Examples of Flows and their Associated Complex Potentials, following White’s *Fluid Mechanics* (5th edition)

\[ z = x + iy \quad w = \phi + i\psi \quad \frac{dw}{dz} = V_x - iV_y \]

<table>
<thead>
<tr>
<th>Description</th>
<th>( \vec{V} )</th>
<th>( w )</th>
<th>( \psi )</th>
<th>( \phi )</th>
</tr>
</thead>
</table>
| **Uniform flow**  
See page 265, 545. | \( V_x = U, V_y = V \) | \( w = (U - iV)z \) | \( Uy - Vx \) | \( Ux + Vy \) |
| **Simple source** of strength \( m \)  
m\( m = Q/(2\pi b) \)  
if \( m < 0 \), it is a “sink”.  
See page 265, 545. | \( V_r = m/r \)  
\( V_\theta = 0 \)  
origin is “singular” | \( w = m\ln(z - z_0) \) | \( m\theta \) | \( m\ln(r) \) |
| **“Irrotational” vortex** (CCW),  
with center at \( z_0 \).  
This vortex is fastest at its center.  
Vorticity at the origin \( \to \infty \), but  
is zero everywhere else.  
See page 265, 546. | \( V_r = 0 \)  
\( V_\theta = k/r \) | \( w = -ik\ln(z - z_0) \) | \( -k\ln(r) \) | \( k\theta \) |
| **Doublet** of strength \( \lambda \) \( \text{m}^3/\text{s} \),  
located at \( z_0 \).  
See page 543. | \( u = -\lambda(x^2 - y^2)/(x^2 + y^2)^2 \)  
\( v = -2\lambda xy/(x^2 + y^2)^2 \) | \( w = \lambda/(z - z_0) \) | \( -\lambda\sin(\theta)/r \) | \( \lambda\cos(\theta)/r \) |
| **Stagnation Point** (corner flow), \( u>0 \) along \( y=0, x>0 \).  
See page 546. | \( n \) corresponds to the angle \( \beta \) of the corner: \( \beta = 180^\circ/n=\pi/n \) | \( w = Az^n \) | \( Ar^n\sin(n\theta) \) | \( Ar^n\cos(n\theta) \) |