```
m[n_, z_] := Pochhammer[z, n] / (n!)
bo2[z_, k_] := Sum[m[k - 2 j, z] m[j, -z], {j, 0, k / 2}]
bo3[z_, k_] := Sum[m[k - 2 j, z + 1] m[j, -z], {j, 0, k / 2}]
bo3a[z_, k_] := Sum[m[j, z] m[l, -z], {l, 0, k / 2}, {j, 0, k - 2 l}]
bo3b[z_, t_, k_] := Sum[m[j, z] m[l, -z], {l, 0, k / t}, {j, 0, k - t l}]
```

```
Table[bo3[k, j], {k, 0, 5}, {j, 0, k}] // Grid
```

```
1
1  2
1  3   4
1  4   7   8
1  5  11  15  16
1  6  16  26  31  32
```

```
Table[Sum[Binomial[k, n], {n, 0, j}], {k, 0, 5}, {j, 0, k}] // Grid
```

```
1
1  2
1  3   4
1  4   7   8
1  5  11  15  16
1  6  16  26  31  32
```

```
Table[bo3[7.3, j], {j, 0, 8}]
```

```
{1, 8.3, 31.295, 71.9195, 115.591, 144.414, 155.463, 157.515, 157.592}
```

```
Table[Sum[Binomial[7.3, n], {n, 0, j}], {j, 0, 8}]
```

```
{1., 8.3, 31.295, 71.9195, 115.591, 144.414, 155.463, 157.515, 157.592}
```

```
bo2[2.3, 2]
```

```
1.495
```

```
Binomial[2.3, 2]
```

```
1.495
```

```
bin[z_, k_] := Product[z - j, {j, 0, k - 1}] / k!
neg[n_, t_] := 1 - t (Floor[n / t] - Floor[(n - 1) / t])
al[n_, t_, 0] := UnitStep[n]
al[n_, t_, k_] := al[n, t, k] = Sum[neg[j, t] / j al[n - j, t, k - 1], {j, 1, n}]
az[n_, t_, z_] := Sum[z^k / k! al[n, t, k], {k, 0, n}]
daz[n_, t_, z_] := az[n, t, z] - az[n - 1, t, z]
bn[z_, k_] := daz[k, 2, z]
```

```
Table[daz[n, 2, 3], {n, 0, 5}]
```

```
{1, 3, 3, 1, 0, 0}
```

```
Table[bn[7, n], {n, 0, 7}]
```

```
{1, 7, 21, 35, 35, 21, 7, 1}
```

```
(1 + x) / (1 + x / 2)
```

$$\frac{1 + x}{1 + \frac{x}{2}}$$

```
D[bo3b[z, 5, 20], z] /. z → 0
```

$$\frac{23502835}{15519504}$$

```
HarmonicNumber[20] - HarmonicNumber[Floor[20 / 5]]
```

$$\frac{23502835}{15519504}$$

```
D[az[20, 5, z], z] /. z → 0
```

$$\frac{23502835}{15519504}$$

```
al[20, 5, 1]
```

$$\frac{23502835}{15519504}$$

```
D[((1 + x) / (1 + x / 2))^z, z] /. z → 0
```

$$\mathrm{Log}\left[\frac{1+x}{1+\frac{x}{2}}\right]$$

```
pri[n_] := Sum[PrimePi[n^(1 / k)] / k, {k, 1, Log2@n}]
bin[z_, k_] := Product[z - j, {j, 0, k - 1}] / k!
FI[n_] := FactorInteger[n]; FI[1] := {}
dz[n_, z_] := Product[(-1)^p[[2]] bin[-z, p[[2]]], {p, FI[n]}]

po[n_, z_] := Sum[dz[j, -z] dz[k, z], {j, 1, n}, {k, 1, (n / j)^(1 / 2)}]
```

```
D[Expand@po[100, z], z] /. z → 0
```

$$-\frac{116}{5}$$

```
pri[10] - pri[100]
```

$$-\frac{116}{5}$$

```
lo[n_, 0] := UnitStep[n - 1]
lo[n_, k_] := lo[n, k] = Sum[Abs[MoebiusMu[j]] lo[Floor[n / j], k - 1], {j, 2, n}]
lz[n_, z_] := Sum[bin[z, k] lo[n, k], {k, 0, Log2@n}]
lzd[n_, z_] := Product[bin[z, p[[2]]], {p, FI[n]}]
lza[n_, z_] := Sum[lzd[j, z], {j, 1, n}]
```

```
Expand@lz[100, z]
```

$$1+\frac{116\,z}{5}+\frac{9389\,z^2}{360}+\frac{395\,z^3}{48}+\frac{347\,z^4}{144}+\frac{17\,z^5}{240}+\frac{7\,z^6}{720}$$

```
1 + Integrate[D[(1 + t)^z, t], {t, 0, x}] + Integrate[D[(1 + u)^-z, u], {u, 0, x / 2}] +
 Integrate[D[(1 + t)^z, t] D[(1 + u)^-z, u], {t, 0, x}, {u, 0, (x - t) / 2}]
```

