -> 0.10}]
```

```
NetChain [  ]
```



```
Show[Plot[net3[x], {x, -3, 3}], plot]
```



```
net3[-3]
```

```
9.94843
```

```
For[i = 1, i ≤ Length[data], i++, Print["Iteratia:=", i];  
Print["x=", data[[i]][[1]], ";y=", data[[i]][[2]]]]
```

```
Iteratia:=1
```

```
x=-0.4;y=0.204014
```

```
Iteratia:=2
```

```
x=2.6;y=4.37417
```

```
Iteratia:=3
```

```
x=-1.2;y=0.209442
```

```
Iteratia:=4
```

x=1.4;y=3.48946
Iteratia:=5
x=-3.;y=11.9013
Iteratia:=6
x=0.4;y=-3.25727
Iteratia:=7
x=-2.6;y=8.57659
Iteratia:=8
x=1.2;y=3.17516
Iteratia:=9
x=2.;y=3.42802
Iteratia:=10
x=-0.2;y=-1.46723
Iteratia:=11
x=-1.4;y=1.06316
Iteratia:=12
x=-1.;y=2.52901
Iteratia:=13
x=0.8;y=-1.08093
Iteratia:=14
x=2.8;y=8.35008
Iteratia:=15
x=0.2;y=-0.502939
Iteratia:=16
x=0.6;y=-1.63866
Iteratia:=17
x=-2.8;y=8.64984
Iteratia:=18
x=1.;y=-0.756198
Iteratia:=19
x=-2.;y=0.935989
Iteratia:=20
x=-2.4;y=6.3142
Iteratia:=21
x=1.8;y=0.444296
Iteratia:=22

x=-0.8;y=-0.829896

Iteratia:=23

x=-1.8;y=1.46992

Iteratia:=24

x=1.6;y=2.80594

Iteratia:=25

x=3.;y=11.0417

Iteratia:=26

x=-1.6;y=3.59723

Iteratia:=27

x=0.;y=0.331214

Iteratia:=28

x=2.4;y=6.48153

Iteratia:=29

x=2.2;y=4.0835

Iteratia:=30

x=-2.2;y=6.15326

Iteratia:=31

x=-0.6;y=-1.71323

```
For[i = 1, i ≤ Length[data], i++, Print["Iteratia:=", i];  
  diferenta = net3[data[[i]][[1]]] - data[[i]][[2]];  
  Print[diferenta]]
```

Iteratia:=1

-1.07534

Iteratia:=2

2.3678

Iteratia:=3

0.3543

Iteratia:=4

-2.1273

Iteratia:=5

-1.95292

Iteratia:=6

2.40631

Iteratia:=7

-0.711981

Iteratia:=8
-2.47719
Iteratia:=9
0.48608
Iteratia:=10
0.474481
Iteratia:=11
0.162877
Iteratia:=12
-2.48944
Iteratia:=13
0.78879
Iteratia:=14
-0.750318
Iteratia:=15
-0.482212
Iteratia:=16
1.0163
Iteratia:=17
0.337549
Iteratia:=18
0.902679
Iteratia:=19
3.2014
Iteratia:=20
0.318169
Iteratia:=21
2.54646
Iteratia:=22
0.465436
Iteratia:=23
1.54699
Iteratia:=24
-0.674163
Iteratia:=25
-2.66181

```

Iteratia:=26
-1.55529
Iteratia:=27
-1.36228
Iteratia:=28
-0.658166
Iteratia:=29
0.786386
Iteratia:=30
-0.789275
Iteratia:=31
1.04902

```

Neural networks - fitting unidimensional functions - Example 2

```

data = Table[
  x → x^3 - 1 * Sin[x] + x^2 + RandomVariate[NormalDistribution[0, 1.15]], {x, -3, 3, .2}]
{-3. → -18.5056, -2.8 → -13.8727, -2.6 → -10.2163, -2.4 → -5.13506, -2.2 → -4.84505,
-2. → -3.34146, -1.8 → -3.5176, -1.6 → -1.72395, -1.4 → -2.1973, -1.2 → -0.583127,
-1. → 0.100725, -0.8 → -0.126424, -0.6 → 0.96393, -0.4 → 0.336701, -0.2 → 2.38153,
0. → 0.11811, 0.2 → -0.280514, 0.4 → -0.533424, 0.6 → 2.2669, 0.8 → 0.771408,
1. → 2.57241, 1.2 → 1.95851, 1.4 → 3.62513, 1.6 → 4.78974, 1.8 → 6.96426, 2. → 10.5092,
2.2 → 15.4215, 2.4 → 19.4179, 2.6 → 22.9977, 2.8 → 27.3934, 3. → 36.0758}

Length[data]
31

data[[1]][[1]]
-3.

