Semester Project - CPU Temps

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1 Overview

As a Computer Scientist, I have a number of interests. Many of these interests overlap. While designing this project, I happened to be batch encoding some videos. I decided to write a quick script to grab CPU temperature data every 30 seconds. This resulted in three sets of data:

- sensors-2018.12.26.txt
- sensors-2019.01.26.txt
- sensors-2019.02.09.txt

- sensors-2018.12.26-no-labels.txt
- sensors-2019.01.26-no-labels.txt
- sensors-2019.02.09-no-labels.txt

To visualize this data I used Gnuplot to generate three graphs:

- sensors-2018.12.26.svg
- sensors-2019.01.26.svg
- sensors-2019.02.09.svg

Click on each item to view either the graph or raw text file.

Each of the encoding jobs ran for 5 to 10 hours. If you look at the data you see four temperatures for each reading. My CPU is a 4-core (8 thread) Intel i7-6700K. I found myself interested in not only the behavior of the readings, but also in the temperature differences between the 4 CPU cores.

1.1 Input

Data takes the form of temperatures in a `txt` file. All data points are whitespace delimited. For example, if I had 5

temperature readings:

Example 1: Sample Input with Labels

```
+61.0°C +63.0°C +50.0°C +58.0°C
+80.0°C +81.0°C +68.0°C +77.0°C
+62.0°C +63.0°C +52.0°C +60.0°C
+83.0°C +82.0°C +70.0°C +79.0°C
+68.0°C +69.0°C +58.0°C +65.0°C
```

Example 2: Sample Input without Labels

```
61.0 63.0 50.0 58.0
80.0 81.0 68.0 77.0
62.0 63.0 52.0 60.0
83.0 82.0 70.0 79.0
68.0 69.0 58.0 65.0
```

would be a possible input files. Each line represents temperature readings from 4 processor cores. Process each temperature column independently. Readings are taken every 30 seconds. In this example:

- line 1 is 0 *sec*
- line 2 is 30 *sec*,
- line 3 is 60 *sec*.
- line 4 is 90 *sec*.
- line 5 is 120 *sec*.
- line 6 is 150 *sec*.
- line 7 is 180 *sec*.

Your first step should be to pre-process this data into a usable form. **Conceptually,** you need the data in the following format:

Time (sec)	Core 0	Core 1	Core 2	Core 3
0	61.0	63.0	50.0	58.0
30	80.0	81.0	68.0	77.0
60	62.0	63.0	52.0	60.0
90	83.0	82.0	70.0	79.0
120	68.0	69.0	58.0	65.0

This table is a conceptual visualization of the data. You may select any combination data structures, e.g., ADTS (classes or structs), arrays, lists, vectors, or maps.

This “table” can be represented by five vectors (or similar data structure), e.g.,

Example 3: Data Structures: C++

```
std::vector<int> time = {};
std::vector<double> readings_core_0 = {};
std::vector<double> readings_core_1 = {};
std::vector<double> readings_core_2 = {};
std::vector<double> readings_core_3 = {};
```

Example 4: Data Structures: Java

```
int[] time = new int[numberOfReadings];
double[] readings_core_0 = new double[numberOfReadings];
double[] readings_core_1 = new double[numberOfReadings];
double[] readings_core_2 = new double[numberOfReadings];
double[] readings_core_3 = new double[numberOfReadings];
```

Example 5: Data Structures: Python

```
time = []
readings_core_0 = []
readings_core_1 = []
readings_core_2 = []
readings_core_3 = []
```

1.2 Import Input Libraries

You may opt to `#include` or `import` the C++, Java, or Python input libraries provided here.

1.3 Output Format

All output must be written to text files (one file per core). Each line must take the form:

$x_k <= x < x_{k+1}$; $y_i = c_0 + c_1 x$; *type*

where

- x_k and x_{k+1} are the domain in which y_k is applicable
- y_k is the k^{th} function
- *type* is either *least-squares* or *interpolation*

For the example data in described in Section 2.1 (Input Format) you would generate 4 output files.

- `{basename}-core-0.{txt}`
- `{basename}-core-1.{txt}`
- `{basename}-core-2.{txt}`
- `{basename}-core-3.{txt}`

You will have:

- $n - 1$ interpolation lines for each core
- **exactly one least squares approximation line for each core**

2 Sample Execution & Output

2.1 Input Data

The Overview listed three input files, as an introduction. If you would like more test data…

- sensors-2018.12.26.txt
- sensors-2019.01.26.txt
- sensors-2019.02.09.txt
- sensors-2019.06.07.txt
- sensors-2019.06.14.txt
- sensors-2019.07.12.txt
- sensors-2019.08.04.txt
- sensors-2019.08.12.txt
- sensors-2019.08.25.txt
- sensors-2019.09.07.txt
- sensors-2019.12.24.txt
- sensors-2019.12.25.txt
- sensors-2019.12.26.txt
- sensors-2019.12.29.txt
- sensors-2020.01.02.txt

- sensors-2018.12.26-no-labels.txt
- sensors-2019.01.26-no-labels.txt
- sensors-2019.02.09-no-labels.txt
- sensors-2019.06.07-no-labels.txt
- sensors-2019.06.14-no-labels.txt
- sensors-2019.07.12-no-labels.txt
- sensors-2019.08.04-no-labels.txt
- sensors-2019.08.12-no-labels.txt
- sensors-2019.08.25-no-labels.txt
- sensors-2019.09.07-no-labels.txt
- sensors-2019.12.24-no-labels.txt
- sensors-2019.12.25-no-labels.txt
- sensors-2019.12.26-no-labels.txt
- sensors-2019.12.29-no-labels.txt
- sensors-2020.01.02-no-labels.txt

2.2 Sample Output

The following is an example of *piecewise linear interpolation* output for a single core.

