Integrate[ff[t_] E^(-s t), {t, 0, Infinity}]

$\int_0^\infty e^{-s t}\, \mathrm{ff}[t\_]\, dt$

Integrate[E^(-s x) x^(k - 1), x] /. x → 10

$-s^{-k}\,\mathrm{Gamma}[k, 10\, s]$

Integrate[(x)^(-s - 1) Log[x]^(k - 1), x] /. x → 10

$-s^{-k}\,\mathrm{Gamma}[k, s\,\mathrm{Log}[10]]$

Integrate[E^(-s t), {t, 0, Infinity}]

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

Integrate[t^(-s - 1) Log[t]^(k - 1), {t, 1, Infinity}]

$\mathrm{ConditionalExpression}\left[s^{-k}\,\mathrm{Gamma}[k], \mathrm{Re}[s] > 0 \,\&\&\, \mathrm{Re}[k] > 0\right]$

Integrate[E^(-s t) t^(k - 1), {t, 0, Infinity}]

$\mathrm{ConditionalExpression}\left[s^{-k}\,\mathrm{Gamma}[k], \mathrm{Re}[s] > 0 \,\&\&\, \mathrm{Re}[k] > 0\right]$

Integrate[t^(-s - 1), {t, 1, Infinity}]

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

Integrate[t^(-s - 1) Log[t], {t, 1, Infinity}]

$\mathrm{ConditionalExpression}\left[\frac{1}{s^2}, \mathrm{Re}[s] > 0\right]$

Integrate[LaguerreL[t, x], x]

LaguerreL[t, x] - LaguerreL[1 + t, x]

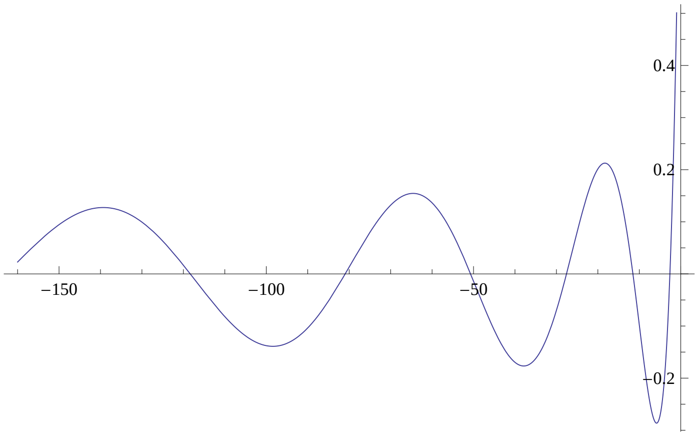
Integrate[x^(s t), {t, 0, Infinity}]

$\mathrm{ConditionalExpression}\left[-\frac{1}{s\,\mathrm{Log}[x]}, \mathrm{Re}[s\,\mathrm{Log}[x]] < 0\right]$

Integrate[x^(s t), {t, 0, Infinity}]

$\mathrm{ConditionalExpression}\left[-\frac{1}{s\,\mathrm{Log}[x]}, \mathrm{Re}[s\,\mathrm{Log}[x]] < 0\right]$

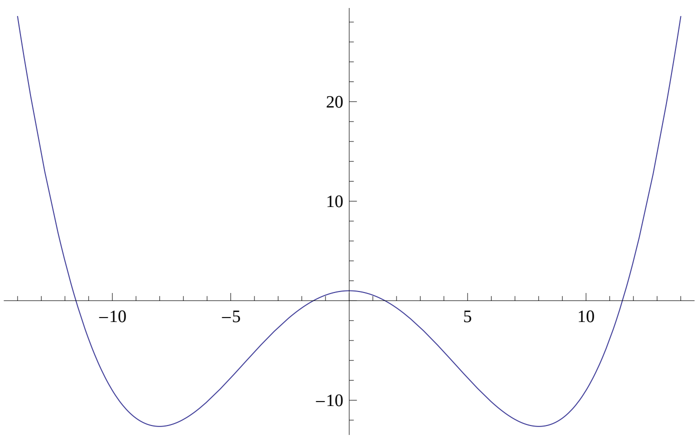
```
Plot[ LaguerreL[ t, Log[.5]], {t, -160, 0}]
```




```
N@Integrate[ LaguerreL[ -t, Log[.5]], {t, 0, 600}]
```

