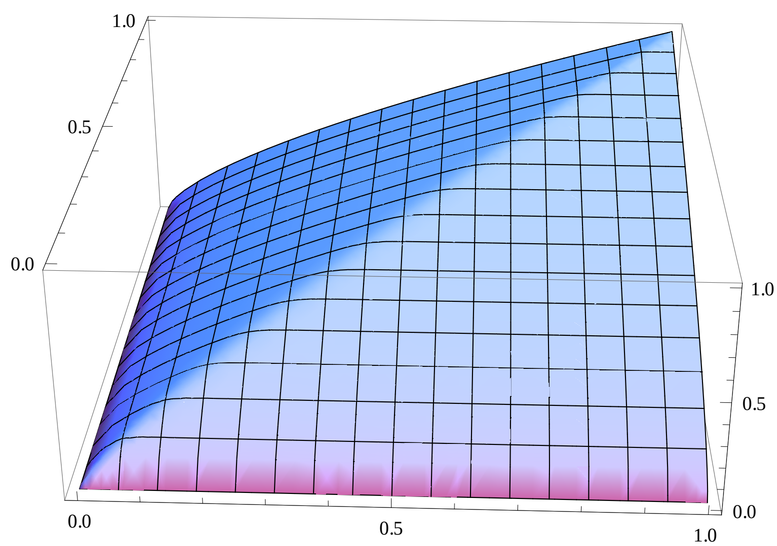
```
ddc[x_, y_, z_, a_] :=
 (e^(((-Log[x])^a + (-Log[y])^a)^(1/a) - ((-Log[x])^a + (-Log[y])^a + (-Log[z])^a)^(1/a))
   (-1 + a + ((-Log[x])^a + (-Log[y])^a + (-Log[z])^a)^(1/a))
   (((-Log[x])^a + (-Log[y])^a)/((-Log[x])^a + (-Log[y])^a + (-Log[z])^a))^(2 - 1/a)) /
  (-1 + a + ((-Log[x])^a + (-Log[y])^a)^(1/a))

f2[x_, y_, z3_, a_] :=
 FindRoot[ddc[x, y, z, a] - z3, {z, 0.0000000000001, 1}, Method → "Brent"][[1, 2]]

Exit[]

A = 20; Plot3D[f2[x, y, 0.999, A], {x, of, 1 + of}, {y, of, 1 + of}, PlotPoints → 30]
```

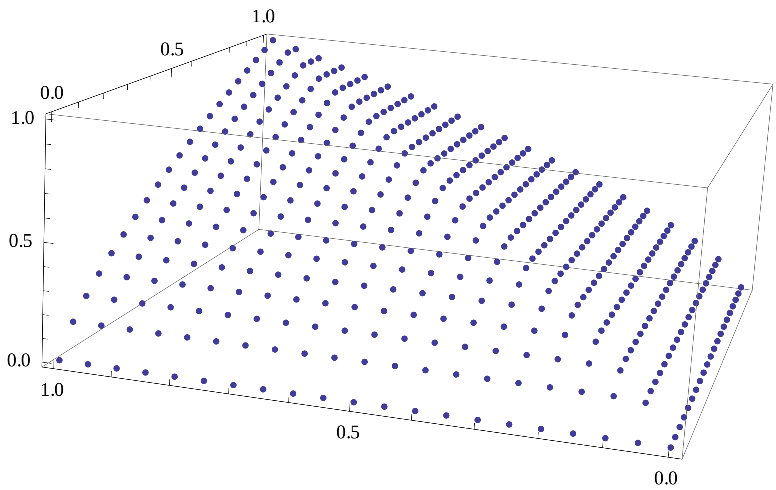



```
A = 20; nx = 20; ny = 20; of = 0.000001;
M = Flatten[Table[{{x / nx + of, y / ny + of}, f2[x / nx + of, y / ny + of, 0.999, A]},
    {x, 0, nx}, {y, 0, ny}] // N, 1];
M2 = Flatten[Table[{x / nx + of, y / ny + of, f2[x / nx + of, y / ny + of, 0.999, A]},
     {x, 0, nx}, {y, 0, ny}] // N, 1];

f3 = Interpolation[M]

InterpolatingFunction[{{1. × 10^-6, 1.}, {1. × 10^-6, 1.}}, <>]
```

```
ListPointPlot3D[M2, PlotRange → All]
```




```
h = Flatten[Table[x ^ n y ^ m, {n, 0, 3}, {m, 0, 3}]]
```