ex-interpolation-one-core.txt +

```
   0 <= x <   30; y_0    =   61.0000 +  0.6333x; interpolation
  30 <= x <   60; y_1    =   98.0000 + -0.6000x; interpolation
  60 <= x <   90; y_2    =   20.0000 +  0.7000x; interpolation
  90 <= x <  120; y_3    =  128.0000 + -0.5000x; interpolation
 120 <= x <  150; y_4    =   12.0000 +  0.4667x; interpolation
 150 <= x <  180; y_5    =  112.0000 + -0.2000x; interpolation
 180 <= x <  210; y_6    =   34.0000 +  0.2333x; interpolation
 210 <= x <  240; y_7    =  146.0000 + -0.3000x; interpolation
 240 <= x <  270; y_8    =    2.0000 +  0.3000x; interpolation
 270 <= x <  300; y_9    =  137.0000 + -0.2000x; interpolation
 300 <= x <  330; y_10   =  197.0000 + -0.4000x; interpolation
 330 <= x <  360; y_11   =  -78.0000 +  0.4333x; interpolation
 360 <= x <  390; y_12   =  222.0000 + -0.4000x; interpolation
 390 <= x <  420; y_13   =   79.0000 + -0.0333x; interpolation
 420 <= x <  450; y_14   = -215.0000 +  0.6667x; interpolation
 450 <= x <  480; y_15   =   85.0000 +  0.0000x; interpolation
 480 <= x <  510; y_16   =  389.0000 + -0.6333x; interpolation
 510 <= x <  540; y_17   =  151.0000 + -0.1667x; interpolation
 540 <= x <  570; y_18   = -353.0000 +  0.7667x; interpolation
 570 <= x <  600; y_19   =  445.0000 + -0.6333x; interpolation
 600 <= x <  630; y_20   =   45.0000 +  0.0333x; interpolation
 630 <= x <  660; y_21   =   87.0000 + -0.0333x; interpolation
 660 <= x <  690; y_22   = -375.0000 +  0.6667x; interpolation
 690 <= x <  720; y_23   =   85.0000 +  0.0000x; interpolation
 720 <= x <  750; y_24   =  541.0000 + -0.6333x; interpolation
 750 <= x <  780; y_25   = -434.0000 +  0.6667x; interpolation
 780 <= x <  810; y_26   =   86.0000 +  0.0000x; interpolation
 810 <= x <  840; y_27   =  167.0000 + -0.1000x; interpolation
 840 <= x <  870; y_28   =   -1.0000 +  0.1000x; interpolation
 870 <= x <  900; y_29   =   86.0000 +  0.0000x; interpolation
 900 <= x <  930; y_30   =   56.0000 +  0.0333x; interpolation
 930 <= x <  960; y_31   =  118.0000 + -0.0333x; interpolation
 960 <= x <  990; y_32   =  246.0000 + -0.1667x; interpolation
 990 <= x < 1020; y_33   =  -51.0000 +  0.1333x; interpolation
1020 <= x < 1050; y_34   =  731.0000 + -0.6333x; interpolation
```

```
1050 <= x <    1080; y_35     =     101.0000 +  -0.0333x; interpolation
1080 <= x <    1110; y_36     =    -619.0000 +   0.6333x; interpolation
1110 <= x <    1140; y_37     =      84.0000 +   0.0000x; interpolation
1140 <= x <    1170; y_38     =     160.0000 +  -0.0667x; interpolation
1170 <= x <    1200; y_39     =     121.0000 +  -0.0333x; interpolation
1200 <= x <    1230; y_40     =       1.0000 +   0.0667x; interpolation
1230 <= x <    1260; y_41     =      42.0000 +   0.0333x; interpolation
1260 <= x <    1290; y_42     =     -42.0000 +   0.1000x; interpolation
1290 <= x <    1320; y_43     =     302.0000 +  -0.1667x; interpolation
1320 <= x <    1350; y_44     =    1006.0000 +  -0.7000x; interpolation
1350 <= x <    1380; y_45     =     -29.0000 +   0.0667x; interpolation
1380 <= x <    1410; y_46     =    -121.0000 +   0.1333x; interpolation
1410 <= x <    1440; y_47     =    -685.0000 +   0.5333x; interpolation
1440 <= x <    1470; y_48     =     -13.0000 +   0.0667x; interpolation
1470 <= x <    1500; y_49     =     -13.0000 +   0.0667x; interpolation
1500 <= x <    1530; y_50     =     437.0000 +  -0.2333x; interpolation
1530 <= x <    1560; y_51     =     845.0000 +  -0.5000x; interpolation
1560 <= x <    1590; y_52     =    -871.0000 +   0.6000x; interpolation
1590 <= x <    1620; y_53     =     -23.0000 +   0.0667x; interpolation
1620 <= x <    1650; y_54     =      85.0000 +   0.0000x; interpolation
1650 <= x <    1680; y_55     =    1185.0000 +  -0.6667x; interpolation
1680 <= x <    1710; y_56     =    -999.0000 +   0.6333x; interpolation
1710 <= x <    1740; y_57     =    1167.0000 +  -0.6333x; interpolation
1740 <= x <    1770; y_58     =    -109.0000 +   0.1000x; interpolation
1770 <= x <    1800; y_59     =     245.0000 +  -0.1000x; interpolation
1800 <= x <    1830; y_60     =   -1015.0000 +   0.6000x; interpolation
1830 <= x <    1860; y_61     =    1181.0000 +  -0.6000x; interpolation
1860 <= x <    1890; y_62     =       3.0000 +   0.0333x; interpolation
1890 <= x <    1920; y_63     =   -1194.0000 +   0.6667x; interpolation
1920 <= x <    1950; y_64     =    1238.0000 +  -0.6000x; interpolation
1950 <= x <    1980; y_65     =     328.0000 +  -0.1333x; interpolation
1980 <= x <    2010; y_66     =    -134.0000 +   0.1000x; interpolation
2010 <= x <    2040; y_67     =     134.0000 +  -0.0333x; interpolation
2040 <= x <    2070; y_68     =      66.0000 +   0.0000x; interpolation
2070 <= x <    2100; y_69     =   -1314.0000 +   0.6667x; interpolation
2100 <= x <    2130; y_70     =     646.0000 +  -0.2667x; interpolation
2130 <= x <    2160; y_71     =    3628.0000 +  -1.6667x; interpolation
2160 <= x <    2190; y_72     =     172.0000 +  -0.0667x; interpolation
2190 <= x <    2220; y_73     =   -4062.0000 +   1.8667x; interpolation
2220 <= x <    2250; y_74     =    1192.0000 +  -0.5000x; interpolation
2250 <= x <    2280; y_75     =   -1208.0000 +   0.5667x; interpolation
2280 <= x <    2310; y_76     =    1452.0000 +  -0.6000x; interpolation
2310 <= x <    2340; y_77     =   -1397.0000 +   0.6333x; interpolation
2340 <= x <    2370; y_78     =     -71.0000 +   0.0667x; interpolation
2370 <= x <    2400; y_79     =    1825.0000 +  -0.7333x; interpolation
2400 <= x <    2430; y_80     =   -1535.0000 +   0.6667x; interpolation
2430 <= x <    2460; y_81     =     247.0000 +  -0.0667x; interpolation
2460 <= x <    2490; y_82     =    1395.0000 +  -0.5333x; interpolation
2490 <= x <    2520; y_83     =     150.0000 +  -0.0333x; interpolation
2520 <= x <    2550; y_84     =     -18.0000 +   0.0333x; interpolation
2550 <= x <    2580; y_85     =   -1463.0000 +   0.6000x; interpolation
2580 <= x <    2610; y_86     =     -87.0000 +   0.0667x; interpolation
2610 <= x <    2640; y_87     =    2088.0000 +  -0.7667x; interpolation
2640 <= x <    2670; y_88     =    -288.0000 +   0.1333x; interpolation
2670 <= x <    2700; y_89     =   -1534.0000 +   0.6000x; interpolation
2700 <= x <    2730; y_90     =     266.0000 +  -0.0667x; interpolation
2730 <= x <    2760; y_91     =      -7.0000 +   0.0333x; interpolation
2760 <= x <    2790; y_92     =     269.0000 +  -0.0667x; interpolation
2790 <= x <    2820; y_93     =    1664.0000 +  -0.5667x; interpolation
2820 <= x <    2850; y_94     =    -122.0000 +   0.0667x; interpolation
2850 <= x <    2880; y_95     =    -502.0000 +   0.2000x; interpolation
2880 <= x <    2910; y_96     =     554.0000 +  -0.1667x; interpolation
2910 <= x <    2940; y_97     =   -1580.0000 +   0.5667x; interpolation
2940 <= x <    2970; y_98     =     576.0000 +  -0.1667x; interpolation
2970 <= x <    3000; y_99     =    -315.0000 +   0.1333x; interpolation
3000 <= x <    3030; y_100    =     285.0000 +  -0.0667x; interpolation
3030 <= x <    3060; y_101    =     -18.0000 +   0.0333x; interpolation
3060 <= x <    3090; y_102    =     186.0000 +  -0.0333x; interpolation
```

```
3090 <= x <    3120; y_103    =    -432.0000 +   0.1667x; interpolation
3120 <= x <    3150; y_104    =     296.0000 +  -0.0667x; interpolation
3150 <= x <    3180; y_105    =    2186.0000 +  -0.6667x; interpolation
3180 <= x <    3210; y_106    =   -1736.0000 +   0.5667x; interpolation
3210 <= x <    3240; y_107    =    1902.0000 +  -0.5667x; interpolation
3240 <= x <    3270; y_108    =    -258.0000 +   0.1000x; interpolation
3270 <= x <    3300; y_109    =   -1784.0000 +   0.5667x; interpolation
3300 <= x <    3330; y_110    =     416.0000 +  -0.1000x; interpolation
3330 <= x <    3360; y_111    =    -250.0000 +   0.1000x; interpolation
3360 <= x <    3390; y_112    =     -26.0000 +   0.0333x; interpolation
3390 <= x <    3420; y_113    =      87.0000 +   0.0000x; interpolation
3420 <= x <    3450; y_114    =     315.0000 +  -0.0667x; interpolation
3450 <= x <    3480; y_115    =      85.0000 +   0.0000x; interpolation
3480 <= x <    3510; y_116    =    1941.0000 +  -0.5333x; interpolation
3510 <= x <    3540; y_117    =   -1803.0000 +   0.5333x; interpolation
3540 <= x <    3570; y_118    =     321.0000 +  -0.0667x; interpolation
3570 <= x <    3600; y_119    =    -274.0000 +   0.1000x; interpolation
3600 <= x <    3630; y_120    =     446.0000 +  -0.1000x; interpolation
3630 <= x <    3660; y_121    =    -522.0000 +   0.1667x; interpolation
3660 <= x <    3690; y_122    =     576.0000 +  -0.1333x; interpolation
3690 <= x <    3720; y_123    =     -39.0000 +   0.0333x; interpolation
3720 <= x <    3750; y_124    =     209.0000 +  -0.0333x; interpolation
3750 <= x <    3780; y_125    =    2334.0000 +  -0.6000x; interpolation
3780 <= x <    3810; y_126    =   -2454.0000 +   0.6667x; interpolation
3810 <= x <    3840; y_127    =     -41.0000 +   0.0333x; interpolation
3840 <= x <    3870; y_128    =     599.0000 +  -0.1333x; interpolation
3870 <= x <    3900; y_129    =    2276.0000 +  -0.5667x; interpolation
3900 <= x <    3930; y_130    =      66.0000 +   0.0000x; interpolation
3930 <= x <    3960; y_131    =   -2554.0000 +   0.6667x; interpolation
3960 <= x <    3990; y_132    =    1010.0000 +  -0.2333x; interpolation
3990 <= x <    4020; y_133    =    1808.0000 +  -0.4333x; interpolation
4020 <= x <    4050; y_134    =    -202.0000 +   0.0667x; interpolation
4050 <= x <    4080; y_135    =   -1957.0000 +   0.5000x; interpolation
4080 <= x <    4110; y_136    =      83.0000 +   0.0000x; interpolation
4110 <= x <    4140; y_137    =    2549.0000 +  -0.6000x; interpolation
4140 <= x <    4170; y_138    =   -2833.0000 +   0.7000x; interpolation
4170 <= x <    4200; y_139    =     781.0000 +  -0.1667x; interpolation
4200 <= x <    4230; y_140    =    2321.0000 +  -0.5333x; interpolation
4230 <= x <    4260; y_141    =   -3037.0000 +   0.7333x; interpolation
4260 <= x <    4290; y_142    =     371.0000 +  -0.0667x; interpolation
4290 <= x <    4320; y_143    =    2945.0000 +  -0.6667x; interpolation
4320 <= x <    4350; y_144    =    -511.0000 +   0.1333x; interpolation
4350 <= x <    4380; y_145    =   -2251.0000 +   0.5333x; interpolation
4380 <= x <    4410; y_146    =    2859.0000 +  -0.6333x; interpolation
4410 <= x <    4440; y_147    =    5799.0000 +  -1.3000x; interpolation
4440 <= x <    4470; y_148    =   -5893.0000 +   1.3333x; interpolation
4470 <= x <    4500; y_149    =     365.0000 +  -0.0667x; interpolation
4500 <= x <    4530; y_150    =   -2185.0000 +   0.5000x; interpolation
4530 <= x <    4560; y_151    =    -977.0000 +   0.2333x; interpolation
4560 <= x <    4590; y_152    =    1303.0000 +  -0.2667x; interpolation
4590 <= x <    4620; y_153    =   -1145.0000 +   0.2667x; interpolation
4620 <= x <    4650; y_154    =    1319.0000 +  -0.2667x; interpolation
4650 <= x <    4680; y_155    =   -1161.0000 +   0.2667x; interpolation
4680 <= x <    4710; y_156    =    1179.0000 +  -0.2333x; interpolation
4710 <= x <    4740; y_157    =   -1019.0000 +   0.2333x; interpolation
4740 <= x <    4770; y_158    =     403.0000 +  -0.0667x; interpolation
4770 <= x <    4800; y_159    =    3424.0000 +  -0.7000x; interpolation
4800 <= x <    4830; y_160    =   -3616.0000 +   0.7667x; interpolation
4830 <= x <    4860; y_161    =    3629.0000 +  -0.7333x; interpolation
4860 <= x <    4890; y_162    =   -3175.0000 +   0.6667x; interpolation
4890 <= x <    4920; y_163    =    3345.0000 +  -0.6667x; interpolation
4920 <= x <    4950; y_164    =   -3379.0000 +   0.7000x; interpolation
4950 <= x <    4980; y_165    =    3386.0000 +  -0.6667x; interpolation
4980 <= x <    5010; y_166    =    -764.0000 +   0.1667x; interpolation
5010 <= x <    5040; y_167    =   -2100.0000 +   0.4333x; interpolation
5040 <= x <    5070; y_168    =    2436.0000 +  -0.4667x; interpolation
5070 <= x <    5100; y_169    =   -1620.0000 +   0.3333x; interpolation
5100 <= x <    5130; y_170    =      80.0000 +   0.0000x; interpolation
```

```
5130 <= x <    5160; y_171    =    2474.0000 +  -0.4667x; interpolation
5160 <= x <    5190; y_172    =   -3202.0000 +   0.6333x; interpolation
5190 <= x <    5220; y_173    =    3199.0000 +  -0.6000x; interpolation
5220 <= x <    5250; y_174    =    1111.0000 +  -0.2000x; interpolation
5250 <= x <    5280; y_175    =    -989.0000 +   0.2000x; interpolation
5280 <= x <    5310; y_176    =    -813.0000 +   0.1667x; interpolation
5310 <= x <    5340; y_177    =   -2406.0000 +   0.4667x; interpolation
5340 <= x <    5370; y_178    =    2400.0000 +  -0.4333x; interpolation
5370 <= x <    5400; y_179    =   -1896.0000 +   0.3667x; interpolation
5400 <= x <    5430; y_180    =    2064.0000 +  -0.3667x; interpolation
5430 <= x <    5460; y_181    =   -1737.0000 +   0.3333x; interpolation
5460 <= x <    5490; y_182    =    1175.0000 +  -0.2000x; interpolation
5490 <= x <    5520; y_183    =    2090.0000 +  -0.3667x; interpolation
5520 <= x <    5550; y_184    =   -3246.0000 +   0.6000x; interpolation
5550 <= x <    5580; y_185    =    3044.0000 +  -0.5333x; interpolation
5580 <= x <    5610; y_186    =   -2722.0000 +   0.5000x; interpolation
5610 <= x <    5640; y_187    =    3075.0000 +  -0.5333x; interpolation
5640 <= x <    5670; y_188    =   -3505.0000 +   0.6333x; interpolation
5670 <= x <    5700; y_189    =    1598.0000 +  -0.2667x; interpolation
5700 <= x <    5730; y_190    =    2738.0000 +  -0.4667x; interpolation
5730 <= x <    5760; y_191    =   -3947.0000 +   0.7000x; interpolation
5760 <= x <    5790; y_192    =    3733.0000 +  -0.6333x; interpolation
5790 <= x <    5820; y_193    =   -3987.0000 +   0.7000x; interpolation
5820 <= x <    5850; y_194    =    4355.0000 +  -0.7333x; interpolation
5850 <= x <    5880; y_195    =   -4225.0000 +   0.7333x; interpolation
5880 <= x <    5910; y_196    =    4203.0000 +  -0.7000x; interpolation
5910 <= x <    5940; y_197    =   -3480.0000 +   0.6000x; interpolation
5940 <= x <    5970; y_198    =    -312.0000 +   0.0667x; interpolation
5970 <= x <    6000; y_199    =     683.0000 +  -0.1000x; interpolation
6000 <= x <    6030; y_200    =    3683.0000 +  -0.6000x; interpolation
6030 <= x <    6060; y_201    =   -3955.0000 +   0.6667x; interpolation
6060 <= x <    6090; y_202    =    3923.0000 +  -0.6333x; interpolation
6090 <= x <    6120; y_203    =   -4197.0000 +   0.7000x; interpolation
6120 <= x <    6150; y_204    =     903.0000 +  -0.1333x; interpolation
6150 <= x <    6180; y_205    =      83.0000 +   0.0000x; interpolation
6180 <= x <    6210; y_206    =    -947.0000 +   0.1667x; interpolation
6210 <= x <    6240; y_207    =    4642.0000 +  -0.7333x; interpolation
6240 <= x <    6270; y_208    =   -3886.0000 +   0.6333x; interpolation
6270 <= x <    6300; y_209    =    3847.0000 +  -0.6000x; interpolation
6300 <= x <    6330; y_210    =   -4133.0000 +   0.6667x; interpolation
6330 <= x <    6360; y_211    =    4096.0000 +  -0.6333x; interpolation
6360 <= x <    6390; y_212    =   -3748.0000 +   0.6000x; interpolation
6390 <= x <    6420; y_213    =    -127.0000 +   0.0333x; interpolation
6420 <= x <    6450; y_214    =     515.0000 +  -0.0667x; interpolation
6450 <= x <    6480; y_215    =     515.0000 +  -0.0667x; interpolation
6480 <= x <    6510; y_216    =    3971.0000 +  -0.6000x; interpolation
6510 <= x <    6540; y_217    =   -4709.0000 +   0.7333x; interpolation
6540 <= x <    6570; y_218    =    4665.0000 +  -0.7000x; interpolation
6570 <= x <    6600; y_219    =   -4095.0000 +   0.6333x; interpolation
6600 <= x <    6630; y_220    =    4265.0000 +  -0.6333x; interpolation
6630 <= x <    6660; y_221    =    -376.0000 +   0.0667x; interpolation
6660 <= x <    6690; y_222    =   -3706.0000 +   0.5667x; interpolation
6690 <= x <    6720; y_223    =     531.0000 +  -0.0667x; interpolation
6720 <= x <    6750; y_224    =    3891.0000 +  -0.5667x; interpolation
6750 <= x <    6780; y_225    =     516.0000 +  -0.0667x; interpolation
6780 <= x <    6810; y_226    =    7070.0000 +  -1.0333x; interpolation
6810 <= x <    6840; y_227    =     714.0000 +  -0.1000x; interpolation
6840 <= x <    6870; y_228    =  -11370.0000 +   1.6667x; interpolation
6870 <= x <    6900; y_229    =    -607.0000 +   0.1000x; interpolation
6900 <= x <    6930; y_230    =    -377.0000 +   0.0667x; interpolation
6930 <= x <    6960; y_231    =     316.0000 +  -0.0333x; interpolation
6960 <= x <    6990; y_232    =    1012.0000 +  -0.1333x; interpolation
6990 <= x <    7020; y_233    =      80.0000 +   0.0000x; interpolation
7020 <= x <    7050; y_234    =    1484.0000 +  -0.2000x; interpolation
7050 <= x <    7080; y_235    =   -1336.0000 +   0.2000x; interpolation
7080 <= x <    7110; y_236    =   -1572.0000 +   0.2333x; interpolation
7110 <= x <    7140; y_237    =    5775.0000 +  -0.8000x; interpolation
7140 <= x <    7170; y_238    =   -4697.0000 +   0.6667x; interpolation
```

```
7170 <= x <  7200; y_239 =    83.0000 +  0.0000x; interpolation
7200 <= x <  7230; y_240 =  -397.0000 +  0.0667x; interpolation
7230 <= x <  7260; y_241 =   326.0000 + -0.0333x; interpolation
7260 <= x <  7290; y_242 =  4682.0000 + -0.6333x; interpolation
7290 <= x <  7320; y_243 = -5281.0000 +  0.7333x; interpolation
7320 <= x <  7350; y_244 =  5211.0000 + -0.7000x; interpolation
7350 <= x <  7380; y_245 =  -179.0000 +  0.0333x; interpolation
7380 <= x <  7410; y_246 = -4853.0000 +  0.6667x; interpolation
7410 <= x <  7440; y_247 =  5027.0000 + -0.6667x; interpolation
7440 <= x <  7470; y_248 = -5141.0000 +  0.7000x; interpolation
7470 <= x <  7500; y_249 =  1084.0000 + -0.1333x; interpolation
7500 <= x <  7530; y_250 =    84.0000 +  0.0000x; interpolation
7530 <= x <  7560; y_251 =  2092.0000 + -0.2667x; interpolation
7560 <= x <  7590; y_252 =  3100.0000 + -0.4000x; interpolation
7590 <= x <  7620; y_253 =  -695.0000 +  0.1000x; interpolation
7620 <= x <  7650; y_254 = -3997.0000 +  0.5333x; interpolation
7650 <= x <  7680; y_255 =    83.0000 +  0.0000x; interpolation
7680 <= x <  7710; y_256 =  -685.0000 +  0.1000x; interpolation
7710 <= x <  7740; y_257 =   343.0000 + -0.0333x; interpolation
7740 <= x <  7770; y_258 =  5245.0000 + -0.6667x; interpolation
7770 <= x <  7800; y_259 =  -453.0000 +  0.0667x; interpolation
7800 <= x <  7830; y_260 = -4093.0000 +  0.5333x; interpolation
7830 <= x <  7860; y_261 =  3998.0000 + -0.5000x; interpolation
7860 <= x <  7890; y_262 = -4910.0000 +  0.6333x; interpolation
7890 <= x <  7920; y_263 =    87.0000 +  0.0000x; interpolation
7920 <= x <  7950; y_264 =   351.0000 + -0.0333x; interpolation
7950 <= x <  7980; y_265 =   351.0000 + -0.0333x; interpolation
7980 <= x <  8010; y_266 =  5405.0000 + -0.6667x; interpolation
8010 <= x <  8040; y_267 = -4474.0000 +  0.5667x; interpolation
8040 <= x <  8070; y_268 =  4370.0000 + -0.5333x; interpolation
8070 <= x <  8100; y_269 = -5045.0000 +  0.6333x; interpolation
8100 <= x <  8130; y_270 =  4945.0000 + -0.6000x; interpolation
8130 <= x <  8160; y_271 =  -475.0000 +  0.0667x; interpolation
8160 <= x <  8190; y_272 =   885.0000 + -0.1000x; interpolation
8190 <= x <  8220; y_273 = -5940.0000 +  0.7333x; interpolation
8220 <= x <  8250; y_274 =   636.0000 + -0.0667x; interpolation
8250 <= x <  8280; y_275 =  5036.0000 + -0.6000x; interpolation
8280 <= x <  8310; y_276 = -4900.0000 +  0.6000x; interpolation
8310 <= x <  8340; y_277 =  5072.0000 + -0.6000x; interpolation
8340 <= x <  8370; y_278 = -4380.0000 +  0.5333x; interpolation
8370 <= x <  8400; y_279 =   642.0000 + -0.0667x; interpolation
8400 <= x <  8430; y_280 =  4842.0000 + -0.5667x; interpolation
8430 <= x <  8460; y_281 = -5836.0000 +  0.7000x; interpolation
8460 <= x <  8490; y_282 =  1496.0000 + -0.1667x; interpolation
8490 <= x <  8520; y_283 =  7156.0000 + -0.8333x; interpolation
8520 <= x <  8550; y_284 = -3068.0000 +  0.3667x; interpolation
8550 <= x <  8580; y_285 = -4778.0000 +  0.5667x; interpolation
8580 <= x <  8610; y_286 =  5232.0000 + -0.6000x; interpolation
8610 <= x <  8640; y_287 = -5961.0000 +  0.7000x; interpolation
8640 <= x <  8670; y_288 =  4983.0000 + -0.5667x; interpolation
8670 <= x <  8700; y_289 = -5132.0000 +  0.6000x; interpolation
8700 <= x <  8730; y_290 =  7338.0000 + -0.8333x; interpolation
8730 <= x <  8760; y_291 = -5757.0000 +  0.6667x; interpolation
8760 <= x <  8790; y_292 =  5047.0000 + -0.5667x; interpolation
8790 <= x <  8820; y_293 =    66.0000 +  0.0000x; interpolation
8820 <= x <  8850; y_294 = -5520.0000 +  0.6333x; interpolation
8850 <= x <  8880; y_295 =   380.0000 + -0.0333x; interpolation
8880 <= x <  8910; y_296 =  -508.0000 +  0.0667x; interpolation
8910 <= x <  8940; y_297 =   680.0000 + -0.0667x; interpolation
8940 <= x <  8970; y_298 =    84.0000 +  0.0000x; interpolation
8970 <= x <  9000; y_299 =  5167.0000 + -0.5667x; interpolation
9000 <= x <  9030; y_300 =  -833.0000 +  0.1000x; interpolation
9030 <= x <  9060; y_301 = -4144.0000 +  0.4667x; interpolation
9060 <= x <  9090; y_302 =  4312.0000 + -0.4667x; interpolation
9090 <= x <  9120; y_303 = -4172.0000 +  0.4667x; interpolation
9120 <= x <  9150; y_304 =  4340.0000 + -0.4667x; interpolation
9150 <= x <  9180; y_305 =  2815.0000 + -0.3000x; interpolation
9180 <= x <  9210; y_306 =  5569.0000 + -0.6000x; interpolation
```