2.40209

```
Plot[Re[ LaguerreL[t I, Log[3]]], {t, -14, 14}]
```




```
gg[n_, rr_] := If[ rr == 0, 1, (-1)^(rr) Gamma[ rr, 0, -Log[n]] / Gamma[rr]]
hh[n_, z_, t_: 30] := Sum[ Binomial[z, k] gg[n, k], {k, 0, t}]
```

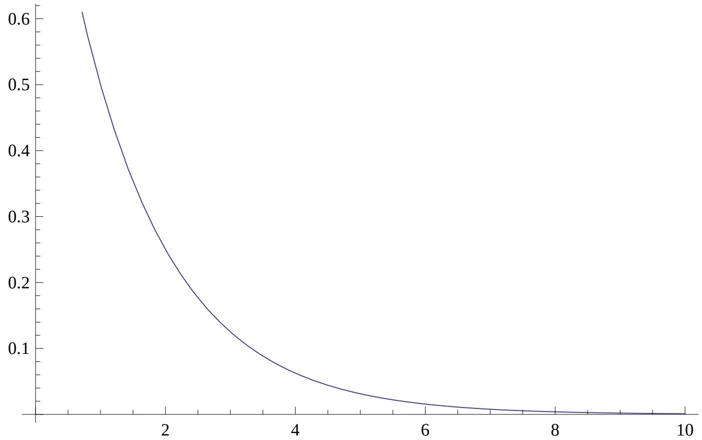
```
Chop@N@hh[100, -4]
```

-0.167536

```
LaguerreL[4, Log[100.]]
```

-0.167536

```
Plot[ .5^t, {t, 0, 10}]
```




```
D[ Log[x], x] /. x → (15)
```

$\frac{1}{15}$

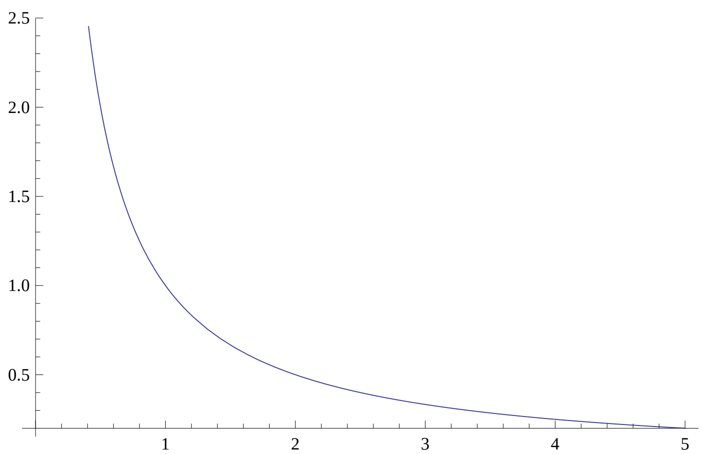
```
N[Limit[ D[ LogIntegral[x] - Log[Log[x]] - EulerGamma, x], x → 3 I]]
```

0.441496 - 0.327838 i

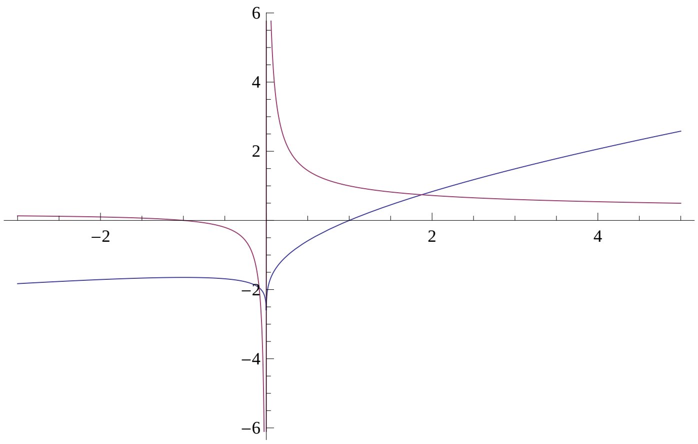
```
Limit[ D[ LogIntegral[x], x], x → (15)]
```

