

```
ClearAll["Global`*"]
```

```
D2[n_, k_] := D2[n, k] = Sum[D2[Floor[n / j], k - 1], {j, 2, n}]; D2[n_, 0] := 1
```

```
DD[n_, z_] := Sum[FactorialPower[z, a] / a! D2[n, a], {a, 0, Log[2, n]}]
```

```
ddd[n_, z_] := (DD[n, z] - 1) / z
```

```
f2[n_, a_, r_, d_] := Sum[DD[n, r Cos[2 Pi t / a] + I r Sin[2 Pi t / a] + d] /  
  (r Cos[2 Pi t / a] + I r Sin[2 Pi t / a] + d) / a, {t, 0, a}]
```

```
f2b[n_, a_, r_, d_] := Sum[(DD[n, r Cos[2 Pi t / a] + I r Sin[2 Pi t / a] + d]) /  
  (r Cos[2 Pi t / a] + I r Sin[2 Pi t / a] + d), {t, 0, a}] / (2 Pi r)
```

```
f2a[n_, a_, r_, d_, k_] := Sum[DD[n, r Cos[2 Pi t / a] + I r Sin[2 Pi t / a] + d] /  
  (r Cos[2 Pi t / a] + I r Sin[2 Pi t / a] + d)^k / a, {t, 0, a}]
```

```
f3[n_, z_] := N[(DD[n, z] - 1) / z]
```

```
f5[n_, a_, r_, d_] :=
```

```
  Sum[DD[n, E^(I t)] / (E^(I t)) * I E^(I t) * .0001, {t, 0, 2 Pi, .0001}]
```

```
f2[100, 10 000, 1.1, 0]
```

```
28.5444 - 3.51927 × 10-15 i
```

```
f3[100, 0.00001]
```

```
28.5338
```

```
f5[100, 1000., 1., 0]
```

```
1.25036 × 10-7 + 6.28465 i
```

```
f4[a_, r_, d_] := Sum[1 / (E^(t)) * I E^(t) * .01, {t, 0, 2 Pi, .01}]
```

```
f4[10 000., 1., 0.]
```

```
0. + 6.29 i
```

```
1 / (2. Pi)
```

```
0.159155
```

```
Integrate[1 / E^(I t), {t, 0, 2 Pi}]
```

```
0
```

```
(DD[100, 1 + 100 I] - 1) / (1 + 100 I) + (DD[100, 1 - 100 I] - 1) / (1 - 100 I)
```

```
583 667 782
```

---

9

```
ddd[100, .001]
```

```
1028.58
```

```

ddd[100, -.001]
-971.512

ddd[100, .001 I]
28.5333 - 999.955 i

ddd[100, -1. I]
8.125 - 40.0139 i

Integrate[I, {t, 0, 2 Pi}]
2 i  $\pi$ 

```

```

f2a[100, 10 000, 1, 0, 4.]
4.25306 + 8.72718  $\times 10^{-16}$  i

K[n_] := If[n == 1, 0, FullSimplify[MangoldtLambda[n] / Log[n]]]
P[n_, k_] := P[n, k] = Sum[ K[j] P[Floor[n / j], k - 1], {j, 2, n}]; P[n_, 0] := 1

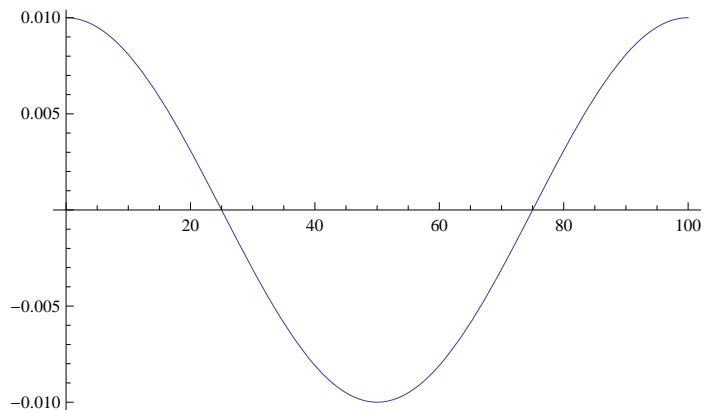
N[P[100, 4]] / 24
4.24306

```

```

f4a[a_, r_, d_] := Plot[Re[(r Cos[2 Pi t / a] + I r Sin[2 Pi t / a] + d) / a], {t, 0, a}]
f4b[a_, r_, d_] := Plot[Im[(r Cos[2 Pi t / a] + I r Sin[2 Pi t / a] + d) / a], {t, 0, a}]
f4a[100, 1, 0]