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 9210 <= x <  9240; y_307 =  4341.0000 + -0.4667x; interpolation
 9240 <= x <  9270; y_308 = -12291.0000 +  1.3333x; interpolation
 9270 <= x <  9300; y_309 =  -4257.0000 +  0.4667x; interpolation
 9300 <= x <  9330; y_310 =  5353.0000 + -0.5667x; interpolation
 9330 <= x <  9360; y_311 =  -4599.0000 +  0.5000x; interpolation
 9360 <= x <  9390; y_312 =  3825.0000 + -0.4000x; interpolation
 9390 <= x <  9420; y_313 =  -4626.0000 +  0.5000x; interpolation
 9420 <= x <  9450; y_314 =  1654.0000 + -0.1667x; interpolation
 9450 <= x <  9480; y_315 =  -866.0000 +  0.1000x; interpolation
 9480 <= x <  9510; y_316 =  714.0000 + -0.0667x; interpolation
 9510 <= x <  9540; y_317 =  4835.0000 + -0.5000x; interpolation
 9540 <= x <  9570; y_318 =  -1525.0000 +  0.1667x; interpolation
 9570 <= x <  9600; y_319 =  -4396.0000 +  0.4667x; interpolation
 9600 <= x <  9630; y_320 =  2324.0000 + -0.2333x; interpolation
 9630 <= x <  9660; y_321 =  -3133.0000 +  0.3333x; interpolation
 9660 <= x <  9690; y_322 =  3307.0000 + -0.3333x; interpolation
 9690 <= x <  9720; y_323 =  3953.0000 + -0.4000x; interpolation
 9720 <= x <  9750; y_324 =  -6739.0000 +  0.7000x; interpolation
 9750 <= x <  9780; y_325 =  6261.0000 + -0.6333x; interpolation
 9780 <= x <  9810; y_326 =  -6453.0000 +  0.6667x; interpolation
 9810 <= x <  9840; y_327 =  1068.0000 + -0.1000x; interpolation
 9840 <= x <  9870; y_328 =  3036.0000 + -0.3000x; interpolation
 9870 <= x <  9900; y_329 =  -3215.0000 +  0.3333x; interpolation
 9900 <= x <  9930; y_330 =  1735.0000 + -0.1667x; interpolation
 9930 <= x <  9960; y_331 =  -1244.0000 +  0.1333x; interpolation
 9960 <= x <  9990; y_332 =  -580.0000 +  0.0667x; interpolation
 9990 <= x <  10020; y_333 =  419.0000 + -0.0333x; interpolation
10020 <= x <  10050; y_334 =  7099.0000 + -0.7000x; interpolation
10050 <= x <  10080; y_335 =  -7306.0000 +  0.7333x; interpolation
10080 <= x <  10110; y_336 =  7142.0000 + -0.7000x; interpolation
10110 <= x <  10140; y_337 =  -272.0000 +  0.0333x; interpolation
10140 <= x <  10170; y_338 =  -6694.0000 +  0.6667x; interpolation
10170 <= x <  10200; y_339 =  6527.0000 + -0.6333x; interpolation
10200 <= x <  10230; y_340 =  -5033.0000 +  0.5000x; interpolation
10230 <= x <  10260; y_341 =  6220.0000 + -0.6000x; interpolation
10260 <= x <  10290; y_342 =  -7118.0000 +  0.7000x; interpolation
10290 <= x <  10320; y_343 =  85.0000 +  0.0000x; interpolation
10320 <= x <  10350; y_344 =  1117.0000 + -0.1000x; interpolation
10350 <= x <  10380; y_345 =  5257.0000 + -0.5000x; interpolation
10380 <= x <  10410; y_346 =  -5815.0000 +  0.5667x; interpolation
10410 <= x <  10440; y_347 =  6330.0000 + -0.6000x; interpolation
10440 <= x <  10470; y_348 =  -6894.0000 +  0.6667x; interpolation
10470 <= x <  10500; y_349 =  7066.0000 + -0.6667x; interpolation
10500 <= x <  10530; y_350 =  -6584.0000 +  0.6333x; interpolation
10530 <= x <  10560; y_351 =  436.0000 + -0.0333x; interpolation
10560 <= x <  10590; y_352 =  -972.0000 +  0.1000x; interpolation
10590 <= x <  10620; y_353 =  1146.0000 + -0.1000x; interpolation
10620 <= x <  10650; y_354 =  -978.0000 +  0.1000x; interpolation
10650 <= x <  10680; y_355 =  2572.0000 + -0.2333x; interpolation
10680 <= x <  10710; y_356 =  6132.0000 + -0.5667x; interpolation
10710 <= x <  10740; y_357 =  -7791.0000 +  0.7333x; interpolation
10740 <= x <  10770; y_358 =  7245.0000 + -0.6667x; interpolation
10770 <= x <  10800; y_359 =  -7474.0000 +  0.7000x; interpolation
10800 <= x <  10830; y_360 =  8366.0000 + -0.7667x; interpolation
10830 <= x <  10860; y_361 =  -1381.0000 +  0.1333x; interpolation
10860 <= x <  10890; y_362 =  -6449.0000 +  0.6000x; interpolation
10890 <= x <  10920; y_363 =  1900.0000 + -0.1667x; interpolation
10920 <= x <  10950; y_364 =  -2104.0000 +  0.2000x; interpolation
10950 <= x <  10980; y_365 =  1181.0000 + -0.1000x; interpolation
10980 <= x <  11010; y_366 =  -1381.0000 +  0.1333x; interpolation
11010 <= x <  11040; y_367 =  7794.0000 + -0.7000x; interpolation
11040 <= x <  11070; y_368 =  -6926.0000 +  0.6333x; interpolation
11070 <= x <  11100; y_369 =  7096.0000 + -0.6333x; interpolation
11100 <= x <  11130; y_370 =  -7704.0000 +  0.7000x; interpolation
11130 <= x <  11160; y_371 =  7878.0000 + -0.7000x; interpolation
11160 <= x <  11190; y_372 =  -306.0000 +  0.0333x; interpolation
11190 <= x <  11220; y_373 =  -5155.0000 +  0.4667x; interpolation
11220 <= x <  11250; y_374 =  5317.0000 + -0.4667x; interpolation
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11250 <= x <   11280; y_375    =   -6308.0000 +   0.5667x; interpolation
11280 <= x <   11310; y_376    =    6476.0000 +  -0.5667x; interpolation
11310 <= x <   11340; y_377    =   -6719.0000 +   0.6000x; interpolation
11340 <= x <   11370; y_378    =    6889.0000 +  -0.6000x; interpolation
11370 <= x <   11400; y_379    =   -6755.0000 +   0.6000x; interpolation
11400 <= x <   11430; y_380    =     845.0000 +  -0.0667x; interpolation
11430 <= x <   11460; y_381    =   21800.0000 +  -1.9000x; interpolation
11460 <= x <   11490; y_382    =  -14872.0000 +   1.3000x; interpolation
11490 <= x <   11520; y_383    =     831.0000 +  -0.0667x; interpolation
11520 <= x <   11550; y_384    =   -8385.0000 +   0.7333x; interpolation
11550 <= x <   11580; y_385    =    7785.0000 +  -0.6667x; interpolation
11580 <= x <   11610; y_386    =   -7655.0000 +   0.6667x; interpolation
11610 <= x <   11640; y_387    =    8212.0000 +  -0.7000x; interpolation
11640 <= x <   11670; y_388    =   -7696.0000 +   0.6667x; interpolation
11670 <= x <   11700; y_389    =    7475.0000 +  -0.6333x; interpolation
11700 <= x <   11730; y_390    =   -7345.0000 +   0.6333x; interpolation
11730 <= x <   11760; y_391    =    7513.0000 +  -0.6333x; interpolation
11760 <= x <   11790; y_392    =   -8167.0000 +   0.7000x; interpolation
11790 <= x <   11820; y_393    =    2444.0000 +  -0.2000x; interpolation
11820 <= x <   11850; y_394    =    4808.0000 +  -0.4000x; interpolation
11850 <= x <   11880; y_395    =   -5857.0000 +   0.5000x; interpolation
11880 <= x <   11910; y_396    =    2459.0000 +  -0.2000x; interpolation
11910 <= x <   11940; y_397    =   -3893.0000 +   0.3333x; interpolation
11940 <= x <   11970; y_398    =    2077.0000 +  -0.1667x; interpolation
11970 <= x <   12000; y_399    =   -1913.0000 +   0.1667x; interpolation
12000 <= x <   12030; y_400    =     887.0000 +  -0.0667x; interpolation
12030 <= x <   12060; y_401    =    7704.0000 +  -0.6333x; interpolation
12060 <= x <   12090; y_402    =   -7974.0000 +   0.6667x; interpolation
12090 <= x <   12120; y_403    =    8146.0000 +  -0.6667x; interpolation
12120 <= x <   12150; y_404    =   -7206.0000 +   0.6000x; interpolation
12150 <= x <   12180; y_405    =    7779.0000 +  -0.6333x; interpolation
12180 <= x <   12210; y_406    =   -5619.0000 +   0.4667x; interpolation
12210 <= x <   12240; y_407    =    5777.0000 +  -0.4667x; interpolation
12240 <= x <   12270; y_408    =   -1159.0000 +   0.1000x; interpolation
12270 <= x <   12300; y_409    =   -6067.0000 +   0.5000x; interpolation
12300 <= x <   12330; y_410    =    7053.0000 +  -0.5667x; interpolation
12330 <= x <   12360; y_411    =   -6921.0000 +   0.5667x; interpolation
12360 <= x <   12390; y_412    =    5851.0000 +  -0.4667x; interpolation
12390 <= x <   12420; y_413    =   -6126.0000 +   0.5000x; interpolation
12420 <= x <   12450; y_414    =    1326.0000 +  -0.1000x; interpolation
12450 <= x <   12480; y_415    =    6306.0000 +  -0.5000x; interpolation
12480 <= x <   12510; y_416    =   -7422.0000 +   0.6000x; interpolation
12510 <= x <   12540; y_417    =    7590.0000 +  -0.6000x; interpolation
12540 <= x <   12570; y_418    =   -1188.0000 +   0.1000x; interpolation
12570 <= x <   12600; y_419    =   -5797.0000 +   0.4667x; interpolation
12600 <= x <   12630; y_420    =      83.0000 +   0.0000x; interpolation
12630 <= x <   12660; y_421    =   -1180.0000 +   0.1000x; interpolation
12660 <= x <   12690; y_422    =    8104.0000 +  -0.6333x; interpolation
12690 <= x <   12720; y_423    =   -7124.0000 +   0.5667x; interpolation
12720 <= x <   12750; y_424    =    6868.0000 +  -0.5333x; interpolation
12750 <= x <   12780; y_425    =   -6307.0000 +   0.5000x; interpolation
12780 <= x <   12810; y_426    =    6899.0000 +  -0.5333x; interpolation
12810 <= x <   12840; y_427    =   -7619.0000 +   0.6000x; interpolation
12840 <= x <   12870; y_428    =    7361.0000 +  -0.5667x; interpolation
12870 <= x <   12900; y_429    =   -6796.0000 +   0.5333x; interpolation
12900 <= x <   12930; y_430    =    6534.0000 +  -0.5000x; interpolation
12930 <= x <   12960; y_431    =   -5965.0000 +   0.4667x; interpolation
12960 <= x <   12990; y_432    =    7859.0000 +  -0.6000x; interpolation
12990 <= x <   13020; y_433    =   -8595.0000 +   0.6667x; interpolation
13020 <= x <   13050; y_434    =    7029.0000 +  -0.5333x; interpolation
13050 <= x <   13080; y_435    =   -6891.0000 +   0.5333x; interpolation
13080 <= x <   13110; y_436    =    2265.0000 +  -0.1667x; interpolation
13110 <= x <   13140; y_437    =   -1231.0000 +   0.1000x; interpolation
13140 <= x <   13170; y_438    =    5777.0000 +  -0.4333x; interpolation
13170 <= x <   13200; y_439    =   -6515.0000 +   0.5000x; interpolation
13200 <= x <   13230; y_440    =    1405.0000 +  -0.1000x; interpolation
13230 <= x <   13260; y_441    =   -1241.0000 +   0.1000x; interpolation
13260 <= x <   13290; y_442    =    3179.0000 +  -0.2333x; interpolation
```