$\frac{1}{\text{Log}[15]}$

```
Plot[ D[ Log[x], x] /. x → y, {y, 0, 5}]
```




```
aa[x_] := LogIntegral[x] - Log[Log[x]] - EulerGamma

Plot[{Re[aa[y]], Re[D[aa[x], x] /. x → y]}, {y, -3, 5}]
```




```
D[ aa[x], x] /. x → 5
```

$$\frac{4}{5\,\text{Log}[5]}$$

```
D[ aa[2 x], x]
```

$$\frac{2}{\text{Log}[2\,x]} - \frac{1}{x\,\text{Log}[2\,x]}$$

$$\frac{1}{\text{Log}[x]} - \frac{1}{x\,\text{Log}[x]}$$

$$\frac{2}{\text{Log}[2\,x]} - \frac{1}{x\,\text{Log}[2\,x]}$$

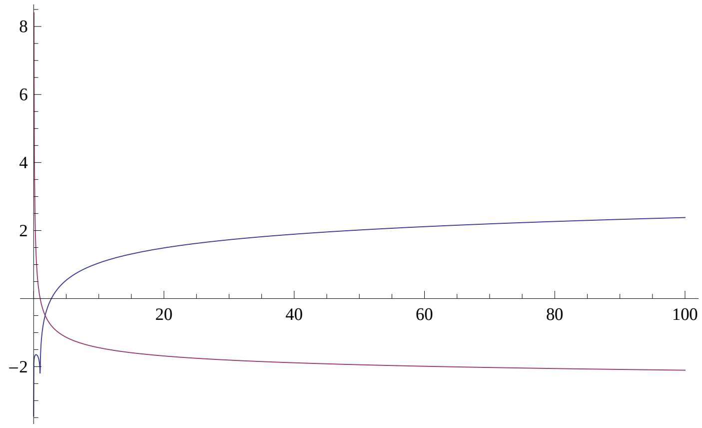
$$\frac{2}{\text{Log}[2\,x]} - \frac{1}{x\,\text{Log}[2\,x]}$$

$$\text{FullSimplify}\left[\frac{2}{\text{Log}[2\,x]} - \frac{1}{x\,\text{Log}[2\,x]}\right]$$

$$\frac{-1 + 2\,x}{x\,\text{Log}[2\,x]}$$

$$\text{Expand}\left[\frac{-1 + 2\,x}{x\,(\text{Log}[2] + \text{Log}[x])}\right]$$

```
aaa[x_] := LogIntegral[x] - Log[Log[x]] - EulerGamma
Plot[{Re[aaa[Log@y]], Re[aaa[1 / y]]}, {y, 0, 100}]
```




```
(D[ ExpIntegralEi[Log@n] - Log@Log@n - EulerGamma, n] /. n → 12)
```

$$\frac{11}{12\,\text{Log}[12]}$$

```
(D[ ExpIntegralEi[Log@n] - Log@Log@n - EulerGamma, n] /. n → 1 / 12)
```

$$\frac{11}{\text{Log}[12]}$$

```
Log[x^(a + b)]
```

$\text{Log}\left[x^{a+b}\right]$

```
Log[ x^a] Log[x^b]
```

$\text{Log}[x^a]\ \text{Log}\left[x^b\right]$

```
Integrate[ z / (n Log[n]) ( LaguerreL[ -z - 1, Log[n]] - LaguerreL[-z, Log[n]] ), {n, 1, x}]
```

```
z (-z HypergeometricPFQ[{1, 1, 1 + z}, {2, 2, 2}, Log[x]] +
    (1 + z) HypergeometricPFQ[{1, 1, 2 + z}, {2, 2, 2}, Log[x]]) Log[x]
```

```
N[Expand[z (-z HypergeometricPFQ[{1, 1, 1 + z}, {2, 2, 2}, Log[x]] +
      (1 + z) HypergeometricPFQ[{1, 1, 2 + z}, {2, 2, 2}, Log[x]]) Log[x] /. {z → 3, x → 10}]]
```

