

## Midterm #1

- Newtonian fluid?
- Material derivative (or substantial derivative)
- use of tensor notation to express terms
- divergence / gradient operators
- Streamwise coordinates - acceleration definition
- conditions for  $\nabla^2 \psi = -\zeta$  ;  $\nabla^2 \phi = 0$
- defn. of  $\psi$
- Cons. of mass eqn. (in form using mat'l der.)
- Euler's eqn. - terms ; tensor notation
- Streamfunction - evaluate velocity components or determine  $\psi$  from velocity.
- General Bernoulli eqn. (include vorticity).  
(simplify under what conditions)
- What is vorticity related to : requires vel. gradients
- "irrotational flow" - how related to  $\phi$
- ~~Convective accel. term contains vorticity~~  
~~(vector identity:  $(\mathbf{v} \cdot \nabla) \mathbf{v} = \frac{1}{2} \nabla (\mathbf{v} \cdot \mathbf{v}) - \mathbf{v} \times \zeta$ )~~
- basic potential flow elements (2D, steady)
- use of superposition to create complex flows
- stagnation point condition
- Circulation definition and evaluation
- Application of Bernoulli's Eqn. in potential flow.
- Sketch  $\psi$  &  $\phi$  lines