```



```

f4c[a_, r_, d_] := Table[N[1 / (r Cos[2 Pi t / a] + I r Sin[2 Pi t / a] + d) / a], {t, 0, a}]

```

**f4c[100, 1, 0] // TableForm**

```

0.01
0.00998027 - 0.000627905 i
0.00992115 - 0.00125333 i
0.00982287 - 0.00187381 i
0.00968583 - 0.0024869 i
0.00951057 - 0.00309017 i
0.00929776 - 0.00368125 i
0.00904827 - 0.00425779 i
0.00876307 - 0.00481754 i
0.00844328 - 0.00535827 i
0.00809017 - 0.00587785 i
0.00770513 - 0.00637424 i
0.00728969 - 0.00684547 i
0.00684547 - 0.00728969 i
0.00637424 - 0.00770513 i
0.00587785 - 0.00809017 i
0.00535827 - 0.00844328 i
0.00481754 - 0.00876307 i
0.00425779 - 0.00904827 i
0.00368125 - 0.00929776 i
0.00309017 - 0.00951057 i
0.0024869 - 0.00968583 i
0.00187381 - 0.00982287 i
0.00125333 - 0.00992115 i
0.000627905 - 0.00998027 i
0. - 0.01 i
-0.000627905 - 0.00998027 i
-0.00125333 - 0.00992115 i
-0.00187381 - 0.00982287 i
-0.0024869 - 0.00968583 i
-0.00309017 - 0.00951057 i
-0.00368125 - 0.00929776 i
-0.00425779 - 0.00904827 i
-0.00481754 - 0.00876307 i
-0.00535827 - 0.00844328 i
-0.00587785 - 0.00809017 i
-0.00637424 - 0.00770513 i
-0.00684547 - 0.00728969 i
-0.00728969 - 0.00684547 i
-0.00770513 - 0.00637424 i
-0.00809017 - 0.00587785 i
-0.00844328 - 0.00535827 i
-0.00876307 - 0.00481754 i
-0.00904827 - 0.00425779 i
-0.00929776 - 0.00368125 i
-0.00951057 - 0.00309017 i
-0.00968583 - 0.0024869 i
-0.00982287 - 0.00187381 i
-0.00992115 - 0.00125333 i
-0.00998027 - 0.000627905 i
-0.01
-0.00998027 + 0.000627905 i
-0.00992115 + 0.00125333 i
-0.00982287 + 0.00187381 i
-0.00968583 + 0.0024869 i

```

```

-0.00951057 + 0.00309017 i
-0.00929776 + 0.00368125 i
-0.00904827 + 0.00425779 i
-0.00876307 + 0.00481754 i
-0.00844328 + 0.00535827 i
-0.00809017 + 0.00587785 i
-0.00770513 + 0.00637424 i
-0.00728969 + 0.00684547 i
-0.00684547 + 0.00728969 i
-0.00637424 + 0.00770513 i
-0.00587785 + 0.00809017 i
-0.00535827 + 0.00844328 i
-0.00481754 + 0.00876307 i
-0.00425779 + 0.00904827 i
-0.00368125 + 0.00929776 i
-0.00309017 + 0.00951057 i
-0.0024869 + 0.00968583 i
-0.00187381 + 0.00982287 i
-0.00125333 + 0.00992115 i
-0.000627905 + 0.00998027 i
0. + 0.01 i
0.000627905 + 0.00998027 i
0.00125333 + 0.00992115 i
0.00187381 + 0.00982287 i
0.0024869 + 0.00968583 i
0.00309017 + 0.00951057 i
0.00368125 + 0.00929776 i
0.00425779 + 0.00904827 i
0.00481754 + 0.00876307 i
0.00535827 + 0.00844328 i
0.00587785 + 0.00809017 i
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0.00844328 + 0.00535827 i
0.00876307 + 0.00481754 i
0.00904827 + 0.00425779 i
0.00929776 + 0.00368125 i
0.00951057 + 0.00309017 i
0.00968583 + 0.0024869 i
0.00982287 + 0.00187381 i
0.00992115 + 0.00125333 i
0.00998027 + 0.000627905 i
0.01

aa = 1000
Plot3D[Re[ddd[200, x + I y]], {x, -aa, aa}, {y, -aa, aa}]

1000

Plot3D[Re[E^(x + I y)], {x, -100, 100}, {y, -100, 100}]

aa = 10
Animate[Plot[Re[ddd[n, x + I]], {x, -aa, aa}], {n, 530, 550}]

10

