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

$z = x + iy$ $\quad$ $w = \phi + i\psi$ $\quad$ $dw/dz = V_x - iV_y$

Description	$\vec{V}$	w	ψ	ϕ
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^2/s, located at z_0. $m = Q/(2\pi b)$ 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 $\rightarrow\infty$, but is zero everywhere else. See page 265, 546.	$V_r = 0$ $V_\theta = k/r$	$w =$ $-ik\ln(z - z_0)$ Use negative values of k for CW rotation; $\Gamma = 2\pi k$	$-k\ln(r)$	$k\theta$
Doublet of strength λ m^3/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 β of the corner: $\beta = 180°/n = \pi/n$	$w = Az^n$	$Ar^n\sin(n\theta)$	$Ar^n\cos(n\theta)$