$$\mathrm{ConditionalExpression}\left[1-\left(\frac{1}{z}-\frac{2^z\,(2+x)^{-z}}{z}\right)z-2^z\left(\frac{1}{3+x}\right)^z(3+x)^z\,z\,\mathrm{Beta}\left[\frac{2}{3+x},1-z,z\right]+\right.$$
$$\left.(3+x)^{-z}\left(\frac{1}{6+2x}\right)^{-z}z\,\mathrm{Beta}\left[\frac{2+x}{3+x},1-z,z\right],\ \mathrm{Re}[x]\geq-1\ ||\ x\notin\mathrm{Reals}\right]$$

$$\textbf{FullSimplify}\left[1-\left(\frac{1}{z}-\frac{2^z\,(2+x)^{-z}}{z}\right)z-2^z\left(\frac{1}{3+x}\right)^z(3+x)^z\,z\,\text{Beta}\left[\frac{2}{3+x},1-z,z\right]+(3+x)^{-z}\left(\frac{1}{6+2x}\right)^{-z}z\,\text{Beta}\left[\frac{2+x}{3+x},1-z,z\right]\right]\;/.\;x\to 3\;/.\;z\to 2$$

Infinity::indet : Indeterminate expression $\frac{4}{25}$ + ComplexInfinity + ComplexInfinity encountered. ≫

```
Indeterminate
```

```
ab[x_, z_] :=
 1 + Integrate[D[(1 + t)^z, t], {t, 0, x}] + Integrate[D[(1 + u)^-z, u], {u, 0, x / 2}] +
  Integrate[D[(1 + t)^z, t] D[(1 + u)^-z, u], {t, 0, x}, {u, 0, x / 2}]
ab2[x_, z_] := ((1 + x) / (1 + x / 2))^z
```

```
ab[6, .5]
```

```
1.32288
```

```
1 + Integrate[D[(1 + t)^z, t], {t, 0, x}] + Integrate[D[(1 + u)^-z, u], {u, 0, x / 2}] +
 Integrate[D[(1 + t)^z, t] D[(1 + u)^-z, u], {t, 0, x}, {u, 0, x / 2}]
```

$$\text{ConditionalExpression}\left[(1+x)^z+(2+x)^{-z}\left(-1+(1+x)^z\right)\left(2^z-(2+x)^z\right)-\left(\frac{1}{z}-\frac{2^z\,(2+x)^{-z}}{z}\right)z,\ \text{Re}[x]\geq -1\ ||\ x\notin \text{Reals}\right]$$

$$\textbf{FullSimplify}\left[(1+x)^z+(2+x)^{-z}\left(-1+(1+x)^z\right)\left(2^z-(2+x)^z\right)-\left(\frac{1}{z}-\frac{2^z\,(2+x)^{-z}}{z}\right)z\right]$$

$$2^z\left(\frac{1+x}{2+x}\right)^z\;/.\;x\to 113.3\;/.\;z\to 2.3$$

```
4.8269
```

```
((1 + x) / (1 + x / 2))^z /. x → 113.3 /. z → 2.3
```

```
4.8269
```

```
D[(1 + t)^z, t]
```

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

```
D[(1 + t)^-z, t] /. t → u
```

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

```
FullSimplify[Integrate[LaguerreL[z - 1, 1, -t], {t, 0, x}]]
```

```
-1 + LaguerreL[z, -x]
```

```
FullSimplify@Integrate[LaguerreL[-z - 1, 1, -t], {t, 0, x / 2}]
```

$$\text{ConditionalExpression}\left[-1+\text{Hypergeometric1F1}\left[z,1,-\frac{x}{2}\right],\ \text{Re}[x]\geq -2\ ||\ x\notin \text{Reals}\right]$$

```
Integrate[LaguerreL[z - 1, 1, -t] LaguerreL[-z - 1, 1, -u], {t, 0, x}, {u, 0, (x - t) / 2}]
```

$$\int_0^x z\,\text{Hypergeometric1F1}[1-z,2,-t]\left(-1+\text{Hypergeometric1F1}\left[z,1,\frac{t-x}{2}\right]\right)dt$$

```
FullSimplify@Table[1 + (-1 + LaguerreL[z, -x]) + (-1 + Hypergeometric1F1[z, 1, -x/2]) +
    Integrate[z Hypergeometric1F1[1 - z, 2, -t] (-1 + Hypergeometric1F1[z, 1, (t - x)/2]), {t, 0, x}], {z,
    -3, 3}] // TableForm
```

$\frac{1}{16} e^{-x} (14 + 2 e^{x} + (-10 + x) x)$

$\frac{1}{4} e^{-x} (3 + e^{x} - x)$

$\frac{1}{2} (1 + e^{-x})$

1

$2 - e^{-x/2}$

$4 - \frac{1}{2} e^{-x/2} (6 + x)$

$8 - \frac{1}{8} e^{-x/2} (56 + x (16 + x))$

```
FullSimplify@Integrate[D[(1 + t)^z, t], {t, 0, x}]
```

ConditionalExpression$[-1 + (1 + x)^{z}, \mathrm{Re}[x] \geq -1 \,||\, x \notin \mathrm{Reals}]$

```
FullSimplify@Integrate[D[(1 + u)^-z, u], {u, 0, x / 2}]
```

