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## Problem 9

Write a finite difference method for the Stokes problem

$$\begin{cases} -\nabla^2 \vec{u} + \nabla p = \vec{f} & \text{in } \Omega \\ \nabla \cdot \vec{u} = 0 & \text{in } \Omega \\ \vec{u} = 0 & \text{on } \partial\Omega \end{cases}$$

where $\Omega = ]0, 1[^2$. Use your code to compute the velocity fields for the following force fields

a) $\vec{f}(\vec{x}) = (\vec{x} - \vec{x}_0)\exp(-50\|\vec{x} - \vec{x}_0\|^2)$, where $\vec{x}_0 = (0.4, 0.3)$.

b) $\vec{f}(\vec{x}) = (0, x_1(1 - x_1))$

c) $\vec{f}(\vec{x}) = (x_1(1 - x_1), 0)$     (Here, be careful to interpret the results correctly.)

Feel free to use the code `mit18086_navierstokes.m` as a starting point.