81.5612

```
-1 + N@LaguerreL[ -3, Log[10]]
```

81.5612

```
Integrate[ z / (n Log[n]) ( LaguerreL[ -z - 1, Log[n]] - LaguerreL[-z, Log[n]] ), {n, 0, x}]
```

```
1 + z (-z HypergeometricPFQ[{1, 1, 1 + z}, {2, 2, 2}, Log[x]] +
     (1 + z) HypergeometricPFQ[{1, 1, 2 + z}, {2, 2, 2}, Log[x]]) Log[x]
```

```
N[1 + z (-z HypergeometricPFQ[{1, 1, 1 + z}, {2, 2, 2}, Log[x]] +
      (1 + z) HypergeometricPFQ[{1, 1, 2 + z}, {2, 2, 2}, Log[x]]) Log[x] /. {z → 3, x → 10}]
```

82.5612 + 0. i

```
N@LaguerreL[ -3, Log[10]]
```

82.5612

```
Integrate[ z / (n Log[n]) ( LaguerreL[ -z - 1, Log[n]] - LaguerreL[-z, Log[n]] ), {n, 0, 1}]
```

1

```
D[LaguerreL[-3, n], n] /. n → 1
```

$$\frac{13\,e}{2}$$

```
Integrate[ D[ LaguerreL[ -a, Log[x]], x] (LaguerreL[-b, Log[n] - Log[x]]), {x, 1, n}]
```

$$\int_1^n -\frac{\text{LaguerreL}[-b, \text{Log}[n] - \text{Log}[x]]\ \text{LaguerreL}[-1 - a, 1, \text{Log}[x]]}{x}\, dx$$

```
Integrate[ (a / (x Log[x]) (LaguerreL[ -a - 1, Log[x]] - LaguerreL[-a, Log[x]]))
  (LaguerreL[-b, Log[n] - Log[x]]), {x, 1, n}]
```

$$\int_1^n \frac{1}{x\,\text{Log}[x]}\, a\,(\text{LaguerreL}[-1 - a, \text{Log}[x]] - \text{LaguerreL}[-a, \text{Log}[x]])\ \text{LaguerreL}[-b, \text{Log}[n] - \text{Log}[x]]\, dx$$

```
Integrate[ LaguerreL[ -b, Log[n / x]], {x, 1, n}]
```

$$\int_1^n \text{LaguerreL}\left[-b, \text{Log}\left[\frac{n}{x}\right]\right] dx$$

```
Integrate[ x, {x, 50, 100}]
```

3750

```
Integrate[ 50 × 50 x, {x, 1, 2}]
```

3750

```
N[Integrate[ z / (n Log[n]) (LaguerreL[-z - 1, Log[n]] - LaguerreL[-z, Log[n]]), {n, x, x y}] /.
  {x → 5, y → 6, z → 3}]
```

380.024

```
N[Integrate[ z / (x n Log[x n]) (LaguerreL[-z - 1, Log[x n]] - LaguerreL[-z, Log[x n]]),
   {n, 0, y}] /. {x → 5, y → 6, z → 3}]
```

81.5188

```
N[Integrate[ z / (n Log[x n]) (LaguerreL[-z - 1, Log[x n]] - LaguerreL[-z, Log[x n]]),
   {n, 0, y}] /. {x → 5, y → 6, z → 3}]
```

407.594

```
N[Integrate[ D[LaguerreL[-z, Log[n]], n], {n, x, x y}] /. {x → 5, y → 6, z → 3}]
```

$Aborted

```
N[Integrate[ 1 / Log[y] - 1 / (y Log[y]), {y, 1, 40}]]
```

13.957

```
N[Integrate[ 1 / Log[y] - 1 / (y Log[y]), {y, 1, 5}] +
  Integrate[ 1 / Log[y] - 1 / (y Log[y]), {y, 5, 40}]]
```

13.957

```
ff[n_] := N[Integrate[ 1 / Log[y] - 1 / (y Log[y]), {y, 1, n}]]
```

```
ff[40]
```