ConditionalExpression$[-1 + 2^{z} (2 + x)^{-z}, \mathrm{Re}[x] \geq -2 \,||\, x \notin \mathrm{Reals}]$

```
FullSimplify@Integrate[D[(1 + t)^z, t] D[(1 + u)^-z, u], {t, 0, x}, {u, 0, x / 2}]
```

ConditionalExpression$[(2 + x)^{-z} (-1 + (1 + x)^{z}) (2^{z} - (2 + x)^{z}), \mathrm{Re}[x] \geq -1 \,||\, x \notin \mathrm{Reals}]$

```
1 + Integrate[D[(1 + t)^z, t], {t, 0, x}] + Integrate[D[(1 + u)^-z, u], {u, 0, x / k}] +
  Integrate[D[(1 + t)^z, t] D[(1 + u)^-z, u], {t, 0, x}, {u, 0, x / k}]
```

ConditionalExpression$\left[1 + \left(\frac{k + x}{k}\right)^{-z} (-1 + (1 + x)^{z}) - \left(\frac{1}{z} - \frac{\left(\frac{k+x}{k}\right)^{-z}}{z}\right) z,\right.$

$\left.(\mathrm{Re}[x] \geq -1 \,||\, x \notin \mathrm{Reals}) \,\&\&\, \left(\left(k \neq 0 \,\&\&\, x \neq 0 \,\&\&\, \mathrm{Re}\left[\frac{k}{x}\right] \geq 0\right) \,||\, \mathrm{Re}\left[\frac{k}{x}\right] \leq -1 \,||\, \frac{k}{x} \notin \mathrm{Reals}\right)\right]$

$\mathbf{FullSimplify}\left[1 + \left(\frac{k + x}{k}\right)^{-z} (-1 + (1 + x)^{z}) - \left(\frac{1}{z} - \frac{\left(\frac{k+x}{k}\right)^{-z}}{z}\right) z\right]$ /. x → 8. /. k → 3. /. z → 2.3

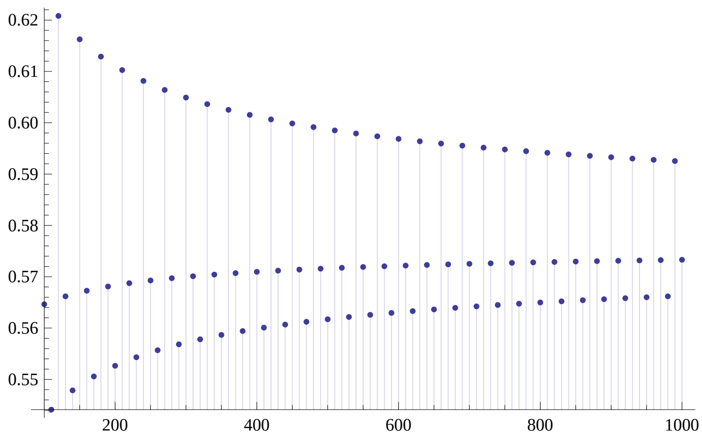
7.88739

```
((1 + x) / (1 + x / k))^z /. x → 8. /. k → 3. /. z → 2.3
```

7.88739

```
pz[x_, z_] := Pochhammer[z, x] / x!
pk[x_, z_, k_] := Sum[pz[t, z] pz[u, -z], {t, 0, x}, {u, 0, (x - t) / k}]
pka[x_, z_, k_] := Sum[pz[x - u k, z + 1] pz[u, -z], {u, 0, x / k}]
pkb[x_, z_, k_] := Sum[pz[x - u k, -z + 1] pz[u, z], {u, 0, x / k}]
```

```
DiscretePlot[pka[n, z, 3] /. z → -.5, {n, 100, 1000, 10}]
```



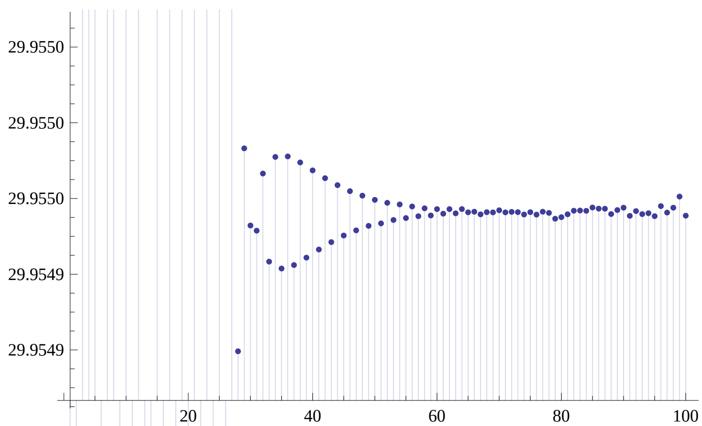

```
2^(5.1 + 3 I)
```

```
-16.7023 + 29.955 ⅈ
```

```
pka[30., 2.5, 2]
```

```
5.65685
```

```
DiscretePlot[Im@pka[n, z, 2] /. z → (5.1 + 3 I), {n, 1, 100}]
```




```
bb[x_, z_] := 1 + (-1 + LaguerreL[z, -x]) + (-1 + Hypergeometric1F1[z, 1, -x/2]) +
  ∫_0^x z Hypergeometric1F1[1 - z, 2, -t] (-1 + Hypergeometric1F1[z, 1, (t - x)/2]) ⅆt
```

```
N[bb[58., 2.5 + I]]
```

```
4.35147 + 3.61451 ⅈ
```

```
2^(2.5 + I)
```

```
4.35147 + 3.61451 ⅈ
```

```
Limit[((1 + x) / (1 + x / k))^z, x → Infinity]
```

