neo-hookean

In[1]:=
```
F = {{x00, x01, x02}, {x10, x11, x12}, {x20, x21, x22}};
j = Det[F];
trace = Tr[Transpose[F].F];

psi = C * (trace / Power[j, 2/3] - 3) + D * (j - 1)^2;

psiPrint = psi;
psiPrint = psiPrint /. j → J;
psiPrint = psiPrint /. trace → tr;
psiPrint
```

Out[8]=
$$D\,(-1+J)^2 + C\left(-3+\frac{tr}{J^{2/3}}\right)$$

gradient

In[9]:=
```
dpsi = Function[x, D[psi, x]];
g = Map[dpsi, Flatten[F]];

gPrint = g;
gPrint = gPrint /. j → J;
gPrint = gPrint /. trace → tr;

Grid[Transpose[{gPrint}], {Frame → All, Spacings → 1.5 {1, 1}}]
```

Out[14]=

$2\,D\,(-1+J)\,(-x12\,x21+x11\,x22)+C\left(\frac{2\,x00}{J^{2/3}}-\frac{2\,tr\,(-x12\,x21+x11\,x22)}{3\,J^{5/3}}\right)$
$2\,D\,(-1+J)\,(x12\,x20-x10\,x22)+C\left(\frac{2\,x01}{J^{2/3}}-\frac{2\,tr\,(x12\,x20-x10\,x22)}{3\,J^{5/3}}\right)$
$2\,D\,(-1+J)\,(-x11\,x20+x10\,x21)+C\left(\frac{2\,x02}{J^{2/3}}-\frac{2\,tr\,(-x11\,x20+x10\,x21)}{3\,J^{5/3}}\right)$
$2\,D\,(-1+J)\,(x02\,x21-x01\,x22)+C\left(\frac{2\,x10}{J^{2/3}}-\frac{2\,tr\,(x02\,x21-x01\,x22)}{3\,J^{5/3}}\right)$
$2\,D\,(-1+J)\,(-x02\,x20+x00\,x22)+C\left(\frac{2\,x11}{J^{2/3}}-\frac{2\,tr\,(-x02\,x20+x00\,x22)}{3\,J^{5/3}}\right)$
$2\,D\,(-1+J)\,(x01\,x20-x00\,x21)+C\left(\frac{2\,x12}{J^{2/3}}-\frac{2\,tr\,(x01\,x20-x00\,x21)}{3\,J^{5/3}}\right)$
$2\,D\,(-1+J)\,(-x02\,x11+x01\,x12)+C\left(-\frac{2\,tr\,(-x02\,x11+x01\,x12)}{3\,J^{5/3}}+\frac{2\,x20}{J^{2/3}}\right)$
$2\,D\,(-1+J)\,(x02\,x10-x00\,x12)+C\left(-\frac{2\,tr\,(x02\,x10-x00\,x12)}{3\,J^{5/3}}+\frac{2\,x21}{J^{2/3}}\right)$
$2\,D\,(-1+J)\,(-x01\,x10+x00\,x11)+C\left(-\frac{2\,tr\,(-x01\,x10+x00\,x11)}{3\,J^{5/3}}+\frac{2\,x22}{J^{2/3}}\right)$