$\{1, y, y^2, y^3, x, x\,y, x\,y^2, x\,y^3, x^2, x^2\,y, x^2\,y^2, x^2\,y^3, x^3, x^3\,y, x^3\,y^2, x^3\,y^3\}$

```
A[i_] := D[D[#, {x, M[[i, 1]]}], {y, M[[i, 2]]}] &
```

```
Co = Inverse[Transpose[Flatten[Table[
     A[j][h] /. x → M[[i, 1]] /. y → M[[i, 2]], {j, 4}, {i, 4}], 1]]]; Co // MatrixForm
```

$$\begin{pmatrix}
1 & 0 & -3 & 2 & 0 & 0 & 0 & 0 & -3 & 0 & 9 & -6 & 2 & 0 & -6 & 4 \\
0 & 0 & 3 & -2 & 0 & 0 & 0 & 0 & 0 & 0 & -9 & 6 & 0 & 0 & 6 & -4 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 9 & -6 & 0 & 0 & -6 & 4 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 3 & 0 & -9 & 6 & -2 & 0 & 6 & -4 \\
0 & 1 & -2 & 1 & 0 & 0 & 0 & 0 & 0 & -3 & 6 & -3 & 0 & 2 & -4 & 2 \\
0 & 0 & -1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 3 & -3 & 0 & 0 & -2 & 2 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -3 & 3 & 0 & 0 & 2 & -2 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 3 & -6 & 3 & 0 & -2 & 4 & -2 \\
0 & 0 & 0 & 0 & 0 & 1 & -2 & 1 & 0 & -2 & 4 & -2 & 0 & 1 & -2 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & -1 & 1 & 0 & 0 & 2 & -2 & 0 & 0 & -1 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & -1 & 0 & 0 & -1 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -1 & 2 & -1 & 0 & 1 & -2 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & -3 & 2 & -2 & 0 & 6 & -4 & 1 & 0 & -3 & 2 \\
0 & 0 & 0 & 0 & 0 & 0 & 3 & -2 & 0 & 0 & -6 & 4 & 0 & 0 & 3 & -2 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -3 & 2 & 0 & 0 & 3 & -2 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -1 & 0 & 3 & -2 & 1 & 0 & -3 & 2
\end{pmatrix}$$