k^z

```
FullSimplify[Integrate[LaguerreL[z - 1, 1, -Log[t]], {t, 1, x}]]
```

$$\int_1^x \text{LaguerreL}[-1+z, 1, -\text{Log}[t]]\, dt$$

```
FullSimplify@Integrate[LaguerreL[-z - 1, 1, -Log[u]], {u, 1, x^(1 / 2)}]
```

$$\int_1^{\sqrt{x}} -z\, \text{Hypergeometric1F1}[1+z, 2, -\text{Log}[u]]\, du$$

```
Integrate[LaguerreL[z - 1, 1, -Log[t]] LaguerreL[-z - 1, 1, -Log[u]],
 {t, 1, x}, {u, 1, (x / t) ^ (1 / 2)}]
```

$$\int_1^x \left(-1+\text{LaguerreL}\left[z, \frac{1}{2}\text{Log}\left[\frac{x}{t}\right]\right]\right) \text{LaguerreL}[-1+z, 1, -\text{Log}[t]]\, dt$$

```
cc[x_, z_] :=
```

$$1+\int_1^x \text{LaguerreL}[-1+z, 1, -\text{Log}[t]]\, dt + \int_1^{\sqrt{x}} -z\, \text{Hypergeometric1F1}[1+z, 2, -\text{Log}[u]]\, du + \int_1^x \left(-1+\text{LaguerreL}\left[z, \frac{1}{2}\text{Log}\left[\frac{x}{t}\right]\right]\right) \text{LaguerreL}[-1+z, 1, -\text{Log}[t]]\, dt$$

```
FullSimplify@cc[x, 1]
```

$$\text{ConditionalExpression}\left[\frac{1+x}{2}, \text{Re}[x] \geq 0 \mid\mid x \notin \text{Reals}\right]$$

```
FullSimplify@cc[x, 2]
```

$$\text{ConditionalExpression}\left[\frac{1}{4}(1+3x+x\,\text{Log}[x]), \text{Re}[x] \geq 0 \mid\mid x \notin \text{Reals}\right]$$

```
FullSimplify@cc[x, 3]
```

$$\text{ConditionalExpression}\left[\frac{1}{16}(2+14x+x\,\text{Log}[x]\,(10+\text{Log}[x])), \text{Re}[x] \geq 0 \mid\mid x \notin \text{Reals}\right]$$

```
pkk[x_, z_, k_] :=
 Sum[pz[t, 2 z] pz[u, -z] pz[v, -z], {t, 0, x}, {u, 0, (x - t) / k}, {v, 0, (x - t - k u) / k}]
pkk[20., 2.6, 2]
```

36.7583

```
4^(2.6)
```

36.7583

```
FullSimplify[Sum[Pochhammer[-z, u] / u!, {u, 0, Floor[(x - t) / t]}]]
```

$$\frac{\text{Gamma}\left[-z+\text{Floor}\left[\frac{x}{t}\right]\right]}{\text{Gamma}[1-z]\,\text{Gamma}\left[\text{Floor}\left[\frac{x}{t}\right]\right]}$$

```
Sum[Gamma[-z + Floor[x/t]] / (Gamma[1 - z] Gamma[Floor[x/t]]), {t, 0, x}]
```

$$\sum_{t=0}^{x} \frac{\text{Gamma}\left[-z+\text{Floor}\left[\frac{x}{t}\right]\right]}{\text{Gamma}[1-z]\,\text{Gamma}\left[\text{Floor}\left[\frac{x}{t}\right]\right]}$$

Sum[Gamma[-z + x / t] / (Gamma[1 - z] Gamma[x / t]), {t, 0, x}]

$$\sum_{t=0}^{x} \frac{\text{Gamma}\left[\frac{x}{t} - z\right]}{\text{Gamma}\left[\frac{x}{t}\right] \text{Gamma}[1 - z]}$$

Expand@FullSimplify[(1 - x^4) / (1 - x)]

$1 + x + x^2 + x^3$

(1 - x^k) / (1 - x)

$$\frac{1 - x^k}{1 - x}$$

(1 + x) / (1 + x / k)

$$\frac{1 + x}{1 + \frac{x}{k}}$$

```
pz[x_, z_] := Pochhammer[z, x] / x!
pt[x_, z_, a_] := If[x / a < 1, 1, Sum[pz[j, z] pt[x - a j, z, a + 1], {j, 0, x / a}]]
```

D[Expand@pt[20, z, 1], z] /. z → 0

$$\frac{7257705647}{232792560}$$

Sum[PartitionsP[j], {j, 0, 20}]

2714

Sum[HarmonicNumber[Floor[20 / k]], {k, 1, 20}]

$$\frac{7257705647}{232792560}$$

FullSimplify@Expand[x / (1 - x - x^2) /. x → (1 + x)]

$$-\frac{1 + x}{1 + x (3 + x)}$$

Sum[Fibonacci[k] x^k, {k, 0, Infinity}]

$$-\frac{x}{-1 + x + x^2}$$

Table[D[x / (1 - x - x^2), {x, k}] / k! /. x → 0, {k, 0, 20}]