```
13290 <= x <  13320; y_443  =  -3466.0000 +  0.2667x; interpolation
13320 <= x <  13350; y_444  =   3194.0000 + -0.2333x; interpolation
13350 <= x <  13380; y_445  =  -2591.0000 +  0.2000x; interpolation
13380 <= x <  13410; y_446  =   8113.0000 + -0.6000x; interpolation
13410 <= x <  13440; y_447  =   4984.0000 + -0.3667x; interpolation
13440 <= x <  13470; y_448  = -12936.0000 +  0.9667x; interpolation
13470 <= x <  13500; y_449  =   8616.0000 + -0.6333x; interpolation
13500 <= x <  13530; y_450  =  -9384.0000 +  0.7000x; interpolation
13530 <= x <  13560; y_451  =   9107.0000 + -0.6667x; interpolation
13560 <= x <  13590; y_452  =  -8069.0000 +  0.6000x; interpolation
13590 <= x <  13620; y_453  =   9145.0000 + -0.6667x; interpolation
13620 <= x <  13650; y_454  =  -9015.0000 +  0.6667x; interpolation
13650 <= x <  13680; y_455  =   9185.0000 + -0.6667x; interpolation
13680 <= x <  13710; y_456  =  -2215.0000 +  0.1667x; interpolation
13710 <= x <  13740; y_457  =   9667.0000 + -0.7000x; interpolation
13740 <= x <  13770; y_458  =  10583.0000 + -0.7667x; interpolation
13770 <= x <  13800; y_459  = -22465.0000 +  1.6333x; interpolation
13800 <= x <  13830; y_460  =  -3145.0000 +  0.2333x; interpolation
13830 <= x <  13860; y_461  =   7919.0000 + -0.5667x; interpolation
13860 <= x <  13890; y_462  =  -8251.0000 +  0.6000x; interpolation
13890 <= x <  13920; y_463  =   8880.0000 + -0.6333x; interpolation
13920 <= x <  13950; y_464  =  -8752.0000 +  0.6333x; interpolation
13950 <= x <  13980; y_465  =   8918.0000 + -0.6333x; interpolation
13980 <= x <  14010; y_466  =  -9722.0000 +  0.7000x; interpolation
14010 <= x <  14040; y_467  =   8958.0000 + -0.6333x; interpolation
14040 <= x <  14070; y_468  =  -7422.0000 +  0.5333x; interpolation
14070 <= x <  14100; y_469  =   8055.0000 + -0.5667x; interpolation
14100 <= x <  14130; y_470  =  -9335.0000 +  0.6667x; interpolation
14130 <= x <  14160; y_471  =   9505.0000 + -0.6667x; interpolation
14160 <= x <  14190; y_472  =  -1351.0000 +  0.1000x; interpolation
14190 <= x <  14220; y_473  =  -7500.0000 +  0.5333x; interpolation
14220 <= x <  14250; y_474  =   7668.0000 + -0.5333x; interpolation
14250 <= x <  14280; y_475  =  -8482.0000 +  0.6000x; interpolation
14280 <= x <  14310; y_476  =   8654.0000 + -0.6000x; interpolation
14310 <= x <  14340; y_477  =  -7564.0000 +  0.5333x; interpolation
14340 <= x <  14370; y_478  =   8210.0000 + -0.5667x; interpolation
14370 <= x <  14400; y_479  =  -9992.0000 +  0.7000x; interpolation
14400 <= x <  14430; y_480  =    568.0000 + -0.0333x; interpolation
14430 <= x <  14460; y_481  =  10188.0000 + -0.7000x; interpolation
14460 <= x <  14490; y_482  =  -9092.0000 +  0.6333x; interpolation
14490 <= x <  14520; y_483  =   7813.0000 + -0.5333x; interpolation
14520 <= x <  14550; y_484  =  -6223.0000 +  0.4333x; interpolation
14550 <= x <  14580; y_485  =   5902.0000 + -0.4000x; interpolation
14580 <= x <  14610; y_486  =  -5276.0000 +  0.3667x; interpolation
14610 <= x <  14640; y_487  =   7873.0000 + -0.5333x; interpolation
14640 <= x <  14670; y_488  =  -8231.0000 +  0.5667x; interpolation
14670 <= x <  14700; y_489  =   9862.0000 + -0.6667x; interpolation
14700 <= x <  14730; y_490  = -11208.0000 +  0.7667x; interpolation
14730 <= x <  14760; y_491  =   9414.0000 + -0.6333x; interpolation
14760 <= x <  14790; y_492  =  -8790.0000 +  0.6000x; interpolation
14790 <= x <  14820; y_493  =   -902.0000 +  0.0667x; interpolation
14820 <= x <  14850; y_494  =   6508.0000 + -0.4333x; interpolation
14850 <= x <  14880; y_495  =  -6362.0000 +  0.4333x; interpolation
14880 <= x <  14910; y_496  =   3062.0000 + -0.2000x; interpolation
14910 <= x <  14940; y_497  =  -2902.0000 +  0.2000x; interpolation
14940 <= x <  14970; y_498  =   3074.0000 + -0.2000x; interpolation
14970 <= x <  15000; y_499  =   6567.0000 + -0.4333x; interpolation
15000 <= x <  15030; y_500  =   -433.0000 +  0.0333x; interpolation
15030 <= x <  15060; y_501  =  -7447.0000 +  0.5000x; interpolation
15060 <= x <  15090; y_502  =   6609.0000 + -0.4333x; interpolation
15090 <= x <  15120; y_503  =  -6972.0000 +  0.4667x; interpolation
15120 <= x <  15150; y_504  =   -420.0000 +  0.0333x; interpolation
15150 <= x <  15180; y_505  =   -420.0000 +  0.0333x; interpolation
15180 <= x <  15210; y_506  =     86.0000 +  0.0000x; interpolation
15210 <= x <  15240; y_507  =   8705.0000 + -0.5667x; interpolation
15240 <= x <  15270; y_508  =  -8567.0000 +  0.5667x; interpolation
15270 <= x <  15300; y_509  =   5176.0000 + -0.3333x; interpolation
15300 <= x <  15330; y_510  =  -3494.0000 +  0.2333x; interpolation
```

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15330 <= x <  15360; y_511  =   5704.0000 +  -0.3667x; interpolation
15360 <= x <  15390; y_512  =  -7096.0000 +   0.4667x; interpolation
15390 <= x <  15420; y_513  =  10859.0000 +  -0.7000x; interpolation
15420 <= x <  15450; y_514  = -10215.0000 +   0.6667x; interpolation
15450 <= x <  15480; y_515  =   9870.0000 +  -0.6333x; interpolation
15480 <= x <  15510; y_516  =     66.0000 +   0.0000x; interpolation
15510 <= x <  15540; y_517  =     66.0000 +   0.0000x; interpolation
15540 <= x <  15570; y_518  =  -8222.0000 +   0.5333x; interpolation
15570 <= x <  15600; y_519  =     82.0000 +   0.0000x; interpolation
15600 <= x <  15630; y_520  =   2162.0000 +  -0.1333x; interpolation
15630 <= x <  15660; y_521  =  -3569.0000 +   0.2333x; interpolation
15660 <= x <  15690; y_522  =   1129.0000 +  -0.0667x; interpolation
15690 <= x <  15720; y_523  =  -2009.0000 +   0.1333x; interpolation
15720 <= x <  15750; y_524  =   2183.0000 +  -0.1333x; interpolation
15750 <= x <  15780; y_525  =   9533.0000 +  -0.6000x; interpolation
15780 <= x <  15810; y_526  = -10455.0000 +   0.6667x; interpolation
15810 <= x <  15840; y_527  =  10625.0000 +  -0.6667x; interpolation
15840 <= x <  15870; y_528  = -10495.0000 +   0.6667x; interpolation
15870 <= x <  15900; y_529  =   -444.0000 +   0.0333x; interpolation
15900 <= x <  15930; y_530  =    616.0000 +  -0.0333x; interpolation
15930 <= x <  15960; y_531  =  10705.0000 +  -0.6667x; interpolation
15960 <= x <  15990; y_532  = -11107.0000 +   0.7000x; interpolation
15990 <= x <  16020; y_533  =  11279.0000 +  -0.7000x; interpolation
16020 <= x <  16050; y_534  = -10081.0000 +   0.6333x; interpolation
16050 <= x <  16080; y_535  =  17739.0000 +  -1.1000x; interpolation
16080 <= x <  16110; y_536  =  12915.0000 +  -0.8000x; interpolation
16110 <= x <  16140; y_537  = -23601.0000 +   1.4667x; interpolation
16140 <= x <  16170; y_538  =  -5309.0000 +   0.3333x; interpolation
16170 <= x <  16200; y_539  =  -2075.0000 +   0.1333x; interpolation
16200 <= x <  16230; y_540  =  11425.0000 +  -0.7000x; interpolation
16230 <= x <  16260; y_541  =  -9674.0000 +   0.6000x; interpolation
16260 <= x <  16290; y_542  =   9296.0000 +  -0.5667x; interpolation
16290 <= x <  16320; y_543  =  -9709.0000 +   0.6000x; interpolation
16320 <= x <  16350; y_544  =   9331.0000 +  -0.5667x; interpolation
16350 <= x <  16380; y_545  =  -8109.0000 +   0.5000x; interpolation
16380 <= x <  16410; y_546  =   8271.0000 +  -0.5000x; interpolation
16410 <= x <  16440; y_547  = -10327.0000 +   0.6333x; interpolation
16440 <= x <  16470; y_548  =  10497.0000 +  -0.6333x; interpolation
16470 <= x <  16500; y_549  =  -9816.0000 +   0.6000x; interpolation
16500 <= x <  16530; y_550  =   9984.0000 +  -0.6000x; interpolation
16530 <= x <  16560; y_551  =  -8199.0000 +   0.5000x; interpolation
16560 <= x <  16590; y_552  =   8361.0000 +  -0.5000x; interpolation
16590 <= x <  16620; y_553  =  -9888.0000 +   0.6000x; interpolation
16620 <= x <  16650; y_554  =  10056.0000 +  -0.6000x; interpolation
16650 <= x <  16680; y_555  = -10479.0000 +   0.6333x; interpolation
16680 <= x <  16710; y_556  =  10093.0000 +  -0.6000x; interpolation
16710 <= x <  16740; y_557  =  -7174.0000 +   0.4333x; interpolation
16740 <= x <  16770; y_558  =   7334.0000 +  -0.4333x; interpolation
16770 <= x <  16800; y_559  =  -9436.0000 +   0.5667x; interpolation
16800 <= x <  16830; y_560  =  10164.0000 +  -0.6000x; interpolation
16830 <= x <  16860; y_561  = -10032.0000 +   0.6000x; interpolation
16860 <= x <  16890; y_562  =  10762.0000 +  -0.6333x; interpolation
16890 <= x <  16920; y_563  =  -9506.0000 +   0.5667x; interpolation
16920 <= x <  16950; y_564  =   8542.0000 +  -0.5000x; interpolation
16950 <= x <  16980; y_565  = -10103.0000 +   0.6000x; interpolation
16980 <= x <  17010; y_566  =  10273.0000 +  -0.6000x; interpolation
17010 <= x <  17040; y_567  =  -9572.0000 +   0.5667x; interpolation
17040 <= x <  17070; y_568  =   9740.0000 +  -0.5667x; interpolation
17070 <= x <  17100; y_569  =  -8468.0000 +   0.5000x; interpolation
17100 <= x <  17130; y_570  =  -1628.0000 +   0.1000x; interpolation
17130 <= x <  17160; y_571  =  11505.0000 +  -0.6667x; interpolation
17160 <= x <  17190; y_572  = -11947.0000 +   0.7000x; interpolation
17190 <= x <  17220; y_573  =  12692.0000 +  -0.7333x; interpolation
17220 <= x <  17250; y_574  =  -9694.0000 +   0.5667x; interpolation
17250 <= x <  17280; y_575  =   9856.0000 +  -0.5667x; interpolation
17280 <= x <  17310; y_576  = -12032.0000 +   0.7000x; interpolation
17310 <= x <  17340; y_577  =    662.0000 +  -0.0333x; interpolation
17340 <= x <  17370; y_578  =   9910.0000 +  -0.5667x; interpolation
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17370 <= x <  17400; y_579 =  -8039.0000 +  0.4667x; interpolation
17400 <= x <  17430; y_580 =  10521.0000 +  -0.6000x; interpolation
17430 <= x <  17460; y_581 =  -6909.0000 +  0.4000x; interpolation
17460 <= x <  17490; y_582 =   4731.0000 +  -0.2667x; interpolation
17490 <= x <  17520; y_583 =  -9261.0000 +  0.5333x; interpolation
17520 <= x <  17550; y_584 =   8843.0000 +  -0.5000x; interpolation
17550 <= x <  17580; y_585 =  -9877.0000 +  0.5667x; interpolation
17580 <= x <  17610; y_586 =  10633.0000 +  -0.6000x; interpolation
17610 <= x <  17640; y_587 =  -9912.0000 +  0.5667x; interpolation
17640 <= x <  17670; y_588 =   9492.0000 +  -0.5333x; interpolation
17670 <= x <  17700; y_589 =   1835.0000 +  -0.1000x; interpolation
17700 <= x <  17730; y_590 = -11735.0000 +  0.6667x; interpolation
17730 <= x <  17760; y_591 =  11905.0000 +  -0.6667x; interpolation
17760 <= x <  17790; y_592 = -11775.0000 +  0.6667x; interpolation
17790 <= x <  17820; y_593 =  11945.0000 +  -0.6667x; interpolation
17820 <= x <  17850; y_594 = -11221.0000 +  0.6333x; interpolation
17850 <= x <  17880; y_595 =  11984.0000 +  -0.6667x; interpolation
17880 <= x <  17910; y_596 = -13048.0000 +  0.7333x; interpolation
17910 <= x <  17940; y_597 =  12623.0000 +  -0.7000x; interpolation
17940 <= x <  17970; y_598 = -10699.0000 +  0.6000x; interpolation
17970 <= x <  18000; y_599 =  10865.0000 +  -0.6000x; interpolation
18000 <= x <  18030; y_600 = -10735.0000 +  0.6000x; interpolation
18030 <= x <  18060; y_601 =  11502.0000 +  -0.6333x; interpolation
18060 <= x <  18090; y_602 = -12578.0000 +  0.7000x; interpolation
18090 <= x <  18120; y_603 =  12145.0000 +  -0.6667x; interpolation
18120 <= x <  18150; y_604 = -12015.0000 +  0.6667x; interpolation
18150 <= x <  18180; y_605 =  12790.0000 +  -0.7000x; interpolation
18180 <= x <  18210; y_606 = -12662.0000 +  0.7000x; interpolation
18210 <= x <  18240; y_607 =  12225.0000 +  -0.6667x; interpolation
18240 <= x <  18270; y_608 = -10879.0000 +  0.6000x; interpolation
18270 <= x <  18300; y_609 =  11045.0000 +  -0.6000x; interpolation
18300 <= x <  18330; y_610 = -10305.0000 +  0.5667x; interpolation
18330 <= x <  18360; y_611 =   9858.0000 +  -0.5333x; interpolation
18360 <= x <  18390; y_612 = -11562.0000 +  0.6333x; interpolation
18390 <= x <  18420; y_613 =   4989.0000 +  -0.2667x; interpolation
18420 <= x <  18450; y_614 =  31391.0000 +  -1.7000x; interpolation
18450 <= x <  18480; y_615 =   1256.0000 +  -0.0667x; interpolation
18480 <= x <  18510; y_616 = -36320.0000 +  1.9667x; interpolation
18510 <= x <  18540; y_617 =  12423.0000 +  -0.6667x; interpolation
18540 <= x <  18570; y_618 = -12297.0000 +  0.6667x; interpolation
18570 <= x <  18600; y_619 =  11844.0000 +  -0.6333x; interpolation
18600 <= x <  18630; y_620 = -12956.0000 +  0.7000x; interpolation
18630 <= x <  18660; y_621 =  13126.0000 +  -0.7000x; interpolation
18660 <= x <  18690; y_622 = -11754.0000 +  0.6333x; interpolation
18690 <= x <  18720; y_623 =  11920.0000 +  -0.6333x; interpolation
18720 <= x <  18750; y_624 = -12416.0000 +  0.6667x; interpolation
18750 <= x <  18780; y_625 =  11959.0000 +  -0.6333x; interpolation
18780 <= x <  18810; y_626 =  -9325.0000 +  0.5000x; interpolation
18810 <= x <  18840; y_627 =  -3055.0000 +  0.1667x; interpolation
18840 <= x <  18870; y_628 =   1341.0000 +  -0.0667x; interpolation
18870 <= x <  18900; y_629 =    712.0000 +  -0.0333x; interpolation
18900 <= x <  18930; y_630 =   8902.0000 +  -0.4667x; interpolation
18930 <= x <  18960; y_631 =  -8766.0000 +  0.4667x; interpolation
18960 <= x <  18990; y_632 =   8298.0000 +  -0.4333x; interpolation
18990 <= x <  19020; y_633 =  -9426.0000 +  0.5000x; interpolation
19020 <= x <  19050; y_634 =   -550.0000 +  0.0333x; interpolation
19050 <= x <  19080; y_635 =  12150.0000 +  -0.6333x; interpolation
19080 <= x <  19110; y_636 = -12654.0000 +  0.6667x; interpolation
19110 <= x <  19140; y_637 =  13463.0000 +  -0.7000x; interpolation
19140 <= x <  19170; y_638 = -11419.0000 +  0.6000x; interpolation
19170 <= x <  19200; y_639 =  11585.0000 +  -0.6000x; interpolation
19200 <= x <  19230; y_640 = -12735.0000 +  0.6667x; interpolation
19230 <= x <  19260; y_641 =  12905.0000 +  -0.6667x; interpolation
19260 <= x <  19290; y_642 = -12133.0000 +  0.6333x; interpolation
19290 <= x <  19320; y_643 =  12301.0000 +  -0.6333x; interpolation
19320 <= x <  19350; y_644 = -12171.0000 +  0.6333x; interpolation
19350 <= x <  19380; y_645 =  11694.0000 +  -0.6000x; interpolation
19380 <= x <  19410; y_646 = -12208.0000 +  0.6333x; interpolation
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19410 <= x <  19440; y_647  =  13025.0000 +  -0.6667x; interpolation
19440 <= x <  19470; y_648  =  -9007.0000 +   0.4667x; interpolation
19470 <= x <  19500; y_649  =   8516.0000 +  -0.4333x; interpolation
19500 <= x <  19530; y_650  = -11634.0000 +   0.6000x; interpolation
19530 <= x <  19560; y_651  =  12453.0000 +  -0.6333x; interpolation
19560 <= x <  19590; y_652  = -12975.0000 +   0.6667x; interpolation
19590 <= x <  19620; y_653  =  13145.0000 +  -0.6667x; interpolation
19620 <= x <  19650; y_654  = -13015.0000 +   0.6667x; interpolation
19650 <= x <  19680; y_655  =  13185.0000 +  -0.6667x; interpolation
19680 <= x <  19710; y_656  = -11743.0000 +   0.6000x; interpolation
19710 <= x <  19740; y_657  =  11252.0000 +  -0.5667x; interpolation
19740 <= x <  19770; y_658  = -11778.0000 +   0.6000x; interpolation
19770 <= x <  19800; y_659  =  13923.0000 +  -0.7000x; interpolation
19800 <= x <  19830; y_660  = -14457.0000 +   0.7333x; interpolation
19830 <= x <  19860; y_661  =  12644.0000 +  -0.6333x; interpolation
19860 <= x <  19890; y_662  =  -3244.0000 +   0.1667x; interpolation
19890 <= x <  19920; y_663  =  -5896.0000 +   0.3000x; interpolation
19920 <= x <  19950; y_664  =   5392.0000 +  -0.2667x; interpolation
19950 <= x <  19980; y_665  =  -7908.0000 +   0.4000x; interpolation
19980 <= x <  20010; y_666  =   8742.0000 +  -0.4333x; interpolation
20010 <= x <  20040; y_667  =  -7933.0000 +   0.4000x; interpolation
20040 <= x <  20070; y_668  =   8099.0000 +  -0.4000x; interpolation
20070 <= x <  20100; y_669  =  -7288.0000 +   0.3667x; interpolation
20100 <= x <  20130; y_670  =   6782.0000 +  -0.3333x; interpolation
20130 <= x <  20160; y_671  =  -5967.0000 +   0.3000x; interpolation
20160 <= x <  20190; y_672  =   5457.0000 +  -0.2667x; interpolation
20190 <= x <  20220; y_673  =  -5311.0000 +   0.2667x; interpolation
20220 <= x <  20250; y_674  =   5473.0000 +  -0.2667x; interpolation
20250 <= x <  20280; y_675  =  -4652.0000 +   0.2333x; interpolation
20280 <= x <  20310; y_676  =  -3300.0000 +   0.1667x; interpolation
20310 <= x <  20340; y_677  =   2793.0000 +  -0.1333x; interpolation
20340 <= x <  20370; y_678  =  -2631.0000 +   0.1333x; interpolation
20370 <= x <  20400; y_679  =   2122.0000 +  -0.1000x; interpolation
20400 <= x <  20430; y_680  =  -1958.0000 +   0.1000x; interpolation
20430 <= x <  20460; y_681  =   1447.0000 +  -0.0667x; interpolation
20460 <= x <  20490; y_682  =     83.0000 +   0.0000x; interpolation
20490 <= x <  20520; y_683  =     83.0000 +   0.0000x; interpolation
20520 <= x <  20550; y_684  =   -601.0000 +   0.0333x; interpolation
20550 <= x <  20580; y_685  =  15154.0000 +  -0.7333x; interpolation
20580 <= x <  20610; y_686  =  22700.0000 +  -1.1000x; interpolation
20610 <= x <  20640; y_687  =   2777.0000 +  -0.1333x; interpolation
20640 <= x <  20670; y_688  = -26119.0000 +   1.2667x; interpolation
20670 <= x <  20700; y_689  = -15095.0000 +   0.7333x; interpolation
20700 <= x <  20730; y_690  =  15265.0000 +  -0.7333x; interpolation
20730 <= x <  20760; y_691  = -12375.0000 +   0.6000x; interpolation
20760 <= x <  20790; y_692  =  12537.0000 +  -0.6000x; interpolation
20790 <= x <  20820; y_693  = -14490.0000 +   0.7000x; interpolation
20820 <= x <  20850; y_694  =  14658.0000 +  -0.7000x; interpolation
20850 <= x <  20880; y_695  = -15227.0000 +   0.7333x; interpolation
20880 <= x <  20910; y_696  =  14701.0000 +  -0.7000x; interpolation
20910 <= x <  20940; y_697  = -14573.0000 +   0.7000x; interpolation
20940 <= x <  20970; y_698  =  14045.0000 +  -0.6667x; interpolation
20970 <= x <  21000; y_699  = -12517.0000 +   0.6000x; interpolation
21000 <= x <  21030; y_700  =  12683.0000 +  -0.6000x; interpolation
21030 <= x <  21060; y_701  = -13254.0000 +   0.6333x; interpolation
21060 <= x <  21090; y_702  =  14124.0000 +  -0.6667x; interpolation
21090 <= x <  21120; y_703  = -13293.0000 +   0.6333x; interpolation
21120 <= x <  21150; y_704  =  13459.0000 +  -0.6333x; interpolation
21150 <= x <  21180; y_705  = -13331.0000 +   0.6333x; interpolation
21180 <= x <  21210; y_706  =  13497.0000 +  -0.6333x; interpolation
21210 <= x <  21240; y_707  = -15490.0000 +   0.7333x; interpolation
21240 <= x <  21270; y_708  =  15662.0000 +  -0.7333x; interpolation
21270 <= x <  21300; y_709  = -14116.0000 +   0.6667x; interpolation
21300 <= x <  21330; y_710  =  13574.0000 +  -0.6333x; interpolation
21330 <= x <  21360; y_711  = -14155.0000 +   0.6667x; interpolation
21360 <= x <  21390; y_712  =  14325.0000 +  -0.6667x; interpolation
21390 <= x <  21420; y_713  =   6482.0000 +  -0.3000x; interpolation
21420 <= x <  21450; y_714  =  -6370.0000 +   0.3000x; interpolation
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```
21450 <= x <  21480; y_715  =  -13520.0000 +   0.6333x; interpolation
21480 <= x <  21510; y_716  =   17268.0000 +  -0.8000x; interpolation
21510 <= x <  21540; y_717  =  -16431.0000 +   0.7667x; interpolation
21540 <= x <  21570; y_718  =   15879.0000 +  -0.7333x; interpolation
21570 <= x <  21600; y_719  =  -17914.0000 +   0.8333x; interpolation
21600 <= x <  21630; y_720  =   15206.0000 +  -0.7000x; interpolation
21630 <= x <  21660; y_721  =  -13634.0000 +   0.6333x; interpolation
21660 <= x <  21690; y_722  =   14524.0000 +  -0.6667x; interpolation
21690 <= x <  21720; y_723  =  -15119.0000 +   0.7000x; interpolation
21720 <= x <  21750; y_724  =   16013.0000 +  -0.7333x; interpolation
21750 <= x <  21780; y_725  =  -15162.0000 +   0.7000x; interpolation
21780 <= x <  21810; y_726  =   16782.0000 +  -0.7667x; interpolation
21810 <= x <  21840; y_727  =  -17387.0000 +   0.8000x; interpolation
21840 <= x <  21870; y_728  =   15373.0000 +  -0.7000x; interpolation
21870 <= x <  21900; y_729  =  -14516.0000 +   0.6667x; interpolation
21900 <= x <  21930; y_730  =   15414.0000 +  -0.7000x; interpolation
21930 <= x <  21960; y_731  =  -16019.0000 +   0.7333x; interpolation
21960 <= x <  21990; y_732  =   14725.0000 +  -0.6667x; interpolation
21990 <= x <  22020; y_733  =  -15328.0000 +   0.7000x; interpolation
22020 <= x <  22050; y_734  =   15500.0000 +  -0.7000x; interpolation
22050 <= x <  22080; y_735  =  -13900.0000 +   0.6333x; interpolation
22080 <= x <  22110; y_736  =   14804.0000 +  -0.6667x; interpolation
22110 <= x <  22140; y_737  =  -13939.0000 +   0.6333x; interpolation
22140 <= x <  22170; y_738  =   13367.0000 +  -0.6000x; interpolation
22170 <= x <  22200; y_739  =  -13237.0000 +   0.6000x; interpolation
22200 <= x <  22230; y_740  =   13403.0000 +  -0.6000x; interpolation
22230 <= x <  22260; y_741  =  -14755.0000 +   0.6667x; interpolation
22260 <= x <  22290; y_742  =   15667.0000 +  -0.7000x; interpolation
22290 <= x <  22320; y_743  =  -14796.0000 +   0.6667x; interpolation
22320 <= x <  22350; y_744  =      84.0000 +   0.0000x; interpolation
22350 <= x <  22380; y_745  =   14239.0000 +  -0.6333x; interpolation
22380 <= x <  22410; y_746  =   -3665.0000 +   0.1667x; interpolation
22410 <= x <  22440; y_747  =   -4412.0000 +   0.2000x; interpolation
22440 <= x <  22470; y_748  =   -5160.0000 +   0.2333x; interpolation
22470 <= x <  22500; y_749  =   12067.0000 +  -0.5333x; interpolation
22500 <= x <  22530; y_750  =  -11933.0000 +   0.5333x; interpolation
22530 <= x <  22560; y_751  =   -2170.0000 +   0.1000x; interpolation
22560 <= x <  22590; y_752  =    2342.0000 +  -0.1000x; interpolation
22590 <= x <  22620; y_753  =   14390.0000 +  -0.6333x; interpolation
22620 <= x <  22650; y_754  =    5342.0000 +  -0.2333x; interpolation
22650 <= x <  22680; y_755  =  -19573.0000 +   0.8667x; interpolation
22680 <= x <  22710; y_756  =   -3697.0000 +   0.1667x; interpolation
22710 <= x <  22740; y_757  =    6144.0000 +  -0.2667x; interpolation
22740 <= x <  22770; y_758  =   -3710.0000 +   0.1667x; interpolation
22770 <= x <  22800; y_759  =   -1433.0000 +   0.0667x; interpolation
22800 <= x <  22830; y_760  =   11487.0000 +  -0.5000x; interpolation
22830 <= x <  22860; y_761  =    2355.0000 +  -0.1000x; interpolation
22860 <= x <  22890; y_762  =    3879.0000 +  -0.1667x; interpolation
22890 <= x <  22920; y_763  =  -17485.0000 +   0.7667x; interpolation
22920 <= x <  22950; y_764  =    1615.0000 +  -0.0667x; interpolation
22950 <= x <  22980; y_765  =   13855.0000 +  -0.6000x; interpolation
22980 <= x <  23010; y_766  =  -13721.0000 +   0.6000x; interpolation
23010 <= x <  23040; y_767  =    4687.0000 +  -0.2000x; interpolation
23040 <= x <  23070; y_768  =   35407.0000 +  -1.5333x; interpolation
23070 <= x <  23100; y_769  =    4647.0000 +  -0.2000x; interpolation
23100 <= x <  23130; y_770  =  -43093.0000 +   1.8667x; interpolation
23130 <= x <  23160; y_771  =    3167.0000 +  -0.1333x; interpolation
23160 <= x <  23190; y_772  =   -4553.0000 +   0.2000x; interpolation
23190 <= x <  23220; y_773  =    3950.0000 +  -0.1667x; interpolation
23220 <= x <  23250; y_774  =   10142.0000 +  -0.4333x; interpolation
23250 <= x <  23280; y_775  =  -14658.0000 +   0.6333x; interpolation
23280 <= x <  23310; y_776  =   19486.0000 +  -0.8333x; interpolation
23310 <= x <  23340; y_777  =   -9263.0000 +   0.4000x; interpolation
23340 <= x <  23370; y_778  =    4741.0000 +  -0.2000x; interpolation
23370 <= x <  23400; y_779  =   -7723.0000 +   0.3333x; interpolation
23400 <= x <  23430; y_780  =   -6163.0000 +   0.2667x; interpolation
23430 <= x <  23460; y_781  =    3209.0000 +  -0.1333x; interpolation
23460 <= x <  23490; y_782  =   10247.0000 +  -0.4333x; interpolation
```

