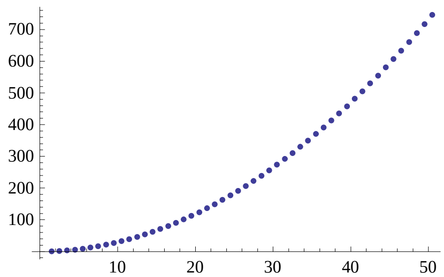
This computes the entropy for radius n = 1 to n = nmax = 50, and summing over l up to lmax = 1000. The infrared cutoff is put at M = 100. This is enough to see the area law.

```
M = 100; nmax = 50; lmax = 1000; Clear[s]
```

```
Do[K = Table[0, {i, 1, M}, {j, 1, M}];
 Do[K[[j, j]] = N[(j + 1 / 2) ^2 / j^2 + (j - 1 / 2) ^2 / j^2 + l (l + 1) / j^2], {j, 2, M}];
 K[[1, 1]] = N[l (l + 1) + (3 / 2) ^2]; Do[K[[j, j + 1]] = N[- (j + 1 / 2) ^2 / j / (j + 1)];
  K[[j + 1, j]] = K[[j, j + 1]], {j, 1, M - 1}]; u = Eigensystem[K]; u1 = u[[1]];
 u2 = u[[2]]; X = Transpose[u2].DiagonalMatrix[1 / Sqrt[u1] / 2].u2;
 P = Transpose[u2].DiagonalMatrix[Sqrt[u1] / 2].u2; Do[XV = Take[X, {1, n}, {1, n}];
  PV = Take[P, {1, n}, {1, n}]; c = Sqrt[Eigenvalues[XV.PV]];
  s[l, n] = (c + 1 / 2).Log[c + 1 / 2] - (c - 1 / 2 + 10^ (-10)).Log[c - 1 / 2 + 10^ (-10)],
  {n, 1, nmax}], {l, 0, lmax}]
```

```
entropy = Table[{n + 1 / 2, Sum[(2 l + 1) s[l, n], {l, 0, lmax}]}, {n, 1, nmax}];
```

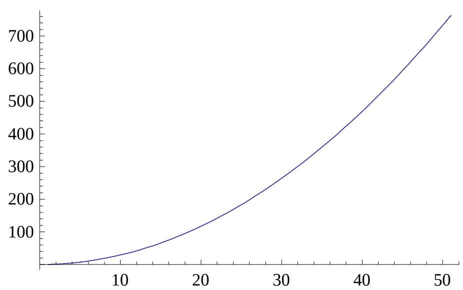
```
aa = ListPlot[entropy]
```




```
fun = Fit[entropy, {x^2}, x]
```

$0.293287\, x^2$

```
bb = Plot[fun, {x, 1, 51}]
```



```
Show[aa, bb]
```