{0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987, 1597, 2584, 4181, 6765}

FullSimplify[1 - x - x^2]

$1 - x (1 + x)$

Sum[Binomial[z, k] (-1)^k x^k, {k, 0, Infinity}]

$(1 - x)^z$

```
fl[j_, k_] := 1 - k (Floor[j / k] - Floor[(j - 1) / k])
tri[z_, x_] := Sum[pz[x - 3 u, z] pz[u, -z], {u, 0, x / 3}]
```

Table[tri[4, k], {k, 0, 12}]

{1, 4, 10, 16, 19, 16, 10, 4, 1, 0, 0, 0, 0}

```
tt[z_] := Sum[tri[z, k] x^k, {k, 0, 10}]
```

```
tt[1]
```

$-1 + x - x^2$

```
(* http://oeis.org/A001350 *)
Clear[am, amm]
am[n_, 0] := UnitStep[n]
am[n_, k_] := am[n, k] = Sum[Fibonacci[j] am[n - j, k - 1], {j, 1, n}]
amz[n_, z_] := Sum[bin[z, k] am[n, k], {k, 0, n}]
damz[n_, z_] := amz[n, z] - amz[n - 1, z]
iv[n_] := Floor[n / 2] - Floor[(n + 1) / 2]
amm[n_, 0] := UnitStep[n]
amm[n_, k_] := amm[n, k] = -Sum[amm[n - j, k - 1], {j, 1, n, 2}]
ammx[n_, k_] := (-1)^k Pochhammer[Floor[(n - k) / 2] + 1, k] / k!
ammz[n_, z_] := Sum[bin[z, k] amm[n, k], {k, 0, n}]
ammxz[n_, z_] := Sum[bin[z, k] ammx[n, k], {k, 0, n}]
dammz[n_, z_] := amz[n, z] - ammz[n - 1, z]
aa[n_] := Fibonacci[n + 1] + Fibonacci[n - 1] - 1 - (-1)^n
aa2[n_] := (Fibonacci[n + 1] + Fibonacci[n - 1] - 1 - (-1)^n) / n

Table[D[amz[j, z], z] /. z → 0, {j, 1, 10}]
Table[D[damz[j, z], z] /. z → 0, {j, 1, 10}]
Table[aa[n] / n, {n, 1, 10}]
Table[damz[j, z] /. z → -1, {j, 1, 32}]
Table[ammz[j, z] /. z → -1, {j, 1, 32}]
```

$\left\{1, \frac{3}{2}, \frac{17}{6}, \frac{49}{12}, \frac{377}{60}, \frac{179}{20}, \frac{1833}{140}, \frac{5241}{280}, \frac{68449}{2520}, \frac{98941}{2520}\right\}$

$\left\{1, \frac{1}{2}, \frac{4}{3}, \frac{5}{4}, \frac{11}{5}, \frac{8}{3}, \frac{29}{7}, \frac{45}{8}, \frac{76}{9}, \frac{121}{10}\right\}$

$\left\{1, \frac{1}{2}, \frac{4}{3}, \frac{5}{4}, \frac{11}{5}, \frac{8}{3}, \frac{29}{7}, \frac{45}{8}, \frac{76}{9}, \frac{121}{10}\right\}$

{-1, 0, -1, 0, -1, 0, -1, 0, -1, 0, -1, 0, -1, 0,
-1, 0, -1, 0, -1, 0, -1, 0, -1, 0, -1, 0, -1, 0, -1, 0, -1, 0}

{2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987,
1597, 2584, 4181, 6765, 10 946, 17 711, 28 657, 46 368, 75 025, 121 393,
196 418, 317 811, 514 229, 832 040, 1 346 269, 2 178 309, 3 524 578, 5 702 887}

```
amm[33, 4]
```

3060

```
ammx[33, 4]
```

3060

```
-Sum[1, {j, 0, Floor[(n - 1) / 2]}] /. Floor[1/2 (-1 + n)] → a
```

$-1 - a$

```
FullSimplify@Sum[1, {j, 0, a}, {k, 0, a - j}] /. a -> Floor[(n / 2 - 1)]
```

66

```
FullSimplify@-Sum[1, {j, 0, a}, {k, 0, a - j}, {l, 0, a - j - k}] /. a -> Floor[(n - 3) / 2] /. n → 33
```

-816

```
FullSimplify@Sum[1, {j, 0, a}, {k, 0, a - j}, {l, 0, a - j - k}, {m, 0, a - j - k - l}] /.
 a -> Floor[(n - 4) / 2]
```

$$\frac{1}{24}\left(1+\text{Floor}\left[\frac{1}{2}(-4+n)\right]\right)\left(2+\text{Floor}\left[\frac{1}{2}(-4+n)\right]\right)\left(3+\text{Floor}\left[\frac{1}{2}(-4+n)\right]\right)\left(4+\text{Floor}\left[\frac{1}{2}(-4+n)\right]\right)$$

```
Table[amm[33, k], {k, 1, 6}]
```

{-17, 136, -816, 3060, -11 628, 27 132}

```
Table[(-1)^k Pochhammer[Floor[(33 - k) / 2] + 1, k] / k!, {k, 1, 6}]
```