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23490 <= x <  23520; y_783  =  -6979.0000 +  0.3000x; interpolation
23520 <= x <  23550; y_784  =  -6195.0000 +  0.2667x; interpolation
23550 <= x <  23580; y_785  =     85.0000 +  0.0000x; interpolation
23580 <= x <  23610; y_786  =  -1487.0000 +  0.0667x; interpolation
23610 <= x <  23640; y_787  =   8744.0000 + -0.3667x; interpolation
23640 <= x <  23670; y_788  =  -7016.0000 +  0.3000x; interpolation
23670 <= x <  23700; y_789  =  12709.0000 + -0.5333x; interpolation
23700 <= x <  23730; y_790  = -10201.0000 +  0.4333x; interpolation
23730 <= x <  23760; y_791  =  -3873.0000 +  0.1667x; interpolation
23760 <= x <  23790; y_792  =  17511.0000 + -0.7333x; interpolation
23790 <= x <  23820; y_793  =  -1521.0000 +  0.0667x; interpolation
23820 <= x <  23850; y_794  = -17401.0000 +  0.7333x; interpolation
23850 <= x <  23880; y_795  =  19169.0000 + -0.8000x; interpolation
23880 <= x <  23910; y_796  = -16651.0000 +  0.7000x; interpolation
23910 <= x <  23940; y_797  =  14432.0000 + -0.6000x; interpolation
23940 <= x <  23970; y_798  =     68.0000 +  0.0000x; interpolation
23970 <= x <  24000; y_799  = -13515.0000 +  0.5667x; interpolation
24000 <= x <  24030; y_800  =  15285.0000 + -0.6333x; interpolation
24030 <= x <  24060; y_801  = -15954.0000 +  0.6667x; interpolation
24060 <= x <  24090; y_802  =   -716.0000 +  0.0333x; interpolation
24090 <= x <  24120; y_803  =   4102.0000 + -0.1667x; interpolation
24120 <= x <  24150; y_804  =  -3134.0000 +  0.1333x; interpolation
24150 <= x <  24180; y_805  =  14576.0000 + -0.6000x; interpolation
24180 <= x <  24210; y_806  =   1680.0000 + -0.0667x; interpolation
24210 <= x <  24240; y_807  =   -741.0000 +  0.0333x; interpolation
24240 <= x <  24270; y_808  = -17709.0000 +  0.7333x; interpolation
24270 <= x <  24300; y_809  =   7370.0000 + -0.3000x; interpolation
24300 <= x <  24330; y_810  =  -3970.0000 +  0.1667x; interpolation
24330 <= x <  24360; y_811  =   -726.0000 +  0.0333x; interpolation
24360 <= x <  24390; y_812  =   -726.0000 +  0.0333x; interpolation
24390 <= x <  24420; y_813  =   2526.0000 + -0.1000x; interpolation
24420 <= x <  24450; y_814  =   -730.0000 +  0.0333x; interpolation
24450 <= x <  24480; y_815  =   -730.0000 +  0.0333x; interpolation
24480 <= x <  24510; y_816  =  15590.0000 + -0.6333x; interpolation
24510 <= x <  24540; y_817  = -14639.0000 +  0.6000x; interpolation
24540 <= x <  24570; y_818  =  14809.0000 + -0.6000x; interpolation
24570 <= x <  24600; y_819  =   -752.0000 +  0.0333x; interpolation
24600 <= x <  24630; y_820  = -16332.0000 +  0.6667x; interpolation
24630 <= x <  24660; y_821  =    909.0000 + -0.0333x; interpolation
24660 <= x <  24690; y_822  =   -735.0000 +  0.0333x; interpolation
24690 <= x <  24720; y_823  =   2557.0000 + -0.1000x; interpolation
24720 <= x <  24750; y_824  =  -2387.0000 +  0.1000x; interpolation
24750 <= x <  24780; y_825  =   1738.0000 + -0.0667x; interpolation
24780 <= x <  24810; y_826  =   -740.0000 +  0.0333x; interpolation
24810 <= x <  24840; y_827  =    914.0000 + -0.0333x; interpolation
24840 <= x <  24870; y_828  =  -1570.0000 +  0.0667x; interpolation
24870 <= x <  24900; y_829  =  15010.0000 + -0.6000x; interpolation
24900 <= x <  24930; y_830  = -14870.0000 +  0.6000x; interpolation
24930 <= x <  24960; y_831  =  15877.0000 + -0.6333x; interpolation
24960 <= x <  24990; y_832  = -14075.0000 +  0.5667x; interpolation
24990 <= x <  25020; y_833  =   2585.0000 + -0.1000x; interpolation
25020 <= x <  25050; y_834  =  15095.0000 + -0.6000x; interpolation
25050 <= x <  25080; y_835  = -16635.0000 +  0.6667x; interpolation
25080 <= x <  25110; y_836  =  -1587.0000 +  0.0667x; interpolation
25110 <= x <  25140; y_837  =   1761.0000 + -0.0667x; interpolation
25140 <= x <  25170; y_838  =    923.0000 + -0.0333x; interpolation
25170 <= x <  25200; y_839  =  -2433.0000 +  0.1000x; interpolation
25200 <= x <  25230; y_840  =  16887.0000 + -0.6667x; interpolation
25230 <= x <  25260; y_841  = -15912.0000 +  0.6333x; interpolation
25260 <= x <  25290; y_842  =  15242.0000 + -0.6000x; interpolation
25290 <= x <  25320; y_843  =   5126.0000 + -0.2000x; interpolation
25320 <= x <  25350; y_844  = -23570.0000 +  0.9333x; interpolation
25350 <= x <  25380; y_845  =   4315.0000 + -0.1667x; interpolation
25380 <= x <  25410; y_846  =  -2453.0000 +  0.1000x; interpolation
25410 <= x <  25440; y_847  =  45826.0000 + -1.8000x; interpolation
25440 <= x <  25470; y_848  =   5122.0000 + -0.2000x; interpolation
25470 <= x <  25500; y_849  = -46667.0000 +  1.8333x; interpolation
25500 <= x <  25530; y_850  =  -2467.0000 +  0.1000x; interpolation
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25530 <= x <  25560; y_851  =   3490.0000 +  -0.1333x; interpolation
25560 <= x <  25590; y_852  =  -4178.0000 +   0.1667x; interpolation
25590 <= x <  25620; y_853  =  16294.0000 +  -0.6333x; interpolation
25620 <= x <  25650; y_854  =   1776.0000 +  -0.0667x; interpolation
25650 <= x <  25680; y_855  = -14469.0000 +   0.5667x; interpolation
25680 <= x <  25710; y_856  =  -3341.0000 +   0.1333x; interpolation
25710 <= x <  25740; y_857  =  14656.0000 +  -0.5667x; interpolation
25740 <= x <  25770; y_858  = -15374.0000 +   0.6000x; interpolation
25770 <= x <  25800; y_859  =   3524.0000 +  -0.1333x; interpolation
25800 <= x <  25830; y_860  =  14704.0000 +  -0.5667x; interpolation
25830 <= x <  25860; y_861  =   -794.0000 +   0.0333x; interpolation
25860 <= x <  25890; y_862  = -17172.0000 +   0.6667x; interpolation
25890 <= x <  25920; y_863  =  15622.0000 +  -0.6000x; interpolation
25920 <= x <  25950; y_864  =    934.0000 +  -0.0333x; interpolation
25950 <= x <  25980; y_865  =   -796.0000 +   0.0333x; interpolation
25980 <= x <  26010; y_866  =   1802.0000 +  -0.0667x; interpolation
26010 <= x <  26040; y_867  =   -799.0000 +   0.0333x; interpolation
26040 <= x <  26070; y_868  =   1805.0000 +  -0.0667x; interpolation
26070 <= x <  26100; y_869  =  -1671.0000 +   0.0667x; interpolation
26100 <= x <  26130; y_870  = -15591.0000 +   0.6000x; interpolation
26130 <= x <  26160; y_871  =     87.0000 +   0.0000x; interpolation
26160 <= x <  26190; y_872  =     87.0000 +   0.0000x; interpolation
26190 <= x <  26220; y_873  =   2706.0000 +  -0.1000x; interpolation
26220 <= x <  26250; y_874  =  14942.0000 +  -0.5667x; interpolation
26250 <= x <  26280; y_875  =  -1683.0000 +   0.0667x; interpolation
26280 <= x <  26310; y_876  = -16575.0000 +   0.6333x; interpolation
26310 <= x <  26340; y_877  =  15874.0000 +  -0.6000x; interpolation
26340 <= x <  26370; y_878  =   4460.0000 +  -0.1667x; interpolation
26370 <= x <  26400; y_879  = -15757.0000 +   0.6000x; interpolation
26400 <= x <  26430; y_880  =  -4317.0000 +   0.1667x; interpolation
26430 <= x <  26460; y_881  =  15946.0000 +  -0.6000x; interpolation
26460 <= x <  26490; y_882  = -14042.0000 +   0.5333x; interpolation
26490 <= x <  26520; y_883  =   1852.0000 +  -0.0667x; interpolation
26520 <= x <  26550; y_884  =  -1684.0000 +   0.0667x; interpolation
26550 <= x <  26580; y_885  =    971.0000 +  -0.0333x; interpolation
26580 <= x <  26610; y_886  =  16033.0000 +  -0.6000x; interpolation
26610 <= x <  26640; y_887  = -12351.0000 +   0.4667x; interpolation
26640 <= x <  26670; y_888  =  12513.0000 +  -0.4667x; interpolation
26670 <= x <  26700; y_889  = -19491.0000 +   0.7333x; interpolation
26700 <= x <  26730; y_890  =  19669.0000 +  -0.7333x; interpolation
26730 <= x <  26760; y_891  =  -1715.0000 +   0.0667x; interpolation
26760 <= x <  26790; y_892  =   3637.0000 +  -0.1333x; interpolation
26790 <= x <  26820; y_893  = -20474.0000 +   0.7667x; interpolation
26820 <= x <  26850; y_894  =  18862.0000 +  -0.7000x; interpolation
26850 <= x <  26880; y_895  =  -2618.0000 +   0.1000x; interpolation
26880 <= x <  26910; y_896  = -15162.0000 +   0.5667x; interpolation
26910 <= x <  26940; y_897  =  16233.0000 +  -0.6000x; interpolation
26940 <= x <  26970; y_898  = -14299.0000 +   0.5333x; interpolation
26970 <= x <  27000; y_899  =  13570.0000 +  -0.5000x; interpolation
27000 <= x <  27030; y_900  = -14330.0000 +   0.5333x; interpolation
27030 <= x <  27060; y_901  =  13601.0000 +  -0.5000x; interpolation
27060 <= x <  27090; y_902  = -12557.0000 +   0.4667x; interpolation
27090 <= x <  27120; y_903  =  13630.0000 +  -0.5000x; interpolation
27120 <= x <  27150; y_904  =   3686.0000 +  -0.1333x; interpolation
27150 <= x <  27180; y_905  =  -4459.0000 +   0.1667x; interpolation
27180 <= x <  27210; y_906  = -13519.0000 +   0.5000x; interpolation
27210 <= x <  27240; y_907  =  13691.0000 +  -0.5000x; interpolation
27240 <= x <  27270; y_908  =   2795.0000 +  -0.1000x; interpolation
27270 <= x <  27300; y_909  = -15385.0000 +   0.5667x; interpolation
27300 <= x <  27330; y_910  =  16465.0000 +  -0.6000x; interpolation
27330 <= x <  27360; y_911  =   -844.0000 +   0.0333x; interpolation
27360 <= x <  27390; y_912  =   -844.0000 +   0.0333x; interpolation
27390 <= x <  27420; y_913  =  -9974.0000 +   0.3667x; interpolation
27420 <= x <  27450; y_914  =  -9060.0000 +   0.3333x; interpolation
27450 <= x <  27480; y_915  =   7410.0000 +  -0.2667x; interpolation
27480 <= x <  27510; y_916  =  13822.0000 +  -0.5000x; interpolation
27510 <= x <  27540; y_917  = -14605.0000 +   0.5333x; interpolation
27540 <= x <  27570; y_918  =  13853.0000 +  -0.5000x; interpolation
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27570 <= x <  27600; y_919 =  -1770.0000 +  0.0667x; interpolation
27600 <= x <  27630; y_920 = -12810.0000 +  0.4667x; interpolation
27630 <= x <  27660; y_921 =  12057.0000 + -0.4333x; interpolation
27660 <= x <  27690; y_922 =   7447.0000 + -0.2667x; interpolation
27690 <= x <  27720; y_923 =  19446.0000 + -0.7000x; interpolation
27720 <= x <  27750; y_924 =  12054.0000 + -0.4333x; interpolation
27750 <= x <  27780; y_925 = -45296.0000 +  1.6333x; interpolation
27780 <= x <  27810; y_926 =  11190.0000 + -0.4000x; interpolation
27810 <= x <  27840; y_927 =  -9204.0000 +  0.3333x; interpolation
27840 <= x <  27870; y_928 =  -7348.0000 +  0.2667x; interpolation
27870 <= x <  27900; y_929 =  12161.0000 + -0.4333x; interpolation
27900 <= x <  27930; y_930 =   3791.0000 + -0.1333x; interpolation
27930 <= x <  27960; y_931 = -12036.0000 +  0.4333x; interpolation
27960 <= x <  27990; y_932 =  -7376.0000 +  0.2667x; interpolation
27990 <= x <  28020; y_933 =   7552.0000 + -0.2667x; interpolation
28020 <= x <  28050; y_934 =  12222.0000 + -0.4333x; interpolation
28050 <= x <  28080; y_935 =  -5543.0000 +  0.2000x; interpolation
28080 <= x <  28110; y_936 = -13031.0000 +  0.4667x; interpolation
28110 <= x <  28140; y_937 =  13205.0000 + -0.4667x; interpolation
28140 <= x <  28170; y_938 = -12121.0000 +  0.4333x; interpolation
28170 <= x <  28200; y_939 =   5720.0000 + -0.2000x; interpolation
28200 <= x <  28230; y_940 =  11360.0000 + -0.4000x; interpolation
28230 <= x <  28260; y_941 =  -9342.0000 +  0.3333x; interpolation
28260 <= x <  28290; y_942 =  -7458.0000 +  0.2667x; interpolation
28290 <= x <  28320; y_943 =   8573.0000 + -0.3000x; interpolation
28320 <= x <  28350; y_944 =  -8419.0000 +  0.3000x; interpolation
28350 <= x <  28380; y_945 =  10481.0000 + -0.3667x; interpolation
28380 <= x <  28410; y_946 =   9535.0000 + -0.3333x; interpolation
28410 <= x <  28440; y_947 = -11299.0000 +  0.4000x; interpolation
28440 <= x <  28470; y_948 = -10351.0000 +  0.3667x; interpolation
28470 <= x <  28500; y_949 =  17170.0000 + -0.6000x; interpolation
28500 <= x <  28530; y_950 =   1970.0000 + -0.0667x; interpolation
28530 <= x <  28560; y_951 = -17050.0000 +  0.6000x; interpolation
28560 <= x <  28590; y_952 =   1038.0000 + -0.0333x; interpolation
28590 <= x <  28620; y_953 =  -2774.0000 +  0.1000x; interpolation
28620 <= x <  28650; y_954 =  19168.0000 + -0.6667x; interpolation
28650 <= x <  28680; y_955 = -18077.0000 +  0.6333x; interpolation
28680 <= x <  28710; y_956 =  18251.0000 + -0.6333x; interpolation
28710 <= x <  28740; y_957 =   1025.0000 + -0.0333x; interpolation
28740 <= x <  28770; y_958 =     67.0000 +  0.0000x; interpolation
28770 <= x <  28800; y_959 = -18154.0000 +  0.6333x; interpolation
28800 <= x <  28830; y_960 =   -874.0000 +  0.0333x; interpolation
28830 <= x <  28860; y_961 =  19307.0000 + -0.6667x; interpolation
28860 <= x <  28890; y_962 =     67.0000 +  0.0000x; interpolation
28890 <= x <  28920; y_963 = -16304.0000 +  0.5667x; interpolation
28920 <= x <  28950; y_964 =  15508.0000 + -0.5333x; interpolation
28950 <= x <  28980; y_965 =   1998.0000 + -0.0667x; interpolation
28980 <= x <  29010; y_966 = -17322.0000 +  0.6000x; interpolation
29010 <= x <  29040; y_967 =  -3784.0000 +  0.1333x; interpolation
29040 <= x <  29070; y_968 =  19448.0000 + -0.6667x; interpolation
29070 <= x <  29100; y_969 =   1037.0000 + -0.0333x; interpolation
29100 <= x <  29130; y_970 = -17393.0000 +  0.6000x; interpolation
29130 <= x <  29160; y_971 =  17563.0000 + -0.6000x; interpolation
29160 <= x <  29190; y_972 =     67.0000 +  0.0000x; interpolation
29190 <= x <  29220; y_973 = -21339.0000 +  0.7333x; interpolation
29220 <= x <  29250; y_974 =   4959.0000 + -0.1667x; interpolation
29250 <= x <  29280; y_975 =  -2841.0000 +  0.1000x; interpolation
29280 <= x <  29310; y_976 =  18631.0000 + -0.6333x; interpolation
29310 <= x <  29340; y_977 =   2022.0000 + -0.0667x; interpolation
29340 <= x <  29370; y_978 =  -1890.0000 +  0.0667x; interpolation
29370 <= x <  29400; y_979 =     68.0000 +  0.0000x; interpolation
29400 <= x <  29430; y_980 = -18552.0000 +  0.6333x; interpolation
29430 <= x <  29460; y_981 =  19707.0000 + -0.6667x; interpolation
29460 <= x <  29490; y_982 =     67.0000 +  0.0000x; interpolation
29490 <= x <  29520; y_983 = -19593.0000 +  0.6667x; interpolation
29520 <= x <  29550; y_984 =  18783.0000 + -0.6333x; interpolation
29550 <= x <  29580; y_985 =   3023.0000 + -0.1000x; interpolation
29580 <= x <  29610; y_986 =  -2893.0000 +  0.1000x; interpolation
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29610 <= x <  29640; y_987  =   4016.0000 +  -0.1333x; interpolation
29640 <= x <  29670; y_988  = -19696.0000 +   0.6667x; interpolation
29670 <= x <  29700; y_989  =   1073.0000 +  -0.0333x; interpolation
29700 <= x <  29730; y_990  =  -2887.0000 +   0.1000x; interpolation
29730 <= x <  29760; y_991  =   5041.0000 +  -0.1667x; interpolation
29760 <= x <  29790; y_992  =  -5871.0000 +   0.2000x; interpolation
29790 <= x <  29820; y_993  =   2073.0000 +  -0.0667x; interpolation
29820 <= x <  29850; y_994  =   2073.0000 +  -0.0667x; interpolation
29850 <= x <  29880; y_995  =  16003.0000 +  -0.5333x; interpolation
29880 <= x <  29910; y_996  =  -2921.0000 +   0.1000x; interpolation
29910 <= x <  29940; y_997  =  -9900.0000 +   0.3333x; interpolation
29940 <= x <  29970; y_998  =  47984.0000 +  -1.6000x; interpolation
29970 <= x <  30000; y_999  =   2030.0000 +  -0.0667x; interpolation
30000 <= x <  30030; y_1000 = -50970.0000 +   1.7000x; interpolation
30030 <= x <  30060; y_1001 =  23104.0000 +  -0.7667x; interpolation
30060 <= x <  30090; y_1002 = -11966.0000 +   0.4000x; interpolation
30090 <= x <  30120; y_1003 =   3079.0000 +  -0.1000x; interpolation
30120 <= x <  30150; y_1004 =  -2945.0000 +   0.1000x; interpolation
30150 <= x <  30180; y_1005 =   2080.0000 +  -0.0667x; interpolation
30180 <= x <  30210; y_1006 = -16028.0000 +   0.5333x; interpolation
30210 <= x <  30240; y_1007 =   1091.0000 +  -0.0333x; interpolation
30240 <= x <  30270; y_1008 =   2099.0000 +  -0.0667x; interpolation
30270 <= x <  30300; y_1009 =  -3955.0000 +   0.1333x; interpolation
30300 <= x <  30330; y_1010 =  18265.0000 +  -0.6000x; interpolation
30330 <= x <  30360; y_1011 = -21164.0000 +   0.7000x; interpolation
30360 <= x <  30390; y_1012 =   5148.0000 +  -0.1667x; interpolation
30390 <= x <  30420; y_1013 =  16291.0000 +  -0.5333x; interpolation
30420 <= x <  30450; y_1014 =  -2975.0000 +   0.1000x; interpolation
30450 <= x <  30480; y_1015 = -17185.0000 +   0.5667x; interpolation
30480 <= x <  30510; y_1016 =   4151.0000 +  -0.1333x; interpolation
30510 <= x <  30540; y_1017 =  -3985.0000 +   0.1333x; interpolation
30540 <= x <  30570; y_1018 =   1105.0000 +  -0.0333x; interpolation
30570 <= x <  30600; y_1019 =  19447.0000 +  -0.6333x; interpolation
30600 <= x <  30630; y_1020 = -19313.0000 +   0.6333x; interpolation
30630 <= x <  30660; y_1021 =  17443.0000 +  -0.5667x; interpolation
30660 <= x <  30690; y_1022 =   2113.0000 +  -0.0667x; interpolation
30690 <= x <  30720; y_1023 =  -3002.0000 +   0.1000x; interpolation
30720 <= x <  30750; y_1024 = -18362.0000 +   0.6000x; interpolation
30750 <= x <  30780; y_1025 =  17513.0000 +  -0.5667x; interpolation
30780 <= x <  30810; y_1026 = -16345.0000 +   0.5333x; interpolation
30810 <= x <  30840; y_1027 =  17546.0000 +  -0.5667x; interpolation
30840 <= x <  30870; y_1028 =   6238.0000 +  -0.2000x; interpolation
30870 <= x <  30900; y_1029 =  -7139.0000 +   0.2333x; interpolation
30900 <= x <  30930; y_1030 = -17439.0000 +   0.5667x; interpolation
30930 <= x <  30960; y_1031 =   4212.0000 +  -0.1333x; interpolation
30960 <= x <  30990; y_1032 =  22788.0000 +  -0.7333x; interpolation
30990 <= x <  31020; y_1033 =  -8202.0000 +   0.2667x; interpolation
31020 <= x <  31050; y_1034 =   3172.0000 +  -0.1000x; interpolation
31050 <= x <  31080; y_1035 = -20633.0000 +   0.6667x; interpolation
31080 <= x <  31110; y_1036 =  18735.0000 +  -0.6000x; interpolation
31110 <= x <  31140; y_1037 = -20671.0000 +   0.6667x; interpolation
31140 <= x <  31170; y_1038 =   1127.0000 +  -0.0333x; interpolation
31170 <= x <  31200; y_1039 =  18790.0000 +  -0.6000x; interpolation
31200 <= x <  31230; y_1040 =   4230.0000 +  -0.1333x; interpolation
31230 <= x <  31260; y_1041 = -21795.0000 +   0.7000x; interpolation
31260 <= x <  31290; y_1042 =  23011.0000 +  -0.7333x; interpolation
31290 <= x <  31320; y_1043 = -23924.0000 +   0.7667x; interpolation
31320 <= x <  31350; y_1044 =   2176.0000 +  -0.0667x; interpolation
31350 <= x <  31380; y_1045 =   8446.0000 +  -0.2667x; interpolation
31380 <= x <  31410; y_1046 =  -7244.0000 +   0.2333x; interpolation
31410 <= x <  31440; y_1047 =  -4103.0000 +   0.1333x; interpolation
31440 <= x <  31470; y_1048 =  20001.0000 +  -0.6333x; interpolation
31470 <= x <  31500; y_1049 = -17763.0000 +   0.5667x; interpolation
31500 <= x <  31530; y_1050 =   1137.0000 +  -0.0333x; interpolation
31530 <= x <  31560; y_1051 =   -965.0000 +   0.0333x; interpolation
31560 <= x <  31590; y_1052 =   2191.0000 +  -0.0667x; interpolation
31590 <= x <  31620; y_1053 =  16933.0000 +  -0.5333x; interpolation
31620 <= x <  31650; y_1054 =     69.0000 +   0.0000x; interpolation
```