data[[1]][[2]]
-18.5056

List@data
{{-3. → -18.5056, -2.8 → -13.8727, -2.6 → -10.2163, -2.4 → -5.13506, -2.2 → -4.84505,
-2. → -3.34146, -1.8 → -3.5176, -1.6 → -1.72395, -1.4 → -2.1973, -1.2 → -0.583127,
-1. → 0.100725, -0.8 → -0.126424, -0.6 → 0.96393, -0.4 → 0.336701, -0.2 → 2.38153,
0. → 0.11811, 0.2 → -0.280514, 0.4 → -0.533424, 0.6 → 2.2669, 0.8 → 0.771408,
1. → 2.57241, 1.2 → 1.95851, 1.4 → 3.62513, 1.6 → 4.78974, 1.8 → 6.96426, 2. → 10.5092,
2.2 → 15.4215, 2.4 → 19.4179, 2.6 → 22.9977, 2.8 → 27.3934, 3. → 36.0758}}

```

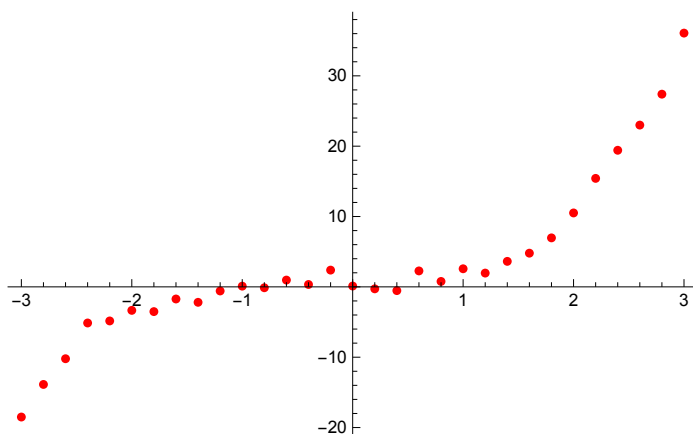
List @@ data

```
{-3. → -18.5056, -2.8 → -13.8727, -2.6 → -10.2163, -2.4 → -5.13506, -2.2 → -4.84505,
-2. → -3.34146, -1.8 → -3.5176, -1.6 → -1.72395, -1.4 → -2.1973, -1.2 → -0.583127,
-1. → 0.100725, -0.8 → -0.126424, -0.6 → 0.96393, -0.4 → 0.336701, -0.2 → 2.38153,
0. → 0.11811, 0.2 → -0.280514, 0.4 → -0.533424, 0.6 → 2.2669, 0.8 → 0.771408,
1. → 2.57241, 1.2 → 1.95851, 1.4 → 3.62513, 1.6 → 4.78974, 1.8 → 6.96426, 2. → 10.5092,
2.2 → 15.4215, 2.4 → 19.4179, 2.6 → 22.9977, 2.8 → 27.3934, 3. → 36.0758}
```

List @@@ data

```
{{-3., -18.5056}, {-2.8, -13.8727}, {-2.6, -10.2163}, {-2.4, -5.13506},
{-2.2, -4.84505}, {-2., -3.34146}, {-1.8, -3.5176}, {-1.6, -1.72395},
{-1.4, -2.1973}, {-1.2, -0.583127}, {-1., 0.100725}, {-0.8, -0.126424},
{-0.6, 0.96393}, {-0.4, 0.336701}, {-0.2, 2.38153}, {0., 0.11811},
{0.2, -0.280514}, {0.4, -0.533424}, {0.6, 2.2669}, {0.8, 0.771408}, {1., 2.57241},
{1.2, 1.95851}, {1.4, 3.62513}, {1.6, 4.78974}, {1.8, 6.96426}, {2., 10.5092},
{2.2, 15.4215}, {2.4, 19.4179}, {2.6, 22.9977}, {2.8, 27.3934}, {3., 36.0758}}
```

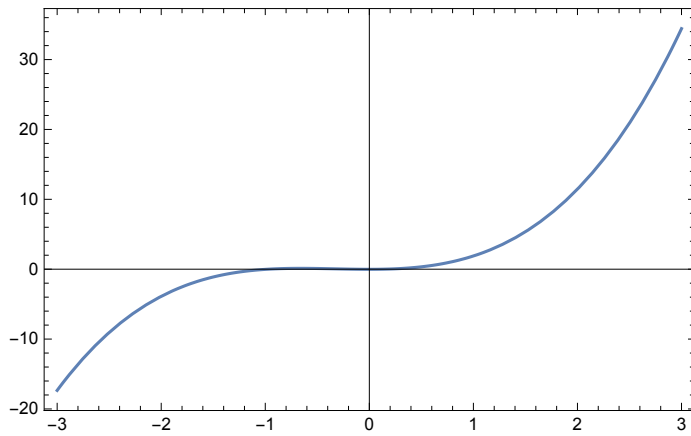
```
a1 = plot = ListPlot[List @@@ data, PlotStyle → Red]
```



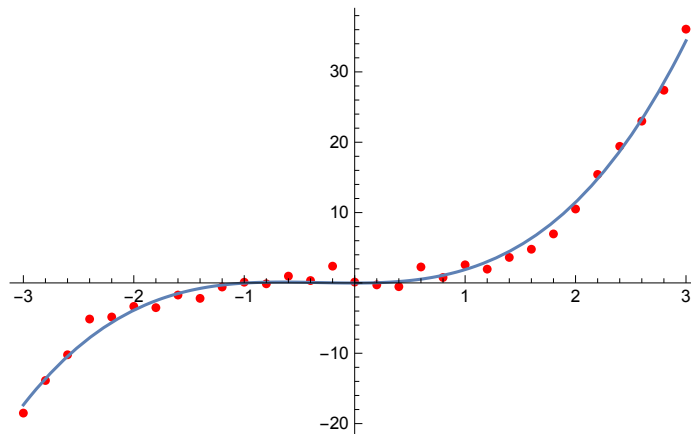
```
n1m = NonlinearModelFit[List @@@ data, a x^3 + b x^2 + c, {a, b, c}, x]
```