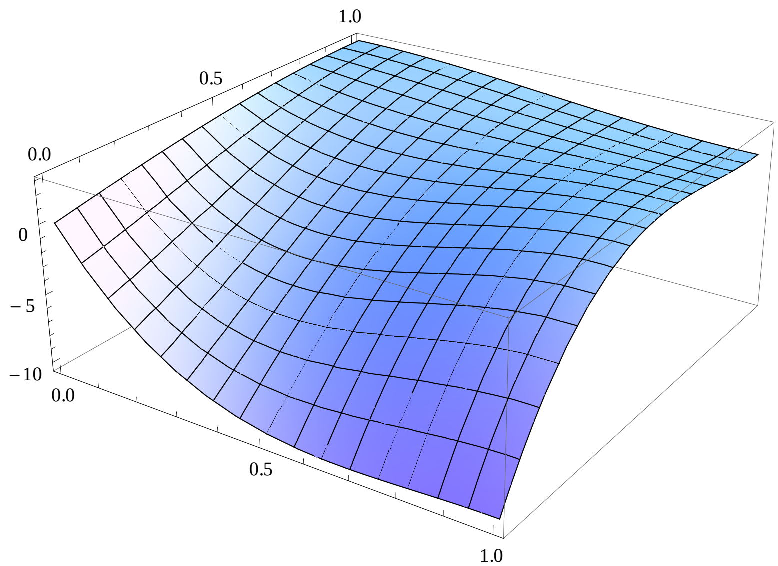
```
Co[[1]]
```

$\{1, 0, -3, 2, 0, 0, 0, 0, -3, 0, 9, -6, 2, 0, -6, 4\}$

```
h.Co[[1]]
```

$1 - 3\,x^2 + 2\,x^3 - 3\,y^2 + 9\,x^2\,y^2 - 6\,x^3\,y^2 + 2\,y^3 - 6\,x^2\,y^3 + 4\,x^3\,y^3$

```
s = {0, 3, 1, -10, 5, 0, 0, 50, 0, 0, 0, -10, -40};
Plot3D[h.Sum[Co[[i]] * s[[i]], {i, Length[s]}], {x, 0, 1}, {y, 0, 1}]
```




```
Co = Table[KroneckerDelta[Ceiling[i / 4] , Ceiling[j / 4]] *
    KroneckerDelta[Mod[i, 4], Mod[j, 4]], {i, 16}, {j, 16}] // MatrixForm
```

$$\begin{pmatrix}
1&0&0&0&0&0&0&0&0&0&0&0&0&0&0&0\\
0&1&0&0&0&0&0&0&0&0&0&0&0&0&0&0\\
0&0&1&0&0&0&0&0&0&0&0&0&0&0&0&0\\
0&0&0&1&0&0&0&0&0&0&0&0&0&0&0&0\\
0&0&0&0&1&0&0&0&0&0&0&0&0&0&0&0\\
0&0&0&0&0&1&0&0&0&0&0&0&0&0&0&0\\
0&0&0&0&0&0&1&0&0&0&0&0&0&0&0&0\\
0&0&0&0&0&0&0&1&0&0&0&0&0&0&0&0\\
0&0&0&0&0&0&0&0&1&0&0&0&0&0&0&0\\
0&0&0&0&0&0&0&0&0&1&0&0&0&0&0&0\\
0&0&0&0&0&0&0&0&0&0&1&0&0&0&0&0\\
0&0&0&0&0&0&0&0&0&0&0&1&0&0&0&0\\
0&0&0&0&0&0&0&0&0&0&0&0&1&0&0&0\\
0&0&0&0&0&0&0&0&0&0&0&0&0&1&0&0\\
0&0&0&0&0&0&0&0&0&0&0&0&0&0&1&0\\
0&0&0&0&0&0&0&0&0&0&0&0&0&0&0&1
\end{pmatrix}$$

```
Ceiling[16 / 4]
```

4

```
Mod[7, 4]
```

3

```
Table[c[i, j], {i, 4}, {j, 4}] // MatrixForm
```

$$\begin{pmatrix} c[1,1] & c[1,2] & c[1,3] & c[1,4] \\ c[2,1] & c[2,2] & c[2,3] & c[2,4] \\ c[3,1] & c[3,2] & c[3,3] & c[3,4] \\ c[4,1] & c[4,2] & c[4,3] & c[4,4] \end{pmatrix}$$

```
Sum[Flatten[Table[x ^ n y ^ m, {n, 0, 3}, {m, 0, 3}]][[i]] * c[j, i], {i, 16}]
```

$$c[j,1] + y\, c[j,2] + y^2 c[j,3] + y^3 c[j,4] + x\, c[j,5] + x\, y\, c[j,6] + x\, y^2 c[j,7] + x\, y^3 c[j,8] + x^2 c[j,9] + x^2 y\, c[j,10] + x^2 y^2 c[j,11] + x^2 y^3 c[j,12] + x^3 c[j,13] + x^3 y\, c[j,14] + x^3 y^2 c[j,15] + x^3 y^3 c[j,16]$$

```
f[x_, y_, j_] := c[j, 1] + y c[j, 2] + y^2 c[j, 3] + y^3 c[j, 4] + x c[j, 5] + x y c[j, 6] +
   x y^2 c[j, 7] + x y^3 c[j, 8] + x^2 c[j, 9] + x^2 y c[j, 10] + x^2 y^2 c[j, 11] +
   x^2 y^3 c[j, 12] + x^3 c[j, 13] + x^3 y c[j, 14] + x^3 y^2 c[j, 15] + x^3 y^3 c[j, 16]
```

```
M = {{0, 0}, {0, 1}, {1, 1}, {1, 0}};
```

```
A =.
```

```
A[4][x ^ 2 y]
```