```
31650 <= x <  31680; y_1055  =  -19976.0000 +   0.6333x; interpolation
31680 <= x <  31710; y_1056  =   23320.0000 +  -0.7333x; interpolation
31710 <= x <  31740; y_1057  =  -20017.0000 +   0.6333x; interpolation
31740 <= x <  31770; y_1058  =    -973.0000 +   0.0333x; interpolation
31770 <= x <  31800; y_1059  =   20207.0000 +  -0.6333x; interpolation
31800 <= x <  31830; y_1060  =      67.0000 +   0.0000x; interpolation
31830 <= x <  31860; y_1061  =  -20092.0000 +   0.6333x; interpolation
31860 <= x <  31890; y_1062  =   17078.0000 +  -0.5333x; interpolation
31890 <= x <  31920; y_1063  =  -16938.0000 +   0.5333x; interpolation
31920 <= x <  31950; y_1064  =    1150.0000 +  -0.0333x; interpolation
31950 <= x <  31980; y_1065  =    -980.0000 +   0.0333x; interpolation
31980 <= x <  32010; y_1066  =      86.0000 +   0.0000x; interpolation
32010 <= x <  32040; y_1067  =   18225.0000 +  -0.5667x; interpolation
32040 <= x <  32070; y_1068  =    -999.0000 +   0.0333x; interpolation
32070 <= x <  32100; y_1069  =    1139.0000 +  -0.0333x; interpolation
32100 <= x <  32130; y_1070  =    2209.0000 +  -0.0667x; interpolation
32130 <= x <  32160; y_1071  =   -6359.0000 +   0.2000x; interpolation
32160 <= x <  32190; y_1072  =  -14935.0000 +   0.4667x; interpolation
32190 <= x <  32220; y_1073  =    6525.0000 +  -0.2000x; interpolation
32220 <= x <  32250; y_1074  =   14043.0000 +  -0.4333x; interpolation
32250 <= x <  32280; y_1075  =   -3157.0000 +   0.1000x; interpolation
32280 <= x <  32310; y_1076  =    5451.0000 +  -0.1667x; interpolation
32310 <= x <  32340; y_1077  =   32376.0000 +  -1.0000x; interpolation
32340 <= x <  32370; y_1078  =    4348.0000 +  -0.1333x; interpolation
32370 <= x <  32400; y_1079  =  -49602.0000 +   1.5333x; interpolation
32400 <= x <  32430; y_1080  =   -5322.0000 +   0.1667x; interpolation
32430 <= x <  32460; y_1081  =    7650.0000 +  -0.2333x; interpolation
32460 <= x <  32490; y_1082  =  -10744.0000 +   0.3333x; interpolation
32490 <= x <  32520; y_1083  =   16331.0000 +  -0.5000x; interpolation
32520 <= x <  32550; y_1084  =  -11853.0000 +   0.3667x; interpolation
32550 <= x <  32580; y_1085  =   18527.0000 +  -0.5667x; interpolation
32580 <= x <  32610; y_1086  =  -20569.0000 +   0.6333x; interpolation
32610 <= x <  32640; y_1087  =   20737.0000 +  -0.6333x; interpolation
32640 <= x <  32670; y_1088  =   -2111.0000 +   0.0667x; interpolation
32670 <= x <  32700; y_1089  =   -8645.0000 +   0.2667x; interpolation
32700 <= x <  32730; y_1090  =  -14095.0000 +   0.4333x; interpolation
32730 <= x <  32760; y_1091  =    3361.0000 +  -0.1000x; interpolation
32760 <= x <  32790; y_1092  =    1177.0000 +  -0.0333x; interpolation
32790 <= x <  32820; y_1093  =   20851.0000 +  -0.6333x; interpolation
32820 <= x <  32850; y_1094  =      65.0000 +   0.0000x; interpolation
32850 <= x <  32880; y_1095  =  -21835.0000 +   0.6667x; interpolation
32880 <= x <  32910; y_1096  =      85.0000 +   0.0000x; interpolation
32910 <= x <  32940; y_1097  =      85.0000 +   0.0000x; interpolation
32940 <= x <  32970; y_1098  =   -2111.0000 +   0.0667x; interpolation
32970 <= x <  33000; y_1099  =   24265.0000 +  -0.7333x; interpolation
33000 <= x <  33030; y_1100  =   -2135.0000 +   0.0667x; interpolation
33030 <= x <  33060; y_1101  =  -18650.0000 +   0.5667x; interpolation
33060 <= x <  33090; y_1102  =    3390.0000 +  -0.1000x; interpolation
33090 <= x <  33120; y_1103  =   17729.0000 +  -0.5333x; interpolation
33120 <= x <  33150; y_1104  =   -2143.0000 +   0.0667x; interpolation
33150 <= x <  33180; y_1105  =  -19823.0000 +   0.6000x; interpolation
33180 <= x <  33210; y_1106  =      85.0000 +   0.0000x; interpolation
33210 <= x <  33240; y_1107  =   -3236.0000 +   0.1000x; interpolation
33240 <= x <  33270; y_1108  =    7844.0000 +  -0.2333x; interpolation
33270 <= x <  33300; y_1109  =   -7682.0000 +   0.2333x; interpolation
33300 <= x <  33330; y_1110  =   23398.0000 +  -0.7000x; interpolation
33330 <= x <  33360; y_1111  =  -19931.0000 +   0.6000x; interpolation
33360 <= x <  33390; y_1112  =   18989.0000 +  -0.5667x; interpolation
33390 <= x <  33420; y_1113  =  -18853.0000 +   0.5667x; interpolation
33420 <= x <  33450; y_1114  =   21251.0000 +  -0.6333x; interpolation
33450 <= x <  33480; y_1115  =  -23349.0000 +   0.7000x; interpolation
33480 <= x <  33510; y_1116  =      87.0000 +   0.0000x; interpolation
33510 <= x <  33540; y_1117  =   23544.0000 +  -0.7000x; interpolation
33540 <= x <  33570; y_1118  =  -15586.0000 +   0.4667x; interpolation
33570 <= x <  33600; y_1119  =   16865.0000 +  -0.5000x; interpolation
33600 <= x <  33630; y_1120  =  -23455.0000 +   0.7000x; interpolation
33630 <= x <  33660; y_1121  =    3449.0000 +  -0.1000x; interpolation
33660 <= x <  33690; y_1122  =   15791.0000 +  -0.4667x; interpolation
```