```

```

aa = 10
Plot3D[Im[ddd[10, x + I y]], {x, -aa, aa}, {y, -aa, aa}]
10

E^(1 / 2. Pi I)
6.12323 × 10-17 + 1. i
Cos[1 / 2. Pi] + I Sin[1 / 2. Pi]
6.12323 × 10-17 + 1. i
Integrate[1 / E^(I t), {t, 0, 2 Pi}]
0
f2[100, 100 000, 13., 0]
28.7835 - 1.42144 × 10-13 i
f2[100, 1 000 000, 113., 0]
$Aborted
Integrate[(E^(I t))^2, {t, 0, Pi}]
0
D[1 / z, z]
- $\frac{1}{z^2}$ 
f2e[n_, a_, r_] := Sum[DD[n, r Cos[2 Pi t / a] + I r Sin[2 Pi t / a]] /
  (r Cos[2 Pi t / a] + I r Sin[2 Pi t / a]), {t, 0, a}] / a
f2e[100, 1000, 1.]
28.633333333333365` + 2.9920510513647967`*^-16 i
f2f[n_, a_, r_] := Sum[DD[n, r E^(2 Pi I t / a)] / (r E^(2 Pi I t / a)), {t, 0, a}] / a
f2f[100, 1000, 1.]
28.6333 + 8.67639 × 10-16 i
f2g[n_, a_, r_, d_] :=
  Sum[DD[n, d + r E^(2 Pi I t / a)] / (d + r E^(2 Pi I t / a)), {t, 0, a}] / a
f2g[100, 100 000, .0001, 0]
28.6336 - 1.19019 × 10-13 i
f2h[n_, a_, r_, d_] := Sum[3^(d + r E^(2 Pi I t / a)) / (d + r E^(2 Pi I t / a)), {t, 0, a}] / a
f2h[100, 1 000 000, 10., 0]
1.10452 + 1.58999 × 10-19 i
Limit[3^(z) / z, z → 0]
∞

```

```
Log[3.]
```

```
1.09861
```

```
f2i[n_, a_, r_, d_] := Sum[1 / (d + r E^(2 Pi I t / a)), {t, 0, a}] / a
```

```
f2i[100, 100 000, 10., 0]
```

```
1. × 10-6 + 2.3905 × 10-18 i
```

```
f6[n_, a_, r_, d_] :=
```

```
Sum[(E^(I t))^2 / (E^(I t) - d) * I E^(I t) * .0001, {t, 0, 2 Pi, .0001}]
```

```
Series[E^x / x, {x, 0, 20}]
```

$$\begin{aligned} & \frac{1}{x} + 1 + \frac{x}{2} + \frac{x^2}{6} + \frac{x^3}{24} + \frac{x^4}{120} + \frac{x^5}{720} + \frac{x^6}{5040} + \frac{x^7}{40320} + \frac{x^8}{362880} + \\ & \frac{x^9}{3628800} + \frac{x^{10}}{39916800} + \frac{x^{11}}{479001600} + \frac{x^{12}}{6227020800} + \frac{x^{13}}{87178291200} + \\ & \frac{x^{14}}{1307674368000} + \frac{x^{15}}{20922789888000} + \frac{x^{16}}{355687428096000} + \frac{x^{17}}{6402373705728000} + \\ & \frac{x^{18}}{121645100408832000} + \frac{x^{19}}{2432902008176640000} + \frac{x^{20}}{51090942171709440000} + O[x]^{21} \end{aligned}$$

```
f8[n_, a_, r_, d_] := Sum[DD[n, r Cos[2 Pi t / a] + I r Sin[2 Pi t / a] + d] /  
(r Cos[2 Pi t / a] + I r Sin[2 Pi t / a] + d) / a, {t, 0, a}]
```

```
f8[100, 1000, 1., 0]
```

```
28.6333 + 5.32126 × 10-16 i
```

```
f9[n_, a_, r_] := Sum[DD[n, r E^(2 Pi I t / a)] / (r E^(2 Pi I t / a)), {t, 0, a}] / a
```

```
f9[100, 20 000., 1]
```

```
28.5383 - 2.01902 × 10-15 i
```

```
f10[n_, a_, r_, d_] := Sum[DD[n, d + r E^(2 Pi I t / a)], {t, 0, a}] / a
```

```
f10[100, 20 000., 1, 2]
```

```
482.074 - 1.13722 × 10-14 i
```