$2\, x\, y$

```
A[1][f[x, y, 2]] /. x → M[[3, 1]] /. y → M[[3, 2]]
```

$$c[2,1] + c[2,2] + c[2,3] + c[2,4] + c[2,5] + c[2,6] + c[2,7] + c[2,8] + c[2,9] + c[2,10] + c[2,11] + c[2,12] + c[2,13] + c[2,14] + c[2,15] + c[2,16]$$

```
S1 = Flatten[Table[(A[k][f[x, y, j * l]] /. x → M[[i, 1]] /. y → M[[i, 2]]) ==
      KroneckerDelta[i, j] * KroneckerDelta[k, l], {i, 4}, {j, 4}, {k, 4}, {l, 4}], 3];
```

```
S1 // MatrixForm
```

```
Solve[S1, Flatten[Table[c[i, j], {i, 16}, {j, 16}]]]
```

{}

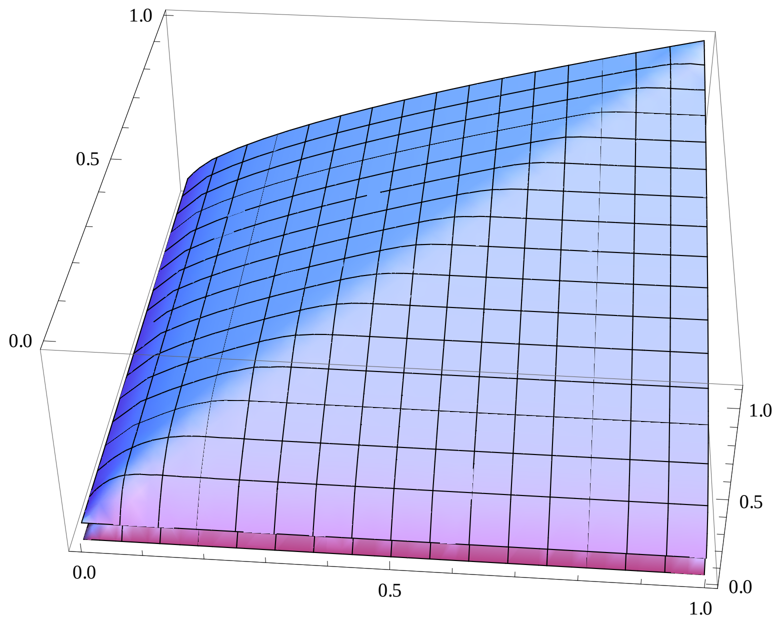
```
Length[S2]
```

128

```
PiecewiseExpand[f3]
```

$\text{InterpolatingFunction}\left[\left\{\left\{1. \times 10^{-6}, 1.\right\}, \left\{1. \times 10^{-6}, 1.\right\}\right\}, <>\right]$

```
A = 20; Plot3D[{f2[x, y, 0.999, A], 0.1 + f3[x, y]}, {x, 0, 1}, {y, 0, 1}, PlotPoints → 20]
```




```
g /. y → 1 /. x → 1 /. a → 3
```