13.957

```
ff[5] + N[Integrate[ 1 / Log[y] - 1 / (y Log[y]), {y, 5, 40}]]
```

13.957

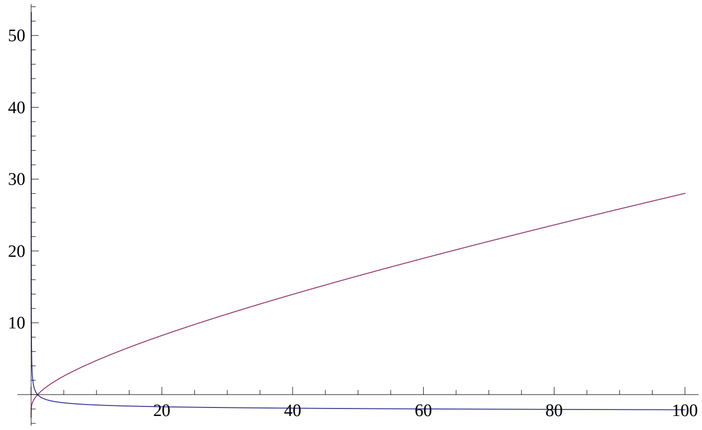
```
ff[5] + N[Integrate[5 (1 / Log[5 y] - 1 / ((5 y) Log[5 y])), {y, 1, 8}]]

13.957

FullSimplify[Expand[x (1 / Log[x y] - 1 / ((x y) Log[x y]))]]
```

$$\frac{-1 + x\,y}{y\,\mathrm{Log}[x\,y]}$$

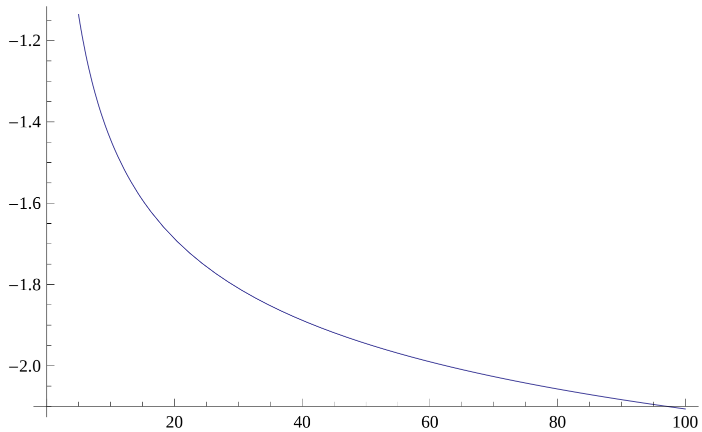
$$\texttt{Integrate}\left[\frac{-1 + x\,y}{y\,\mathrm{Log}[x\,y]}, y\right]$$

```
-Log[Log[x y]] + LogIntegral[x y]

ff[5] + N[Integrate[5 (5 y) / (5 y Log[5 y]) - 5 / ((5 y) Log[5 y]), {y, 1, 8}]]

13.957

ff[5] + N[Integrate[(5 (5 y) - 5) / (5 y Log[5 y]), {y, 1, 8}]]

13.957

ff[5] + N[Integrate[(5 y - 1) / ( y Log[5 y]), {y, 1, 8}]]

13.957


Integrate[D[ x^z, x], {x, 0, 1}]

ConditionalExpression[1, Re[z] > 0]

Integrate[D[ LaguerreL[ -z, Log[y]], y] /. y → x, {x, 0, 1}]

ConditionalExpression[1, Re[z] > 0]

Integrate[ (1 - E^-t) / t, {t, 0, z}]

ConditionalExpression[EulerGamma + Gamma[0, z] + Log[z], Re[z] > 0]

Integrate[ (E^-t) / t, {t, -z, Infinity}]

ConditionalExpression[Gamma[0, -z] + Log[-z], Im[z] ≠ 0 || z < 0]

Sum[ Log[x] ^k / k / k !, {k, 1, Infinity}]

-EulerGamma - Gamma[0, -Log[x]] - Log[-Log[x]]

Sum[ (-1) ^k Log[x] ^k / k / k !, {k, 1, Infinity}]

-EulerGamma - Gamma[0, Log[x]] - Log[Log[x]]
```

```
Plot[{-EulerGamma - Gamma[0, Log[x]] - Log[Log[x]],
  Re[-EulerGamma + LogIntegral[x] - Log[Log[x]]]}, {x, 0, 100}]
```




```
Plot[{Re[(-EulerGamma - Gamma[0, Log[x]] - Log[Log[x]])]}, {x, 0, 100}]
```




```
N[Sum[ (-1)^k Log[x]^k / k / k!, {k, 1, Infinity}] /. x → 1 / 10]
```