{-17, 136, -816, 3060, -11 628, 27 132}

```
ammz[30, -1]
```

2 178 309

```
Sum[Fibonacci[j], {j, 1, 30}]
```

2 178 308

```
ammxz[30, -1]
```

2 178 309

```
ammx2[n_, k_] := (-1)^k Pochhammer[Floor[(n - k) / 2], k] / k!
ammxz2[n_, z_] := Sum[bin[z, k] ammx2[n, k], {k, 0, n}]
ammxz3[n_] := Sum[bin[-1, k] (-1)^k Pochhammer[Floor[(n - k) / 2], k] / k!, {k, 0, n}]
ammxz3a[n_] := Table[bin[-1, k] (-1)^k , {k, 0, n}]
ammxz4[n_] := Sum[Pochhammer[Floor[(n - k) / 2], k] / k!, {k, 0, n}]
ammxz4a[n_] := Sum[Pochhammer[(n - k) / 2, k] / k!, {k, 0, n}]
ammxz4b[n_] :=
 Sum[Pochhammer[k + 1, Floor[(n - k) / 2] - 1] / (Floor[(n - k) / 2] - 1) !, {k, 0, n}]
ammxz4c[n_] := Sum[Binomial[Floor[(n + k) / 2 - 1], k], {k, 0, n}]
ammxz5[n_] := Table[Pochammer[Floor[(n - k) / 2], k] / f[k], {k, 0, n}]
ammxz6[n_] := Sum[Pochhammer[Floor[n / 2 - k], 2 k + 1] / (2 k + 1) !, {k, 0, n / 2}]
```

```
ammxz5[20]
```

$$\left\{\frac{\text{Pochammer}[10, 0]}{\text{f}[0]}, \frac{\text{Pochammer}[9, 1]}{\text{f}[1]}, \frac{\text{Pochammer}[9, 2]}{\text{f}[2]}, \frac{\text{Pochammer}[8, 3]}{\text{f}[3]}, \frac{\text{Pochammer}[8, 4]}{\text{f}[4]}, \frac{\text{Pochammer}[7, 5]}{\text{f}[5]}, \frac{\text{Pochammer}[7, 6]}{\text{f}[6]}, \frac{\text{Pochammer}[6, 7]}{\text{f}[7]}, \frac{\text{Pochammer}[6, 8]}{\text{f}[8]}, \frac{\text{Pochammer}[5, 9]}{\text{f}[9]}, \frac{\text{Pochammer}[5, 10]}{\text{f}[10]}, \frac{\text{Pochammer}[4, 11]}{\text{f}[11]}, \frac{\text{Pochammer}[4, 12]}{\text{f}[12]}, \frac{\text{Pochammer}[3, 13]}{\text{f}[13]}, \frac{\text{Pochammer}[3, 14]}{\text{f}[14]}, \frac{\text{Pochammer}[2, 15]}{\text{f}[15]}, \frac{\text{Pochammer}[2, 16]}{\text{f}[16]}, \frac{\text{Pochammer}[1, 17]}{\text{f}[17]}, \frac{\text{Pochammer}[1, 18]}{\text{f}[18]}, \frac{\text{Pochammer}[0, 19]}{\text{f}[19]}, \frac{\text{Pochammer}[0, 20]}{\text{f}[20]}\right\}$$

```
Fibonacci[90]
```

2 880 067 194 370 816 120

```
ammxz4c[90]
```

2 880 067 194 370 816 120

```
Pochhammer[3, 13] / 13!
```

105

```
Pochhammer[13 + 1, 3 - 1] / (3 - 1)!
```

105

```
(3 × 4 × 5 × 6 7 × 8 × 9 × 10 × 11 × 12 × 13 × 14 × 15) / (1 × 2 × 3 × 4 × 5 × 6 × 7 × 8 × 9 × 10 × 11 × 12 × 13)
```

105

```
Expand[((1 + 5^(1 / 2))^n - (1 - 5^(1 / 2))^n) / (2^n × 5^(1 / 2)) /. n → 7000]
Fibonacci[7000]
FullSimplify@Sum[Pochhammer[z - k, k] / k!, {k, 0, z}]
```

2^{-1+z}

```
Table[D[x / (1 - x - x^2), {x, k}] / k! /. x → 0, {k, 0, 20}]
```

{0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987, 1597, 2584, 4181, 6765}

```
(1 - x - x^2)
```

$1 - x - x^2$

```
m[x_, z_] := Pochhammer[z, x] / x!
pa[n_] := Sum[m[j, -1], {j, 0, n}] - 1 - Sum[m[j, 1] m[k, -1], {j, 0, n}, {k, 0, (n - j) / 2}]
pb[n_] := Sum[m[j, -1], {j, 0, n}] - 1 - Sum[m[k, 1] m[j, -1], {j, 0, n}, {k, 0, (n - j) / 2}]
pc[n_] := Sum[m[j, -1], {j, 0, n}] - 1 - Sum[m[k, 2] m[j, -1], {j, 0, n}, {k, 0, (n - j)}]
Table[pc[j], {j, 1, 10}]
```

