```
f[n_, t_] := Sum[ (-1)^(k+1) / k (-1)^k (1 - Gamma[k, -Log[n]] / Gamma[k]), {k, 1, t}]
N[f[100, 10000]]
```

$28.0217 - 2.09386 \times 10^{-14}\, i$

```
N[-Gamma[0, -Log[100]]] - Log[Log[100]] - EulerGamma - I Pi
```

$28.0217 + 0.\, i$

```
N[Limit[ ((-1)^z - (-1)^z Gamma[z, -Log[100]] / Gamma[z] - 1) / z, z → 0]]
```

$30.1261 + 6.28319\, i$

```
Integrate[ (E^t - 1) / t, {t, 0, Log[n]}]
```

-EulerGamma + ExpIntegralEi[Log[n]] - Log[Log[n]]

```
Integrate[ (E^t - 1) t^(1/2), {t, 0, Log[n]}]
```

$$-\frac{1}{2}\sqrt{\pi}\ \mathrm{Erfi}\left[\sqrt{\mathrm{Log}[n]}\right] + \frac{1}{3}\left(3\,n - 2\,\mathrm{Log}[n]\right)\sqrt{\mathrm{Log}[n]}$$

```
Integrate[ (E^t) t^-1, {t, 0, Log[n]}]
```

Integrate::idiv : Integral of $\frac{e^t}{t}$ does not converge on {0, Log[n]}. ≫

$$\int_0^{\mathrm{Log}[n]} \frac{e^t}{t}\, dt$$

```
Expand[Integrate[ (E^t - 1) t^0, {t, 0, Log[n]}]]
```

$-1 + n - \mathrm{Log}[n]$

```
Expand[Integrate[ (E^t) t^0, {t, 0, Log[n]}]]
```

$-1 + n$

```
Expand[Integrate[ (E^t - 1) t^1, {t, 0, Log[n]}]]
```

$$1 - n + n\,\mathrm{Log}[n] - \frac{\mathrm{Log}[n]^2}{2}$$

```
Expand[Integrate[ (E^t) t^1, {t, 0, Log[n]}]]
```

$1 - n + n\,\mathrm{Log}[n]$

```
Expand[Integrate[ (E^t - 1) t^2, {t, 0, Log[n]}]]
```

$$-2 + 2\,n - 2\,n\,\mathrm{Log}[n] + n\,\mathrm{Log}[n]^2 - \frac{\mathrm{Log}[n]^3}{3}$$

```
Expand[Integrate[ (E^t) t^2, {t, 0, Log[n]}]]
```

$-2 + 2\,n - 2\,n\,\mathrm{Log}[n] + n\,\mathrm{Log}[n]^2$

```
Expand[Integrate[ (E^t - 1) t^3, {t, 0, Log[n]}]]
```

$$6 - 6\,n + 6\,n\,\mathrm{Log}[n] - 3\,n\,\mathrm{Log}[n]^2 + n\,\mathrm{Log}[n]^3 - \frac{\mathrm{Log}[n]^4}{4}$$

```
Expand[Integrate[ (E^t) t^3, {t, 0, Log[n]}]]
```

$6 - 6\,n + 6\,n\,\mathrm{Log}[n] - 3\,n\,\mathrm{Log}[n]^2 + n\,\mathrm{Log}[n]^3$

```
Expand[Integrate[ (E^t - 1) t^4, {t, 0, Log[n]}]]
```

$$-24+24\,n-24\,n\,\mathrm{Log}[n]+12\,n\,\mathrm{Log}[n]^2-4\,n\,\mathrm{Log}[n]^3+n\,\mathrm{Log}[n]^4-\frac{\mathrm{Log}[n]^5}{5}$$

```
Expand[Integrate[ (E^t) t^4, {t, 0, Log[n]}]]
```