4.75435 + 0. i

```
N[Sum[ Log[x]^k / k / k!, {k, 1, Infinity}] /. x → 10]
```

4.75435 + 0. i

```
FullSimplify[D[x^z, x] / ((x^(z + 1) - x^z))]
```

$$\frac{z}{(-1+x)\,x}$$

```
(x^(z + 1) - x^z)
```

$-x^{z} + x^{1+z}$

$\left(x^{-1+z}\, z\right) / \left(-x^{z} + x^{1+z}\right)$

$$\frac{x^{-1+z}\, z}{-x^{z} + x^{1+z}}$$

```
D[ x^z, x]
```

$x^{-1+z}\, z$

$\text{FullSimplify}\left[\frac{5}{(-1+x)\,x}\,(x^6 - x^5)\right]$

$5\,x^4$

```
ll[x_, z_] := LaguerreL[-z, Log[x]]
dl[x_, z_] := z / (x Log[x]) (ll[x, z + 1] - ll[x, z])
gg[x_, z_] := (-1) ^z Gamma[ z, 0, -Log[x]] / Gamma[z]
```

```
D[gg[x, z], x]
```

$-\frac{(-1)^z\,(-\text{Log}[x])^{-1+z}}{\text{Gamma}[z]}$

```
D[ (x - 1) ^z, x]
```

$(-1+x)^{-1+z}\,z$

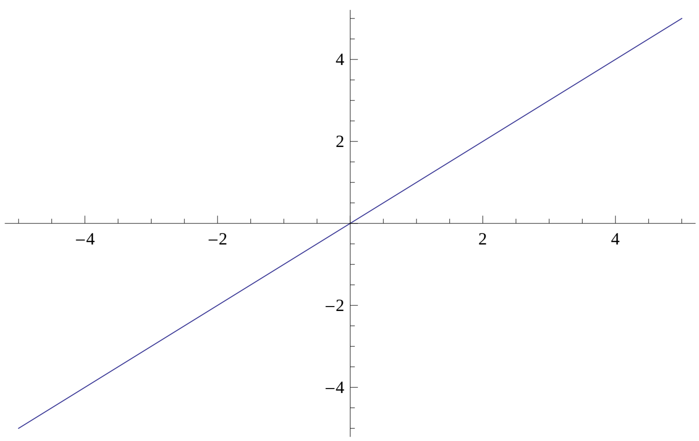
```
Binomial[z, k - 1] (k - 1) + Binomial[z, k] k /. k → 4
```

$\frac{1}{2}\,(-2+z)\,(-1+z)\,z+\frac{1}{6}\,(-3+z)\,(-2+z)\,(-1+z)\,z$

```
Binomial[z, 3]
```

$\frac{1}{6}\,(-2+z)\,(-1+z)\,z$

```
Plot[ D[ LaguerreL[-z, Log[x]], x] /. x → 1, {z, -5, 5}]
```




```
N[D[ LaguerreL[ -n, Log[x]], x] /. x → 1] /. n → 6
```

6.

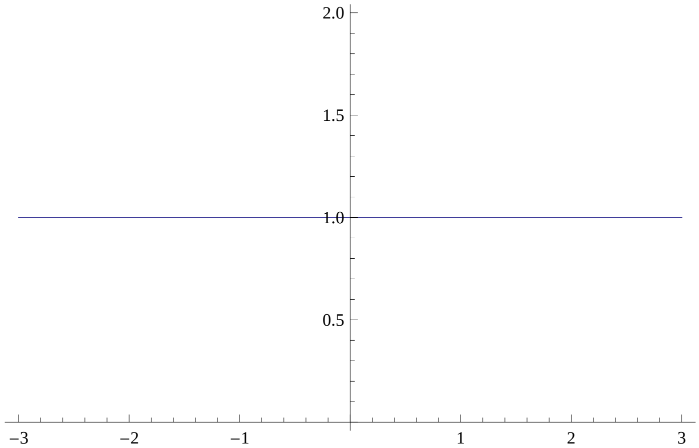
```
FullSimplify[Limit[ dl[x, z], x → 1]]
```

