```mathematica
referenceChebyshev[n_] := Sum[MangoldtLambda[j], {j, 2, n}]
mm[n_, a_, b_] := If[Mod[n, a] == 0, a, 0] - If[Mod[n, b] == 0, b, 0]
L2[n_, 1, a_, b_] := (1 / b) Sum[mm[j, b, a] Log[j / b], {j, b + 1, b n}]
L2[n_, k_, a_, b_] :=
  (1 / b) Sum[If[mm[j, b, a] == 0, 0, mm[j, b, a] L2[b n / j, k - 1, a, b]], {j, b + 1, b n}]
ChebAlta[n_, a_, b_] :=
  Sum[(-1) ^ (c - 1) L2[n, c, a, b], {c, 1, Log[If[(a / b) < 2, (a / b), 2], n]}] +
    Sum[(a / b) ^ c Log[(a / b)], {c, 1, Log[(a / b), n]}]
ChebAlta2[n_, a_, b_] := Sum[(-1) ^ (c - 1) L2[n, c, a, b],
    {c, 1, Log[If[(a / b) < 2, (a / b), 2], n]}]
alpha[n_, a_, b_] := If[Mod[n, b] == 0, b, 0] - If[Mod[n, a] == 0, a, 0]
lr[n_, b_] :=
  b ^ -1 Sum[alpha[j, b + 1, b] (Log[j / b] - lr[n b / j, b]), {j, b + 1, Floor[n b]}]
lrr[n_, j_, b_] := If[n b < j, 0,
    b ^ -1 alpha[j, b + 1, b] (Log[j / b] - lrr[n b / j, b + 1, b]) + lrr[n, j + 1, b]]


{N[ChebAlta[ 100, 3, 2]]}

{94.0453}

N[ChebAlta2[ 100, 3, 2]]

-9.95352

N[lr[100, 2]]

-9.95352

N[lrr[ 100, 3, 2]]

-9.95352




referenceChebyshev[n_] := Sum[MangoldtLambda[j], {j, 2, n}]
num[c_] := Numerator[c]; den[c_] := Denominator[c]
alpha[n_, c_] := den[c] (Floor[n / den[c]] - Floor[(n - 1) / den[c]]) -
  num[c] (Floor[n / num[c]] - Floor[(n - 1) / num[c]])
L2[n_, 1, c_] := L2[n, 1, c] = (1 / den[c])
    Sum[alpha[ j, c] Log[j / den[c]], {j, den[c] + 1, den[c] n}]
L2[n_, k_, c_] := L2[n, k, c] = (1 / den[c]) Sum[
      If[alpha[j, c] == 0, 0, alpha[j, c] L2[den[c] n / j, k - 1, c]], {j, den[c] + 1, den[c] n}]
ChebAlt[n_, c_] := Sum[(-1) ^ (k - 1) L2[n, k, c], {k, 1, Floor[ Log[n] / Log[If[c < 2, c, 2]]]}] +
    Sum[c ^ k Log[c], {k, 1, Floor[Log[n] / Log[c]]}]
Grid[Table[ {N[ referenceChebyshev[n]], N[ChebAlt[n, (b + 1) / b]] },
  {n, 5, 100, 5}, {b, 1, 4}]]




{N[referenceChebyshev[100]], N[ChebAlt[ 100, 3 / 2]]}

{94.0453, 94.0453}
```

```
Grid[
 Table[ {N[ referenceChebyshev[n]], N[ChebAlt[n, (b + 1) / b]] }, {n, 5, 100, 5}, {b, 1, 4}]]
```

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{66.5419, 66.5419} {66.5419, 66.5419} {66.5419, 66.5419} {66.5419, 66.5419}
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{79.4645, 79.4645} {79.4645, 79.4645} {79.4645, 79.4645} {79.4645, 79.4645}
 {84.982, 84.982}   {84.982, 84.982}   {84.982, 84.982}   {84.982, 84.982}
{89.4706, 89.4706} {89.4706, 89.4706} {89.4706, 89.4706} {89.4706, 89.4706}
{89.4706, 89.4706} {89.4706, 89.4706} {89.4706, 89.4706} {89.4706, 89.4706}
{94.0453, 94.0453} {94.0453, 94.0453} {94.0453, 94.0453} {94.0453, 94.0453}

```
num[c_] := Numerator[c]; den[c_] := Denominator[c]
alpha[n_, c_] := den[c] (Floor[n / den[c]] - Floor[(n - 1) / den[c]]) -
  num[c] (Floor[n / num[c]] - Floor[(n - 1) / num[c]])
L2[n_, 1, c_] := L2[n, 1, c] = (1 / den[c])
    Sum[alpha[j, c] Log[j / den[c]], {j, den[c] + 1, den[c] n}]
L2[n_, k_, c_] := L2[n, k, c] = (1 / den[c])
    Sum[If[alpha[j, c] == 0, 0, alpha[j, c] L2[den[c] n / j, k - 1, c]], {j, den[c] + 1, den[c] n}]
```