\[ f_1 = 2 \left( x + y - \frac{1}{2} \right) (x + y - 1) \]
\[ f_2 = 2x \left( x - \frac{1}{2} \right) \]
\[ f_3 = 2y \left( y - \frac{1}{2} \right) \]
\[ f_4 = -4x (x + y - 1) \]
\[ f_5 = 4xy \]
\[ f_6 = -4y (x + y - 1) \]

Straight integrals:

\[ \int_{\mathbf{A}} f_i f_j = \left[ \begin{array}{cccccc}
\frac{1}{60} & \frac{1}{360} & \frac{1}{360} & 0 & -\frac{1}{30} & 0 \\
-\frac{1}{30} & 0 & 0 & \frac{1}{30} & 0 & 0 \\
\frac{3}{50} & \frac{3}{50} & -\frac{3}{50} & 0 & 0 & \frac{3}{30} \\
0 & 0 & 0 & \frac{3}{30} & \frac{3}{30} & \frac{3}{30} \\
-\frac{1}{30} & 0 & 0 & \frac{3}{30} & \frac{3}{30} & \frac{3}{30} \\
0 & -\frac{1}{30} & 0 & \frac{3}{30} & \frac{3}{30} & \frac{3}{30}
\end{array} \right] \]

\[ \int_{\mathbf{A}} f_i \frac{\partial f_i}{\partial x} = \left[ \begin{array}{cccccc}
\frac{1}{7} & \frac{1}{7} & 0 & \frac{2}{7} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{2}{7} & 0 & -\frac{2}{7} & 0 & 0 \\
0 & 0 & 0 & -\frac{2}{7} & -\frac{2}{7} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{2}{7} \\
0 & 0 & 0 & 0 & 0 & 0
\end{array} \right] \]
\[
\begin{align*}
\int_{\mathbf{A}_0} f_i f_j &= \left[ \begin{array}{cccc}
0 & 0 & 0 & -\frac{y}{3} \\
0 & 0 & 0 & 0 \\
0 & 0 & -\frac{1}{3} & -\frac{1}{3} \\
-\frac{2}{3} & 0 & -\frac{2}{3} & 0 \\
\end{array} \right] \\
\int_{\mathbf{A}_0} f_i f_j &= \left[ \begin{array}{cccc}
1 & 0 & 0 & -4 \\
1 & -1 & -4 & 4 \\
0 & 0 & 0 & 0 \\
-4 & 0 & 4 & -4 \\
0 & 4 & -4 & 4 \\
0 & -4 & 4 & -4 \\
\end{array} \right] \\
\int_{\mathbf{A}_0} f_i f_j &= \left[ \begin{array}{cccc}
3 & 1 & 0 & -4 \\
0 & 0 & 0 & 0 \\
1 & -1 & 0 & 4 \\
0 & -4 & 0 & 4 \\
0 & 4 & -4 & 4 \\
-4 & 0 & 4 & -4 \\
\end{array} \right] \\
&= \frac{1}{6}
\end{align*}
\]
\[
\int \left( \frac{\partial \psi_r}{\partial X} \frac{\partial X}{\partial x} + \frac{\partial \psi_r}{\partial Y} \frac{\partial Y}{\partial x} \right) \left( \frac{\partial \psi_s}{\partial X} \frac{\partial X}{\partial x} + \frac{\partial \psi_s}{\partial Y} \frac{\partial Y}{\partial x} \right)
\]