4 Fluid Kinematics

In reference to ***Fluid Mechanics, Cengel, 3rd***

marco.villafuerte.j@uni.pe

4.2 Flow Patterns and visualization.

Table of Contents

4.2 Flow Patterns and visualization. 1
Steady Flow (It does not depend on time) 1
Represent fluid in a 2-D plane. For different values of constant C 1
Unsteady Flow (It does depend on time) 2
Represent fluid in a 2-D plane. For a constant C = 2. *(Check video generated) :* 2
Represent fluid in a 2-D plane. For constants C = 2, 5 and 8. *(Check video generated):* 3

It's better to explain using examples. Process to solve is explained in book. So, let's get straight into it.

Steady Flow (It does not depend on time)

Let a 2-D velocity vector field be:

$$\overrightarrow{V}(x,y,t) = ui + vj$$
$$\overrightarrow{V}(x,y,t) = (0.5 + 0.8x)i + (1.5 - 0.8y)j$$

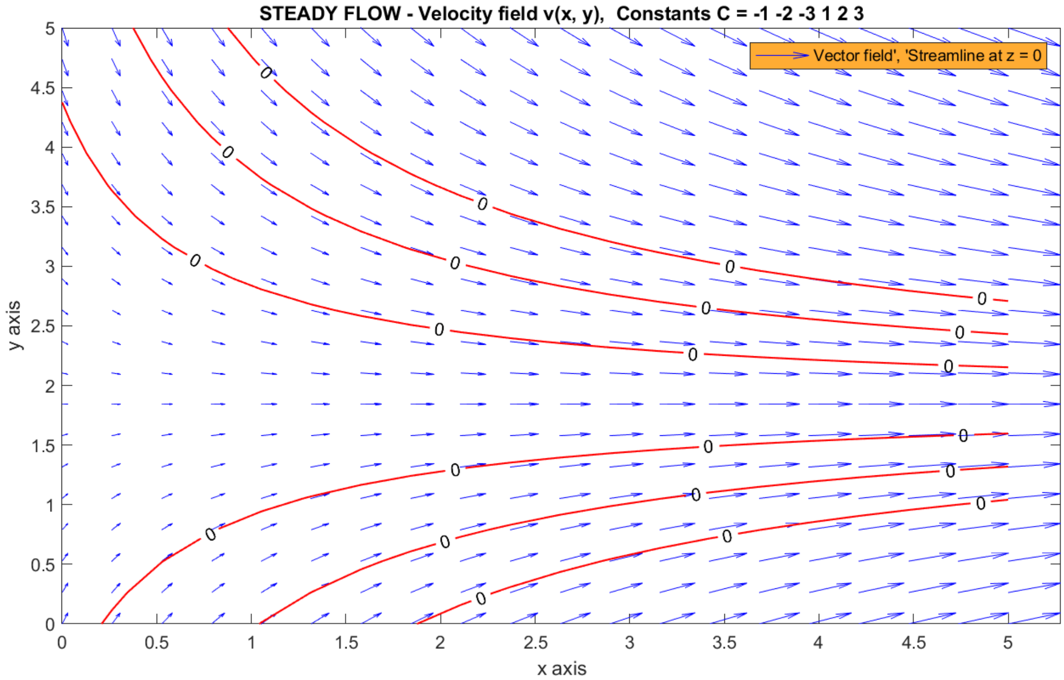
By solving the equation, solution is:

$$y = \frac{C}{0.8(0.5+0.8x)} + 1.875, \;\; C = constant$$

To represent the fluid pattern, it takes to give form to the general expression of function $z = f(x,y,t)$:

$$z = f(x,y,t) = y - \frac{C}{0.8(0.5+0.8x)} - 1.875 = 0$$

Represent fluid in a 2-D plane. For different values of constant C




```
DONE!
```

Unsteady Flow (It does depend on time)

Let a 2-D velocity vector field be:

$$\overrightarrow{V}(x, y, t) = ui + vj$$
$$\overrightarrow{V}(x, y, t) = xi + (-y * t)j$$

**It is spacial 2-D, and 1-D in time.*

By solving the equation, solution is:

$$y = C * x^{-t}, \ C = constant$$

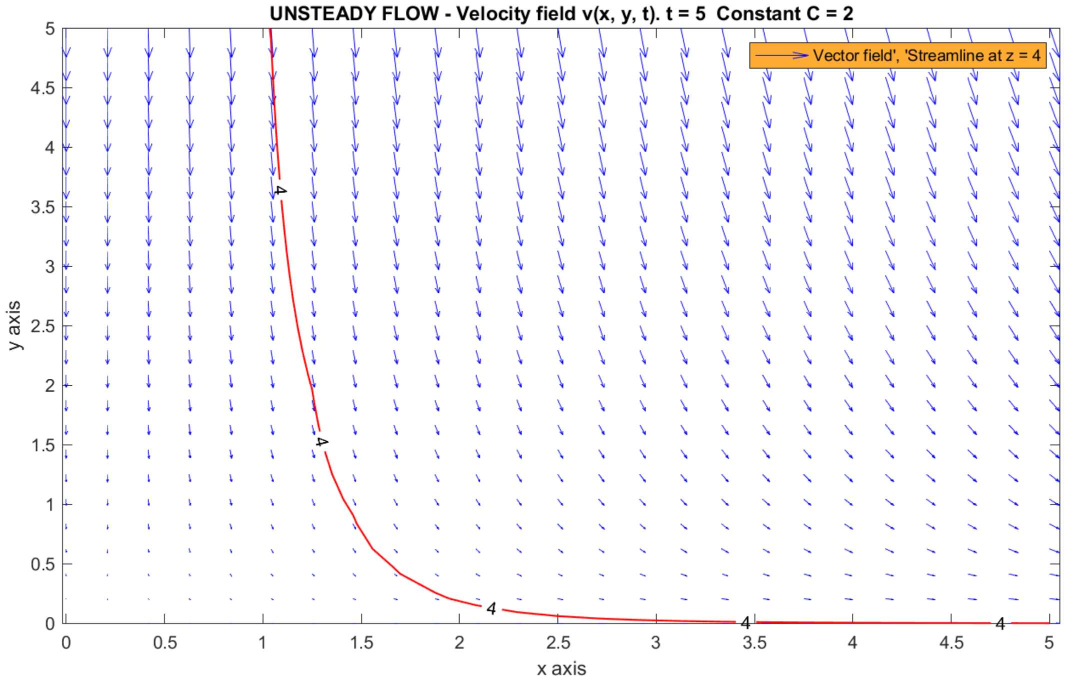
To represent the fluid pattern, it takes to give form to the general expression of function $z = f(x, y, t)$:

$$z = f(x, y, t) = y * x^t - C = 0$$

To plot the function, $z = f(x, y, t)$ must be represented on a plane parallel to x-y plane. So:

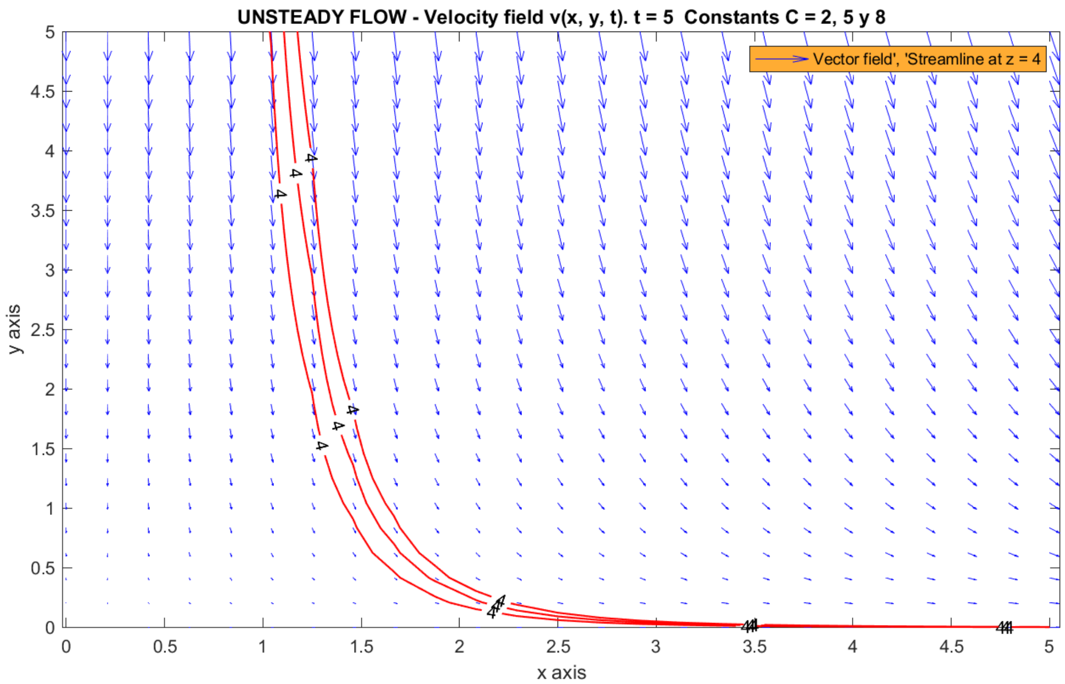
$$z = f(x, y, t) = y * x^t - C = level,$$

Represent fluid in a 2-D plane. For a constant C = 2. ***(Check video generated) :***




```
DONE!
```

Represent fluid in a 2-D plane. For constants C = 2, 5 and 8. ***(Check video generated):***




```
DONE!
```