```
33690 <= x <  33720; y_1123  =  -17899.0000 +   0.5333x; interpolation
33720 <= x <  33750; y_1124  =    5705.0000 +  -0.1667x; interpolation
33750 <= x <  33780; y_1125  =   -5545.0000 +   0.1667x; interpolation
33780 <= x <  33810; y_1126  =    5715.0000 +  -0.1667x; interpolation
33810 <= x <  33840; y_1127  =   16985.0000 +  -0.5000x; interpolation
33840 <= x <  33870; y_1128  =   -4447.0000 +   0.1333x; interpolation
33870 <= x <  33900; y_1129  =  -17995.0000 +   0.5333x; interpolation
33900 <= x <  33930; y_1130  =    5735.0000 +  -0.1667x; interpolation
33930 <= x <  33960; y_1131  =   17045.0000 +  -0.5000x; interpolation
33960 <= x <  33990; y_1132  =   -5595.0000 +   0.1667x; interpolation
33990 <= x <  34020; y_1133  =  -16925.0000 +   0.5000x; interpolation
34020 <= x <  34050; y_1134  =   15961.0000 +  -0.4667x; interpolation
34050 <= x <  34080; y_1135  =  -16954.0000 +   0.5000x; interpolation
34080 <= x <  34110; y_1136  =    5766.0000 +  -0.1667x; interpolation
34110 <= x <  34140; y_1137  =   -1056.0000 +   0.0333x; interpolation
34140 <= x <  34170; y_1138  =    4634.0000 +  -0.1333x; interpolation
34170 <= x <  34200; y_1139  =   -9034.0000 +   0.2667x; interpolation
34200 <= x <  34230; y_1140  =    5786.0000 +  -0.1667x; interpolation
34230 <= x <  34260; y_1141  =   -2201.0000 +   0.0667x; interpolation
34260 <= x <  34290; y_1142  =   22923.0000 +  -0.6667x; interpolation
34290 <= x <  34320; y_1143  =  -25083.0000 +   0.7333x; interpolation
34320 <= x <  34350; y_1144  =   24109.0000 +  -0.7000x; interpolation
34350 <= x <  34380; y_1145  =  -19401.0000 +   0.5667x; interpolation
34380 <= x <  34410; y_1146  =   18417.0000 +  -0.5333x; interpolation
34410 <= x <  34440; y_1147  =  -25169.0000 +   0.7333x; interpolation
34440 <= x <  34470; y_1148  =   25343.0000 +  -0.7333x; interpolation
34470 <= x <  34500; y_1149  =  -22915.0000 +   0.6667x; interpolation
34500 <= x <  34530; y_1150  =   21935.0000 +  -0.6333x; interpolation
34530 <= x <  34560; y_1151  =  -19501.0000 +   0.5667x; interpolation
34560 <= x <  34590; y_1152  =    5843.0000 +  -0.1667x; interpolation
34590 <= x <  34620; y_1153  =   -6840.0000 +   0.2000x; interpolation
34620 <= x <  34650; y_1154  =   -2224.0000 +   0.0667x; interpolation
34650 <= x <  34680; y_1155  =   24341.0000 +  -0.7000x; interpolation
34680 <= x <  34710; y_1156  =  -25367.0000 +   0.7333x; interpolation
34710 <= x <  34740; y_1157  =   24384.0000 +  -0.7000x; interpolation
34740 <= x <  34770; y_1158  =  -19620.0000 +   0.5667x; interpolation
34770 <= x <  34800; y_1159  =   -3394.0000 +   0.1000x; interpolation
34800 <= x <  34830; y_1160  =   24446.0000 +  -0.7000x; interpolation
34830 <= x <  34860; y_1161  =  -23155.0000 +   0.6667x; interpolation
34860 <= x <  34890; y_1162  =   16353.0000 +  -0.4667x; interpolation
34890 <= x <  34920; y_1163  =    7049.0000 +  -0.2000x; interpolation
34920 <= x <  34950; y_1164  =  -13903.0000 +   0.4000x; interpolation
34950 <= x <  34980; y_1165  =   49007.0000 +  -1.4000x; interpolation
34980 <= x <  35010; y_1166  =   10529.0000 +  -0.3000x; interpolation
35010 <= x <  35040; y_1167  =    1193.0000 +  -0.0333x; interpolation
35040 <= x <  35070; y_1168  =   -1143.0000 +   0.0333x; interpolation
35070 <= x <  35100; y_1169  =    2364.0000 +  -0.0667x; interpolation
35100 <= x <  35130; y_1170  =  -12846.0000 +   0.3667x; interpolation
35130 <= x <  35160; y_1171  =  -18701.0000 +   0.5333x; interpolation
35160 <= x <  35190; y_1172  =   10599.0000 +  -0.3000x; interpolation
35190 <= x <  35220; y_1173  =    8253.0000 +  -0.2333x; interpolation
35220 <= x <  35250; y_1174  =   14123.0000 +  -0.4000x; interpolation
35250 <= x <  35280; y_1175  =    1198.0000 +  -0.0333x; interpolation
35280 <= x <  35310; y_1176  =      22.0000 +   0.0000x; interpolation
35310 <= x <  35340; y_1177  =      22.0000 +   0.0000x; interpolation
35340 <= x <  35370; y_1178  =      22.0000 +   0.0000x; interpolation
35370 <= x <  35400; y_1179  =      22.0000 +   0.0000x; interpolation
35400 <= x <  35430; y_1180  =   -3518.0000 +   0.1000x; interpolation
35430 <= x <  35460; y_1181  =    4749.0000 +  -0.1333x; interpolation
35460 <= x <  35490; y_1182  =  -61443.0000 +   1.7333x; interpolation
35490 <= x <  35520; y_1183  =   -8208.0000 +   0.2333x; interpolation
35520 <= x <  35550; y_1184  =   22576.0000 +  -0.6333x; interpolation
35550 <= x <  35580; y_1185  =  -20084.0000 +   0.5667x; interpolation
35580 <= x <  35610; y_1186  =   -3480.0000 +   0.1000x; interpolation
```

3 Programming Requirements & Constraints

All code must follow the requirements outlined in the Submission (Programming Exercises) section of the syllabus.

Your task is to take the temperature readings and generate for each core:

1. A piecewise linear interpolation.
2. A global linear least squares approximation.
3. *(Optional)* A cubic spline (or other non-linear) interpolation.

3.1 Arguments & Execution

Your program must accept an input filename as the first command line argument. Your program **must NOT** prompt the user for a filename.

3.2 Architecture

Your solution must be organized into appropriate "modules" (using each language's best practices). Start with four modules:

1. Input (e.g., using the supplied input libraries)
2. Data pre-processing (i.e., structuring the data for analysis)
3. Piecewise Linear Interpolation
4. Least Squares Approximation

3.3 Documentation Requirements

All code must be properly and fully documented using a language appropriate comment style. All functions (including parameters and return types) must be documented.

1. Doxygen can be used for *C++*, *Java*, or *JavaScript*. Consider the following Doxygen Example:

Example 6: C++ Doxygen Documentation