{-3, -4, -5, -6, -7, -8, -9, -10, -11, -12}

```
b1[z_, n_] := Sum[Binomial[z, j], {j, 0, n}]
b1f[z_, n_] := Sum[b1[z, j], {j, 0, n}]
b1fa[z_, n_] := Sum[Binomial[z, j], {r, 0, n}, {j, 0, r}]
b1fb[z_, n_] := Sum[(n - j + 1) Binomial[z, j], {j, 0, n}]
b1fc[z_, n_] := Sum[Binomial[z, j], {t, 0, n}, {r, 0, t}, {j, 0, r}]
b1fd[z_, n_] := Sum[Binomial[n + 2 - j, n - j] Binomial[z, j], {j, 0, n}]
b2[z_, n_] := Sum[Pochhammer[z + 1, n - 2 k] / (n - 2 k)! Pochhammer[-z, k] / k!, {k, 0, n / 2}]
b5[z_, n_, l_] := Sum[Binomial[z + n - 2 k + l, n - 2 k] Binomial[-z + k - 1, k], {k, 0, n / 2}]
bl[t_] := Table[D[(1 + x)^k (1 - x)^t, {x, j}] / j! /. x → 0, {k, 0, 6}, {j, 0, 2 k}] // Grid
br[t_] := {Table[b5[k, j, -t - 1], {k, 0, 6}, {j, 0, 2 k}] // Grid, bl[t]}
```

```
br[-1]
```

```
 1                                          1
 1 2  2                                     1 2  2
 1 3  4   4   4                             1 3  4   4   4
{1 4  7   8   8   8   8                   , 1 4  7   8   8   8   8                   }
 1 5  11  15  16  16  16  16  16            1 5  11  15  16  16  16  16  16
 1 6  16  26  31  32  32  32  32  32  32    1 6  16  26  31  32  32  32  32  32  32
 1 7  22  42  57  63  64  64  64  64  64  64  64   1 7  22  42  57  63  64  64  64  64  64  64  64
```

```
Table[b1fd[k, j], {k, 0, 6}, {j, 0, 2 k}] // Grid
```

```
1
1 4  9
1 5  13  25   41
1 6  18  38   66  102  146
1 7  24  56  104  168  248  344   456
1 8  31  80  160  272  416  592   800  1040  1312
1 9  39  111 240  432  688  1008  1392  1840  2352  2928  3568
```

```
Sum[f[z, l], {j, 0, 5}, {k, 0, j}, {l, 0, k}]
```

```
21 f[z, 0] + 15 f[z, 1] + 10 f[z, 2] + 6 f[z, 3] + 3 f[z, 4] + f[z, 5]
```

```
Sum[f[z, k], {j, 0, 5}, {k, 0, j}]
```

```
6 f[z, 0] + 5 f[z, 1] + 4 f[z, 2] + 3 f[z, 3] + 2 f[z, 4] + f[z, 5]
```

```
Sum[(6 - j) f[z, j], {j, 0, 5}]
```

```
6 f[z, 0] + 5 f[z, 1] + 4 f[z, 2] + 3 f[z, 3] + 2 f[z, 4] + f[z, 5]
```

```
Sum[Binomial[n + 1 - j, n - j] f[z, j], {j, 0, n}]
```

$$\sum_{j=0}^{n} (1 - j + n)\ f[z, j]$$

```
FullSimplify[Sum[Binomial[z, j], {j, 0, n}]]
```

2^z - Binomial[z, 1 + n] Hypergeometric2F1[1, 1 + n - z, 2 + n, -1]

```
m[x_, z_] := Pochhammer[z, x] / x!
blo[z_, n_] := Sum[m[j, z - 1] m[k, -z], {j, 0, n}, {k, 0, (n - j) / 2}]
```

```
blo[13.3, 4]
```

```
793.343
```

```
Binomial[13.3, 4]
```

```
793.343
```

```
FullSimplify@Sum[Pochhammer[-z, k] / k!, {k, 0, Floor[(n - j) / 2]}]
```

$$\frac{\text{Gamma}\left[1 - z + \text{Floor}\left[\frac{1}{2}\ (-j + n)\right]\right]}{\text{Gamma}[1 - z]\ \text{Gamma}\left[1 + \text{Floor}\left[\frac{1}{2}\ (-j + n)\right]\right]}$$

```
ble1[z_, n_] := Sum[m[j, z] m[k, -z], {j, 0, n}, {k, 0, (n - j) / 2}]
ble2[z_, n_] := Sum[m[n - 2 k, z + 1] m[k, -z], {k, 0, n / 2}]
ble3[z_, n_] := Sum[m[k, z] m[Floor[(n - k) / 2], -z + 1], {k, 0, n}]
```

```
ble1[3.2, 7]
```

```
9.18916
```

```
Binomial[7, 3.2]
```

36.426

```
Sum[m[k, z] m[Floor[(n - k) / 2], -z + 1], {k, 0, n}]
```

$Aborted

```
Expand@FullSimplify[(1 + f[x])^5]
```

$1 + 5\,f[x] + 10\,f[x]^2 + 10\,f[x]^3 + 5\,f[x]^4 + f[x]^5$

```
FullSimplify@Expand[(1 - x^2) / (1 - x)]
```