```
FittedModel[-0.0164791 + 0.950576 x2 + 0.958703 x3]
```

```
a2 = Show[Plot[nlm[x], {x, -3, 3}], Frame -> True]
```



```
Show[a1, a2]
```



```
net = NetChain[{150, Tanh, 150, Tanh, 1}, "Input" -> "Scalar", "Output" -> "Scalar"]  
net1 = NetTrain[net, data, Method -> "ADAM"]
```

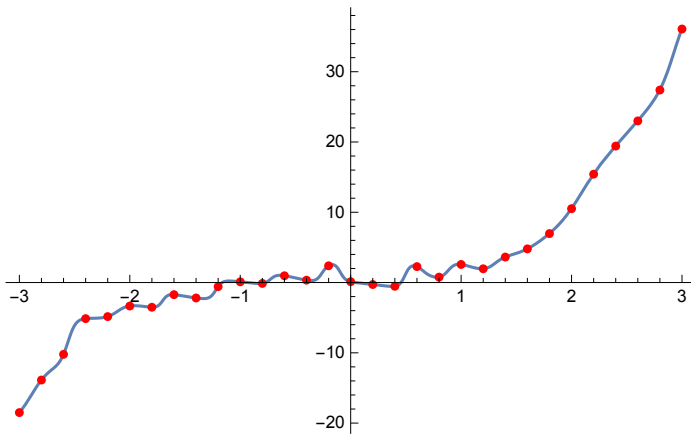
```
NetChain [  ]
```



```
NetChain [  ]
```



```
Show[Plot[net1[x], {x, -3, 3}], plot]
```



```
data = RandomSample[data];
{train, test} = TakeDrop[data, 24];
net2 = NetTrain[net, train, ValidationSet -> test]
```

```
NetChain [  ]
```

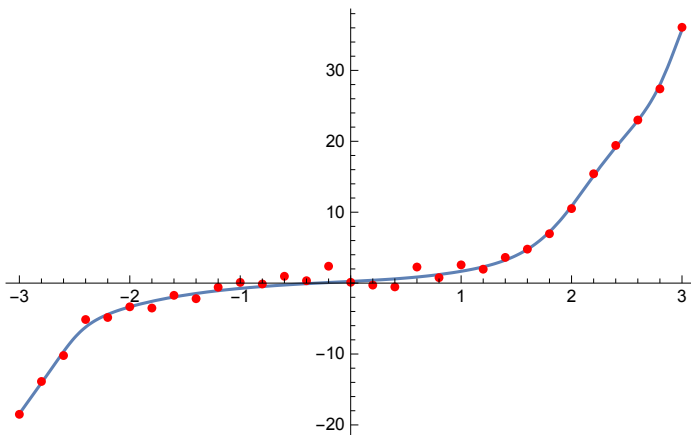


```
net2 = NetTrain[net, train, ValidationSet -> test]
```


```
NetChain [  ]
```



```
Show[Plot[net2[x], {x, -3, 3}], plot]
```

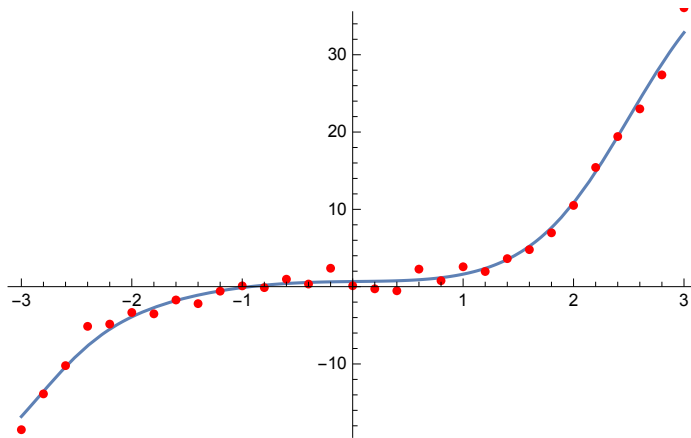