```
/**
 * Retrieve the value stored in three selected Cells
 *
 * @param cell1Id numeric id representing the 1st desired cell
 * @param cell2Id numeric id representing the 2nd desired cell
 * @param cell3Id numeric id representing the 3rd desired cell
 *
 * @return value stored in the Cell
 *
 * @pre (cell1Id > 0 && cell1Id < 10) &&
 *      (cell2Id > 0 && cell2Id < 10) &&
 *      (cell3Id > 0 && cell3Id < 10)
 */
CellTriple get3Cells(int cell1Id, int cell2Id, int cell3Id) const;
```

2. Javadoc can be used for Java. Consider the following Javadoc Example:

Example 7: Javadoc Documentation

```
/**
 * Multi-thread Coin Flip.
```

```
     *
     * @param numTrials # flips to simulate
     * @param numThreads number of threads to use
     *
     * @return Completed FlipTasks
     *
     * @throws InterruptedException if a thread is stopped prematurely
     */
    public static FlipTask[] multiThread(long numTrials, int numThreads)
        throws InterruptedException
```

3. Pydoc or Sphinx can be used for Python. Consider the following Pydoc Example:

Example 8: Python 3 Pydoc Documentation

```
def parse_raw_temps(original_temps: TextIO,
                    step_size: int=30, units: bool=True) -> Iterator[Tuple[float, List[float]] ]:
    """
    Take an input file and time-step size and parse all core temps.

    :param original_temps: an input file
    :param step_size:      time-step in seconds
    :param units: True if the input file includes units and False if the file
                  includes only raw readings (no units)

    :yields: A tuple containing the next time step and a List containing _n_
             core temps as floating point values (where _n_ is the number of
             CPU cores)
    """
```

or the following Sphinx Example:

Example 9: Python 3 Sphinx Documentation

```
def parse_raw_temps(original_temps: TextIO,
                    step_size: int=30, units: bool=True) -> Iterator[Tuple[float, List[float]] ]:
    """
    Take an input file and time-step size and parse all core temps.

    Args:
        original_temps: an input file
        step_size: time-step in seconds
        units: True if the input file includes units and False if the file
            includes only raw readings (no units)

    Yields:
        A tuple containing the next time step and a List containing _n_
        core temps as floating point values (where _n_ is the number of
        CPU cores)
    """
```