$1 + x$

$$D\left[1 + (-1 + \text{LaguerreL}[z, -x]) + \left(-1 + \text{Hypergeometric1F1}\left[z, 1, -\frac{x}{2}\right]\right) + \int_0^x z\,\text{Hypergeometric1F1}[1 - z, 2, -t]\left(-1 + \text{Hypergeometric1F1}\left[z, 1, \frac{t - x}{2}\right]\right) dt, x\right]$$

$$-\frac{1}{2} z\,\text{Hypergeometric1F1}\left[1 + z, 2, -\frac{x}{2}\right] + \int_0^x -\frac{1}{2} z^2\,\text{Hypergeometric1F1}[1 - z, 2, -t]\,\text{Hypergeometric1F1}\left[1 + z, 2, \frac{t - x}{2}\right] dt + \text{LaguerreL}[-1 + z, 1, -x]$$

$$\text{bb}[x\_, z\_] := 1 + (-1 + \text{LaguerreL}[z, -x]) + \left(-1 + \text{Hypergeometric1F1}\left[z, 1, -\frac{x}{2}\right]\right) + \int_0^x z\,\text{Hypergeometric1F1}[1 - z, 2, -t]\left(-1 + \text{Hypergeometric1F1}\left[z, 1, \frac{t - x}{2}\right]\right) dt$$

```
D[Integrate[LaguerreL[z - 1, 1, -t] LaguerreL[-z - 1, 1, -u], {t, 0, x}, {u, 0, (x - t) / 2}], x]
```

$$\int_0^x -\frac{1}{2} z^2\,\text{Hypergeometric1F1}[1 - z, 2, -t]\,\text{Hypergeometric1F1}\left[1 + z, 2, \frac{t - x}{2}\right] dt$$

```
Pochhammer[3, 7] / 7!
```

36

```
3 × 4 × 5 × 6 × 7 × 8 × 9 / (1 × 2 × 3 × 4 × 5 × 6 × 7)
```

36

```
8 × 9 / (1 × 2)
```

36

```
Pochhammer[8, 2] / 2!
```

36

```
p1[x_, z_] := Pochhammer[z, x] / x!
p2[x_, z_] := Pochhammer[x + 1, z - 1] / (z - 1)!
```

```
p1[17, 13]
```

51 895 935

```
p2[17, 13]
```

51 895 935

```
FullSimplify[Sum[(x + j) ! / x ! / j !, {j, 0, t}, {x, 0, s}]]
```

$$-1 + \frac{\text{Gamma}[3 + s + t]}{\text{Gamma}[2 + s]\ \text{Gamma}[2 + t]}$$

```
FullSimplify[(0 + k) ^ (x - 1) / (0 + k / 2) ^ x]
```

$$\frac{2^x}{k}$$

```
m[x_, z_] := Pochhammer[z, x] / x !
m2[x_, z_] := Pochhammer[x + 1, z - 1] / (z - 1) !
m3[x_, z_] := (z + x + 1) ! / (z + 1) ! / x !
ble1a[x_, k_] := Sum[m[j, x - 1] m[t, -x], {j, 0, k}, {t, 0, (k - j) / 2}]
ble1b[x_, k_] := Sum[m[j, x] m[t, -x], {j, 0, k}, {t, 0, (k - j) / 2}]
ben[x_, k_] := Binomial[x, k]
```

```
ble1b[32, 30]
```

4 294 967 263

```
Binomial[32, 10]
```

64 512 240

```
2^32
```

4 294 967 296

```
pp[x_, z_] := (x + z) ! / x ! / z !
```

```
FullSimplify@Sum[pp[x, j], {k, 0, z}, {j, 0, k}]
```

$$\frac{\text{Gamma}[3 + x + z]}{\text{Gamma}[3 + x]\ \text{Gamma}[1 + z]}$$

```
FullSimplify@Sum[pp[x, j], {j, 0, z}]
```

$$\frac{\text{Gamma}[2 + x + z]}{\text{Gamma}[2 + x]\ \text{Gamma}[1 + z]}$$

```
Sum[f[j], {k, 0, 6}, {l, 0, k}, {j, 0, l}]
```

28 f[0] + 21 f[1] + 15 f[2] + 10 f[3] + 6 f[4] + 3 f[5] + f[6]

```
Sum[pp[6 - j, 2] f[j], {j, 0, 6}]
```

28 f[0] + 21 f[1] + 15 f[2] + 10 f[3] + 6 f[4] + 3 f[5] + f[6]

```
Table[pp[6 - k, 2], {k, 0, 6}]
```

{28, 21, 15, 10, 6, 3, 1}

```
Sum[pp[n - j, 2] f[j], {j, 0, n}]
```

$$\sum_{j=0}^{n} \frac{f[j]\ (2 - j + n)\,!}{2\ (-j + n)\,!}$$

```
FullSimplify@Sum[pp[z - j, 3] pp[x, j], {j, 0, z}]
```

$$\frac{\text{Gamma}[5+x+z]}{\text{Gamma}[5+x]\ \text{Gamma}[1+z]}$$

```
FullSimplify[Sum[(a + z - 1)! / a! / (z - 1)!, {a, 0, x}]]
```

$$\frac{\text{Gamma}[1+x+z]}{\text{Gamma}[1+x]\ \text{Gamma}[1+z]}$$