z

```
D[ x^z, x]
```

$x^{-1+z}\,z$

```
Plot[Re[ll[x, 0]], {x, -3, 3}]
```




```
N@dl[3, 1]
```

1.

```
D[x^0, x]
```

0

```
D[gg[n, 4], n]
```

$$\frac{\text{Log}[n]^3}{6}$$

```
D[(n - 1)^5, n]
```

$5\ (-1 + n)^4$

```
D[LaguerreL[-z, Log[n]], {n, 3}]
```

$$-\frac{\text{LaguerreL}[-3-z,\ 3,\ \text{Log}[n]]}{n^3} - \frac{3\ \text{LaguerreL}[-2-z,\ 2,\ \text{Log}[n]]}{n^3} - \frac{2\ \text{LaguerreL}[-1-z,\ 1,\ \text{Log}[n]]}{n^3}$$

```
Integrate[ E^(t (1 - s)) z Hypergeometric1F1[1 - z, 2, t], {t, -Log[x], 0}]
```

$$\int_{-\text{Log}[x]}^{0} e^{(1-s)\ t}\ z\ \text{Hypergeometric1F1}[1-z,\ 2,\ t]\ dt$$

```
1 + N[z Integrate[ E^(t (s - 1)) Hypergeometric1F1[1 - z, 2, t], {t, -Log[x], 0}] /.
   {s → 0, x → 100, z → 3}]
```

2081.41

```
1 + N[z Integrate[ E^(-Log[t] (s - 1)) Hypergeometric1F1[1 - z, 2, -Log[t]], {t, 1, x}] /.
   {s → 0, x → 100, z → 3}]
```

119 334.

```
LaguerreL[-3, 0, Log[100.]]
```

2081.41

```
ff2[n_, s_, z_, t_] :=
 1 + Sum[Binomial[z, k] 1 / (s - 1)^k (Gamma[k, 0, (s - 1) Log[n]] / Gamma[k]), {k, 1, t}]
```

```
Chop@N@ff2[100, -1, 3, 30]
```

119 334.

```
Hypergeometric1F1[3, 1, Log[100.]]
```

2081.41

```
N@Hypergeometric1F1[-2, 2, Log[10]]
```

-0.418935

```
N[D[ LaguerreL[-3, Log[n]], n] /. n → 100]
```

27.4193

```
D[ LaguerreL[-3, Log[n]], n]
```

$$-\frac{\text{LaguerreL}[-4, 1, \text{Log}[n]]}{n}$$

```
N[3 Hypergeometric1F1[ 4, 2, Log[n]] / n /. n → 100]
```

27.4193

$$\text{N}\left[-\frac{\text{LaguerreL}[-4, 1, \text{Log}[n]]}{n} \text{ /. } n \to 100\right]$$

27.4193

```
N[D[ LaguerreL[-z, Log[n]], n] /. {n → 100, z → 4}]
```

90.3236

```
N[z Hypergeometric1F1[ 1 + z, 2, Log[n]] / n /. {n → 100, z → 4}]
```

90.3236

```
N[1 + 3 Integrate[n^-1 Hypergeometric1F1[ 1 + 3, 2, Log[n]], {n, 1, 100}]]
```

2081.41

```
LaguerreL[ -3, Log@100.]
```

2081.41

```
1 + N[z Integrate[ E^ (-Log[t] (s - 1)) Hypergeometric1F1[1 - z, 2, -Log[t]], {t, 1, x}] /.
   {s → 0, x → 100, z → 3}]
ff2[n_, s_, z_, t_] := 1 + Sum[ Binomial[z, k] 1 / (s - 1)^k
    (Gamma[ k, 0, (s - 1) Log[n]] / Gamma[k]), {k, 1, t}]
Chop@N@ff2[100, -1, 3, 30]
```

119 334.