```
net3 = NetTrain[net, data, Method -> {"ADAM", "L2Regularization" -> 0.10}]
```

```
NetChain [  ]
```



```
Show[Plot[net3[x], {x, -3, 3}], plot]
```



```
net3[-3]
```

```
-16.802
```

```
For[i = 1, i ≤ Length[data], i++, Print["Iteratia:=", i];  
  Print["x=", data[[i]][[1]], ";y=", data[[i]][[2]]]]
```

```
Iteratia:=1
```

```
x=-1.;y=0.100725
```

```
Iteratia:=2
```

```
x=2.4;y=19.4179
```

```
Iteratia:=3
```

```
x=0.2;y=-0.280514
```

```
Iteratia:=4
```

```
x=-2.;y=-3.34146
```

```
Iteratia:=5
```

```
x=-2.8;y=-13.8727
```

```
Iteratia:=6
```

```
x=0.4;y=-0.533424
```

```
Iteratia:=7
```

```
x=0.;y=0.11811
```

```
Iteratia:=8
```

```
x=1.8;y=6.96426
```

```
Iteratia:=9
```

```
x=-2.6;y=-10.2163
```

```
Iteratia:=10
```

```
x=0.6;y=2.2669
```

```
Iteratia:=11
```

x=-1.8;y=-3.5176
Iteratia:=12
x=3.;y=36.0758
Iteratia:=13
x=2.;y=10.5092
Iteratia:=14
x=2.8;y=27.3934
Iteratia:=15
x=0.8;y=0.771408
Iteratia:=16
x=1.4;y=3.62513
Iteratia:=17
x=1.6;y=4.78974
Iteratia:=18
x=-2.2;y=-4.84505
Iteratia:=19
x=-0.4;y=0.336701
Iteratia:=20
x=2.6;y=22.9977
Iteratia:=21
x=-2.4;y=-5.13506
Iteratia:=22
x=-1.6;y=-1.72395
Iteratia:=23
x=-3.;y=-18.5056
Iteratia:=24
x=2.2;y=15.4215
Iteratia:=25
x=-0.6;y=0.96393
Iteratia:=26
x=-0.8;y=-0.126424
Iteratia:=27
x=1.2;y=1.95851
Iteratia:=28
x=-1.2;y=-0.583127
Iteratia:=29

```
x=-1.4;y=-2.1973
```

```
Iteratia:=30
```

```
x=-0.2;y=2.38153
```

```
Iteratia:=31
```

```
x=1.;y=2.57241
```

```
For[i = 1, i ≤ Length[data], i++, Print["Iteratia:=", i];  
  diferenta = net3[data[[i]][[1]]] - data[[i]][[2]];  
  Print[diferenta]]
```

```
Iteratia:=1
```

```
-0.224306
```

```
Iteratia:=2
```

```
0.00590138
```

```
Iteratia:=3
```

```
0.976894
```

```
Iteratia:=4
```

```
-0.569239
```

```
Iteratia:=5
```

```
0.322509
```

```
Iteratia:=6
```

```
1.29276
```

```
Iteratia:=7
```

```
0.544419
```

```
Iteratia:=8
```

```
0.666115
```

```
Iteratia:=9
```

```
-0.162125
```

```
Iteratia:=10
```

```
-1.37189
```

```
Iteratia:=11
```

```
0.805253
```

```
Iteratia:=12
```

```
-3.21146
```

```
Iteratia:=13
```

```
0.329985
```

```
Iteratia:=14
```

```
1.43866
```


Iteratia:=15
0.386088
Iteratia:=16
-0.106738
Iteratia:=17
0.434837
Iteratia:=18
-0.668425
Iteratia:=19
0.207531
Iteratia:=20
1.23655
Iteratia:=21
-2.51583
Iteratia:=22
-0.0766193
Iteratia:=23
1.70359
Iteratia:=24
-0.585753
Iteratia:=25
-0.557782
Iteratia:=26
0.315076
Iteratia:=27
0.405178
Iteratia:=28
0.0379421
Iteratia:=29
1.10275
Iteratia:=30
-1.7598
Iteratia:=31
-0.955967