The governing equation is $\frac{\partial T}{\partial t} = \alpha\left(\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2}\right)$ and for steady state, we have $\frac{\partial T}{\partial t} = 0$

```
In[ ]:= nx = 21; ny = 21;
Δx = 1/(nx - 1); Δy = 1/(ny - 1);
k = 1; h = 10; T0 = 300; Tleft = 350; α = 1;
u = 1; v = 2;
T = Array["T", {nx, ny}];
```

```
In[ ]:= discreteEqns = Table[
    u (T[[i + 1, j]] - T[[i - 1, j]])/(2 Δx) + v (T[[i, j + 1]] - T[[i, j - 1]])/(2 Δy) ==
     α ((T[[i + 1, j]] - 2 T[[i, j]] + T[[i - 1, j]])/Δx^2 + (T[[i, j + 1]] - 2 T[[i, j]] + T[[i, j - 1]])/Δy^2),
    {i, 2, nx - 1}, {j, 2, ny - 1}];
```

```
In[ ]:= leftBoundary = Table[T[[1, j]] == Tleft, {j, 2, ny - 1}];
topBoundary = Table[T[[i, ny]] == T[[i, ny - 1]], {i, 1, nx}];
bottomBoundary = Table[T[[i, 1]] == T[[i, 2]], {i, 1, nx}];
(*bottomBoundary = Table[T[[i,1]] == 250,{i,1,nx}];*)
rightBoundary =
  Table[-k/Δx (T[[nx, j]] - T[[nx - 1, j]]) == h (T[[nx, j]] - T0), {j, 2, ny - 1}];
```

```
In[ ]:= eqns = Join[Flatten[discreteEqns],
    leftBoundary, topBoundary, rightBoundary, bottomBoundary];
```

```
In[ ]:= sol = NSolve[eqns, Flatten[T]];
```

```
In[ ]:= TVals = T /. sol // #[[1]] &;
```

In[ ]:=
```
ListContourPlot[Transpose[TVals], PlotLegends → Automatic]
```

Out[ ]=