In[54]:=
```
(* Define the prime counting function π(x) *)
primePiFunction[x_] := PrimePi[x]



(* Precompute π(x/k), π(x/(ek)), and π(x/(e^2k)) for k = 1,
2, 3, 4, 5 to optimize the function n4Function *)
precomputePrimePi[x_] := Module[{e = E, values1, values2, values3},
 values1 = Table[primePiFunction[x / k], {k, 1, 5}];
 values2 = Table[primePiFunction[x / (e * k)], {k, 1, 5}];
 values3 = Table[primePiFunction[x / (e ^ 2 * k)], {k, 1, 5}];
 {values1, values2, values3}
]



(* Define the function \mathcal{N}_{4}(x) using precomputed π values *)
n4Function[x_] := Module[{e = E, logX = Log[x], πValues1, πValues2, πValues3},
 {πValues1, πValues2, πValues3} = precomputePrimePi[x];
 (Total[πValues1] ^ 4) - (e x / logX) (Total[πValues2] ^ 4) + (Total[πValues3] ^ 4)
]



(* Evaluate the function for x = 10^m, where 4 ≤ m ≤ 15 *)
resultsN4 = Table[{10 ^ m, N[n4Function[10 ^ m]]}, {m, 4, 15}]
```

Out[65]=
$$\{\{10\,000, -7.91169\times10^{15}\}, \{100\,000, -1.95931\times10^{20}\}, \{1\,000\,000, -6.4657\times10^{24}\},$$
$$\{10\,000\,000, -2.59798\times10^{29}\}, \{100\,000\,000, -1.2022\times10^{34}\}, \{1\,000\,000\,000, -6.17025\times10^{38}\},$$
$$\{10\,000\,000\,000, -3.42791\times10^{43}\}, \{100\,000\,000\,000, -2.02681\times10^{48}\},$$
$$\{1\,000\,000\,000\,000, -1.26025\times10^{53}\}, \{10\,000\,000\,000\,000, -8.16809\times10^{57}\},$$
$$\{100\,000\,000\,000\,000, -5.48139\times10^{62}\}, \{1\,000\,000\,000\,000\,000, -3.78893\times10^{67}\}\}$$