119 334.

```
N[1 + z Integrate[t^-s Hypergeometric1F1[1 - z, 2, -Log[t]], {t, 1, x}] /.
  {s → 3, x → 120, z → 4}]
```

5.05842

```
ff2[n_, s_, z_, t_] :=
 1 + Sum[Binomial[z, k] 1 / (s - 1)^k (Gamma[k, 0, (s - 1) Log[n]] / Gamma[k]), {k, 1, t}]
Chop@N@ff2[120, 3, 4, 30]
```

5.05842

```
1 + z Integrate[Hypergeometric1F1[1 - z, 2, -Log[t]], {t, 1, x}] /. {z → 3, x → 30}
```

$$1+3\left(\frac{29}{3}+20\,\mathrm{Log}[30]+5\,\mathrm{Log}[30]^2\right)$$

$$N\left[1+3\left(\frac{29}{3}+20\,\mathrm{Log}[30]+5\,\mathrm{Log}[30]^2\right)\right]$$

407.594

```
LaguerreL[-3, Log[30.]]
```

407.594

```
N[1 + 3 Integrate[t^(-1) Hypergeometric1F1[1 + 3, 2, Log[t]], {t, 1, 30}]]
```

407.594

```
1 + z Integrate[t^-s Hypergeometric1F1[1 - z, 2, -Log[t]], {t, 1, x}]
```

$$1+z\int_1^x t^{-s}\,\mathrm{Hypergeometric1F1}[1-z,2,-\mathrm{Log}[t]]\,dt$$

```
Expand@D[LogIntegral[x^3] - LogIntegral[x^2], x]
```

$$-\frac{2x}{\mathrm{Log}\left[x^2\right]}+\frac{3x^2}{\mathrm{Log}\left[x^3\right]}$$

$$-\frac{2x}{\mathrm{Log}\left[x^2\right]}+\frac{3x^2}{\mathrm{Log}\left[x^3\right]}$$

$$-\frac{2x}{\mathrm{Log}\left[x^2\right]}+\frac{3x^2}{\mathrm{Log}\left[x^3\right]}$$

```
N@Log[27]
```

3.29584

```
N[3 Log[3]]
```

3.29584

$$-\frac{6}{2\,\mathrm{Log}[3]}+\frac{27}{3\,\mathrm{Log}[3]}$$

$$\frac{6}{\mathrm{Log}[3]}$$

$$\mathrm{FullSimplify}\left[-\frac{2x}{2\,\mathrm{Log}[x]}+\frac{3x^2}{3\,\mathrm{Log}[x]}\right]$$

$$\frac{(-1+x)\,x}{\mathrm{Log}[x]}$$

```
Expand@D[LogIntegral[x^a] - LogIntegral[x^b], x]
```

$$\frac{a\,x^{-1+a}}{\mathrm{Log}[x^{a}]}-\frac{b\,x^{-1+b}}{\mathrm{Log}[x^{b}]}$$

$$\mathbf{FullSimplify}\left[-\frac{1}{\mathrm{Log}[x]}+\frac{2\,x}{2\,\mathrm{Log}[x]}\right]$$

$$\frac{-1+x}{\mathrm{Log}[x]}$$

$$\mathbf{FullSimplify}\left[\frac{a\,x^{-1+a}}{a\,\mathrm{Log}[x]}-\frac{b\,x^{-1+b}}{b\,\mathrm{Log}[x]}\right]$$

$$\frac{x^{a}-x^{b}}{x\,\mathrm{Log}[x]}$$

$$\mathbf{FullSimplify}[\mathrm{D}[\mathrm{Gamma}[0,\ s\,\mathrm{Log}[x]]-\mathrm{Gamma}[0,\ (s-1)\,\mathrm{Log}[x]]+\mathrm{Log}[s]-\mathrm{Log}[s-1],\ x]]$$

$$\frac{(-1+x)\,x^{-1-s}}{\mathrm{Log}[x]}$$

$$\mathbf{FullSimplify}\left[\frac{x^{(s+1)}-x^{(s)}}{x\,\mathrm{Log}[x]}\right]$$

$$\frac{(-1+x)\,x^{-1+s}}{\mathrm{Log}[x]}$$

$$\mathrm{D}[\mathrm{LaguerreL}[-z,\ (1-s)\,\mathrm{Log}[n]],\ n]$$

$$-\frac{(1-s)\,\mathrm{LaguerreL}[-1-z,\ 1,\ (1-s)\,\mathrm{Log}[n]]}{n}$$

$$\mathrm{D}[\mathrm{LaguerreL}[-z,\ \mathrm{Log}[n]],\ n]$$

$$-\frac{\mathrm{LaguerreL}[-1-z,\ 1,\ \mathrm{Log}[n]]}{n}$$