Assignment 8

The due date for submitting the assignment is too passed.
Per your professor's instruction, you have to resubmit for this assignment.

1. In plane Cauchy flow with \( \vec{u}(x, y, z) = [u(x, y, z), v(x, y, z), w(x, y, z)] \), if \( u_x \neq 0 \), \( w_x \neq 0 \), \( w_y \neq 0 \), the conclusion arrived using the constitutive equation are that \( r \) point

- \( u \) varies in the fluid direction
- \( w \) varies in the fluid direction
- \( w \) does not vary in the fluid direction

No, the answer is incorrect.

Accepted Answer: \( u_x \neq 0 \), \( w_x \neq 0 \), \( w_y \neq 0 \).

2. The boundary conditions for the plane Cauchy flow with bottom plate \( y = 0 \) stationary and top plate \( y = 1 \) moving at \( y = \frac{1}{2} \) are \( r \) point

\( \vec{u}(x, y, z) = [u(x, y, z), v(x, y, z), w(x, y, z)] \)

- \( u = \frac{1}{2} \) at \( y = 0 \)
- \( w = 0 \) at \( y = 0 \)
- \( w = 0 \) at \( y = 1 \)

No, the answer is incorrect.

Accepted Answer: \( u = \frac{1}{2} \) at \( y = 0 \), \( w = 0 \) at \( y = 0 \), \( w = 0 \) at \( y = 1 \).

3. A plane Cauchy flow takes place between two large parallel plates with the bottom plate stationary and top plate moving. The flow is fully developed, and the distance between the plates is 4 mm and the upper plate moves at constant velocity of 40 mm/s. Calculate the magnitude of the rate of rotation of a fluid particle in the flow field \( r \) point

- \( 5 \text{ rad/s} \)
- \( 15 \text{ rad/s} \)
- \( 25 \text{ rad/s} \)

No, the answer is incorrect.

Accepted Answer: \( 25 \text{ rad/s} \).

4. In plane Poiseuille flow with \( \vec{u}(x, y, z) = [u(x, y, z), v(x, y, z), w(x, y, z)] \) and \( p = 0 \) perfectly applying in the x-direction, the x-direction Navier-Stokes equation simplifies to \( r \) point

- \( \frac{\partial u}{\partial x} = 0 \)
- \( \frac{\partial u}{\partial x} = \frac{v}{\eta} \)
- \( \frac{\partial u}{\partial x} = \frac{v}{\eta} \)

No, the answer is incorrect.

Accepted Answer: \( \frac{\partial u}{\partial x} = \frac{v}{\eta} \).

5. Engine at \( T = 180^\circ \text{C} \) is forced to flow between two large parallel plates separated by a gap of length \( 2 \text{ cm} \). The shear rate at the plates is 1000 s\(^{-1}\). The viscosity and density of the engine oil at \( T = 180^\circ \text{C} \) are \( 0.01 \text{ Pa s} \) and \( 850 \text{ kg/m}^3 \), respectively. Estimate the viscosity \( \eta \) of the oil at the boundaries of the plates \( r \) point

- \( 1.2 \text{ Pa s} \)
- \( 0.4 \text{ Pa s} \)
- \( 1.0 \text{ Pa s} \)

No, the answer is incorrect.

Accepted Answer: \( 1.2 \text{ Pa s} \).

6. Choose the correct statement for the plane Poiseuille flow \( r \) point

- Pressure increases along flow direction
- Pressure decreases along flow direction
- Pressure decreases from top plate to bottom plate

No, the answer is incorrect.

Accepted Answer: Pressure decreases along flow direction.

7. \( u_x \) can be interpreted as both viscous stress and \( r \) point

- Convective momentum flux
- Bulk stress
- Body force

No, the answer is incorrect.

Accepted Answer: Convective momentum flux.

8. Make stream function flows from \( r \) point

- A region of higher velocity is a region of lower elevation
- A region of lower elevation is a region of higher velocity
- A region of lower velocity is a region of higher elevation

No, the answer is incorrect.

Accepted Answer: A region of higher velocity is a region of lower elevation.

9. Identify the lower momentum balance equation based on momentum transport convention \( r \) point

\( \frac{\partial p}{\partial x} = \frac{v}{\eta} \)

No, the answer is incorrect.

Accepted Answer: \( \frac{\partial p}{\partial x} = \frac{v}{\eta} \).