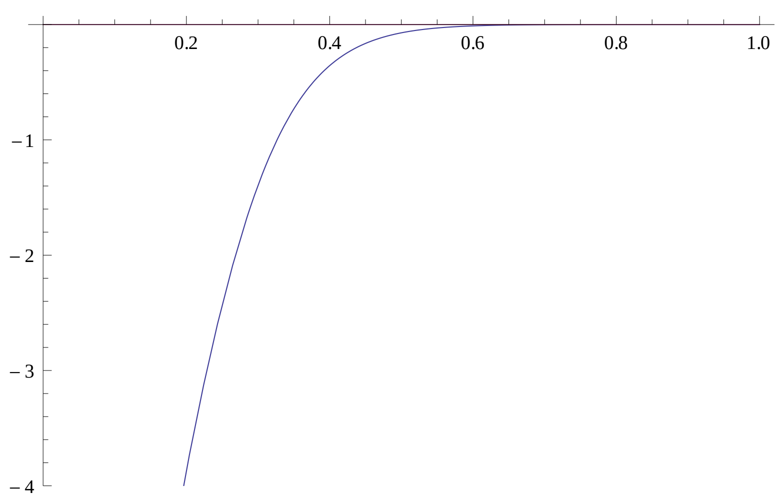
1.00023

```
ny
```

10

```
x =.
```

```
A = 6; xx = 0.3; yy = 0.8;
Plot[{Log[ddc[xx, yy, z, A]], 0 g}, {z, 0, 1}, PlotRange → {-4, 0}]
```




```
g = Normal[InverseSeries[Series[ddc[xx, yy, X, A], {X, 0.4, 55}]] // N] /. X → z];
```

```
g /. z → 0.4
```

1.59248×10^{15}

g

$$0.4+0.187089\,(0.355884+z)+0.236589\,(0.355884+z)^2+0.43407\,(0.355884+z)^3+0.898796\,(0.355884+z)^4+1.99064\,(0.355884+z)^5+4.60201\,(0.355884+z)^6+10.9599\,(0.355884+z)^7+26.677\,(0.355884+z)^8+66.0277\,(0.355884+z)^9+165.596\,(0.355884+z)^{10}+419.78\,(0.355884+z)^{11}+1073.59\,(0.355884+z)^{12}+2766.23\,(0.355884+z)^{13}+7172.9\,(0.355884+z)^{14}+18\,701.7\,(0.355884+z)^{15}+48\,993.6\,(0.355884+z)^{16}+128\,891.\,(0.355884+z)^{17}+340\,346.\,(0.355884+z)^{18}+901\,700.\,(0.355884+z)^{19}+2.39607\times10^{6}\,(0.355884+z)^{20}+6.38421\times10^{6}\,(0.355884+z)^{21}+1.7052\times10^{7}\,(0.355884+z)^{22}+4.56472\times10^{7}\,(0.355884+z)^{23}+1.22444\times10^{8}\,(0.355884+z)^{24}+3.2906\times10^{8}\,(0.355884+z)^{25}+8.85858\times10^{8}\,(0.355884+z)^{26}+2.38862\times10^{9}\,(0.355884+z)^{27}+6.45022\times10^{9}\,(0.355884+z)^{28}+1.74422\times10^{10}\,(0.355884+z)^{29}+4.72266\times10^{10}\,(0.355884+z)^{30}+1.28025\times10^{11}\,(0.355884+z)^{31}+3.4745\times10^{11}\,(0.355884+z)^{32}+9.4395\times10^{11}\,(0.355884+z)^{33}+2.56707\times10^{12}\,(0.355884+z)^{34}+6.98771\times10^{12}\,(0.355884+z)^{35}+1.90378\times10^{13}\,(0.355884+z)^{36}+5.19112\times10^{13}\,(0.355884+z)^{37}+1.41661\times10^{14}\,(0.355884+z)^{38}+3.86871\times10^{14}\,(0.355884+z)^{39}+1.05728\times10^{15}\,(0.355884+z)^{40}+2.89143\times10^{15}\,(0.355884+z)^{41}+7.9125\times10^{15}\,(0.355884+z)^{42}+2.16662\times10^{16}\,(0.355884+z)^{43}+5.93618\times10^{16}\,(0.355884+z)^{44}+1.62733\times10^{17}\,(0.355884+z)^{45}+4.46351\times10^{17}\,(0.355884+z)^{46}+1.2249\times10^{18}\,(0.355884+z)^{47}+3.36311\times10^{18}\,(0.355884+z)^{48}+9.23815\times10^{18}\,(0.355884+z)^{49}+2.53879\times10^{19}\,(0.355884+z)^{50}+6.98002\times10^{19}\,(0.355884+z)^{51}+1.91986\times10^{20}\,(0.355884+z)^{52}+5.2827\times10^{20}\,(0.355884+z)^{53}+1.45416\times10^{21}\,(0.355884+z)^{54}+4.00433\times10^{21}\,(0.355884+z)^{55}$$

ddc[x, y, z, a]