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Pp[x_, 0] := 1
Pp[x_, k_] :=
  Pp[x, k] = Sum[FullSimplify[MangoldtLambda[j] / Log[j]] Pp[x / j, k - 1], {j, 2, Floor[x]}]
Dd[x_, z_] := FullSimplify[Sum[ z^k / k! Pp[x, k], {k, 0, Log[2, x]}]]
Cc[x_, z_] := FullSimplify[Sum[ (-1)^k z^(2 k) / (2 k)! Pp[x, 2 k], {k, 0, Log[2, x]}]]
Ss[x_, z_] :=
  FullSimplify[Sum[ (-1)^(k - 1) z^(2 k - 1) / (2 k - 1)! Pp[x, 2 k - 1], {k, 1, Log[2, x]}]]

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Table[ {Dd[100, n I], Cc[100, n] + I Ss[100, n]}, {n, 1, 6}]

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{ { - 2881 / 72 + 65 I / 8 , - 2881 / 72 + 65 I / 8 } , { - 2029 / 18 - 199 I / 2 , - 2029 / 18 - 199 I / 2 } ,
  { - 557 / 8 - 3241 I / 8 , - 557 / 8 - 3241 I / 8 } , { 2911 / 9 - 924 I , 2911 / 9 - 924 I } ,
  { 98 627 / 72 - 12 567 I / 8 , 98 627 / 72 - 12 567 I / 8 } , { 6835 / 2 - 4253 I / 2 , 6835 / 2 - 4253 I / 2 } }

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Plot[Cc[100, z ], {z, -6, 6}]

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