$$-24+24\,n-24\,n\,\mathrm{Log}[n]+12\,n\,\mathrm{Log}[n]^2-4\,n\,\mathrm{Log}[n]^3+n\,\mathrm{Log}[n]^4$$

```
Expand[Integrate[ (E^t - 1) t^4 / Gamma[5], {t, 0, Log[n]}]]
```

$$-1+n-n\,\mathrm{Log}[n]+\frac{1}{2}\,n\,\mathrm{Log}[n]^2-\frac{1}{6}\,n\,\mathrm{Log}[n]^3+\frac{1}{24}\,n\,\mathrm{Log}[n]^4-\frac{\mathrm{Log}[n]^5}{120}$$

```
Expand[Integrate[ (E^t) t^(5 - 1) / Gamma[5], {t, 0, Log[n]}]]
```

$$-1+n-n\,\mathrm{Log}[n]+\frac{1}{2}\,n\,\mathrm{Log}[n]^2-\frac{1}{6}\,n\,\mathrm{Log}[n]^3+\frac{1}{24}\,n\,\mathrm{Log}[n]^4$$

```
Expand[Integrate[ (E^-t) t^(5 - 1) / Gamma[5], {t, 0, -Log[n]}]]
```

$$1-n+n\,\mathrm{Log}[n]-\frac{1}{2}\,n\,\mathrm{Log}[n]^2+\frac{1}{6}\,n\,\mathrm{Log}[n]^3-\frac{1}{24}\,n\,\mathrm{Log}[n]^4$$

```
Expand[Integrate[ ((E^-t) t^(s - 1)) / Gamma[s], {t, 0, -Log[n]}]]
```

$$\mathrm{ConditionalExpression}\left[1-\frac{\mathrm{Gamma}[s,\,-\mathrm{Log}[n]]}{\mathrm{Gamma}[s]},\ \mathrm{Re}[s]>0\right]$$

```
Expand[Integrate[ ((E^-t) t^(s - 1)) / Gamma[s], {t, -Log[n], 0}]]
```

$$\mathrm{ConditionalExpression}\left[-1+\frac{\mathrm{Gamma}[s,\,-\mathrm{Log}[n]]}{\mathrm{Gamma}[s]},\ \mathrm{Re}[s]>0\right]$$

```
Expand[Integrate[ (E^-t) t^(5 - 1), {t, 0, -Log[n]}]]
```

$$24-24\,n+24\,n\,\mathrm{Log}[n]-12\,n\,\mathrm{Log}[n]^2+4\,n\,\mathrm{Log}[n]^3-n\,\mathrm{Log}[n]^4$$

```
Expand[Integrate[ (E^-t) t^(5 - 1), {t, -Log[n], Infinity}]]
```

$$24\,n-24\,n\,\mathrm{Log}[n]+12\,n\,\mathrm{Log}[n]^2-4\,n\,\mathrm{Log}[n]^3+n\,\mathrm{Log}[n]^4$$

```
Expand[Integrate[ (E^-t) t^(5 - 1), {t, 0, Infinity}]]
```

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```
Integrate[1, {j, 1, n}, {k, 1, n / j}, {l, 1, n / (j k)}, {m, 1, n / (j k l)}, {w, 1, n / (j k l m) }]
```

$$\mathbf{Expand}\left[\mathbf{ConditionalExpression}\left[-1+n+\frac{1}{24}\,n\,\mathrm{Log}[n]\,(-24+\mathrm{Log}[n]\,(12+(-4+\mathrm{Log}[n])\,\mathrm{Log}[n])),\ \mathrm{Re}[n]\geq 0\ ||\ n\notin \mathrm{Reals}\right]\right]$$

$$\mathrm{ConditionalExpression}\left[-1+n-n\,\mathrm{Log}[n]+\frac{1}{2}\,n\,\mathrm{Log}[n]^2-\frac{1}{6}\,n\,\mathrm{Log}[n]^3+\frac{1}{24}\,n\,\mathrm{Log}[n]^4,\ \mathrm{Re}[n]\geq 0\ ||\ n\notin \mathrm{Reals}\right]$$