Unit 3 - Week 1

Assignment 1

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2019-08-14, 23:59 IST.

1) Consider a room inside which a person is standing 3m away from a room heater. Assume that the thermal diffusivity of air in the room is $10^{-5}\mathrm{m}^2/\mathrm{s}$, and the mean velocity of the air is 1 m/s. How fast does the heat reach the person? [Note: Consider nonlinear effects] *1 point*

- 0.1 s
- 3 s
- 6000 s
- 900000 s

No, the answer is incorrect.
Score: 0
Accepted Answers:
3 s

2) Estimate the time for Q.1 using only thermal diffusion. *1 point*

- 0.1 s
- 3 s
- 6000 s
- 900000 s

No, the answer is incorrect.
Score: 0
Accepted Answers:
900000 s

3) Incompressibility condition is given by *1 point*

- $\frac{D\rho}{Dt} = 0$
- $\frac{\partial \rho}{\partial t} = 0$
- $\nabla \cdot \mathbf{u} = 0$
- both 1st and 3rd options.

No, the answer is incorrect.
Score: 0
Accepted Answers:
both 1st and 3rd options.

4) Which of the following two-dimensional flows are incompressible? *1 point*

- $\sin 2x \cos 3y\hat{x} + \cos 2x \sin 3y\hat{y}$
- $x^2 y\hat{x} + (2x^3 - xy^2)\hat{y}$
- $4\cos 3x\hat{x} + 3\sin 2x\hat{y}$
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
$x^2 y\hat{x} + (2x^3 - xy^2)\hat{y}$

5) The material derivative of vorticity is zero for *1 point*

- three-dimensional incompressible, inviscid flows
- two-dimensional incompressible, inviscid flows
- all inviscid flows
- none of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
two-dimensional incompressible, inviscid flows

6) Vorticity is solenoidal for *1 point*

- incompressible flows
- inviscid flows
- incompressible and inviscid flows
- all flows

No, the answer is incorrect.
Score: 0
Accepted Answers:
all flows

7) In a two-dimensional incompressible flow, $u_x = 2A \sin x \sin y$; u_y is given by *1 point*

- $2A \cos x \sin y + f(y)$
- $A \sin x \cos y + f(x)$
- $2A \cos x \cos y + f(x)$
- none of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
$2A \cos x \cos y + f(x)$

8) Consider a domain given by $x \in [0, \pi]$, $y \in [0, \pi]$, $z \in [0, \pi]$. The flow in the domain is given by $4C(\hat{x} \sin x \cos z - \hat{z} \cos x \sin z) + 4B(\hat{y} \sin y \cos z - \hat{z} \cos y \sin z)$. The total kinetic helicity of the flow is *1 point*

- $32BC$
- $16BC$
- 0
- $4BC$

No, the answer is incorrect.
Score: 0
Accepted Answers:
0

9) Statement 1: Navier Stokes equations (with finite viscosity) are Gallilean invariant. Statement 2: Navier Stokes equations (with finite viscosity) are time reversal symmetric. *1 point*

Choose the correct option.

- Statement 1 is true, statement 2 is false.
- Statement 1 is false, statement 2 is true.
- Both statements are true.
- Both statements are false.

No, the answer is incorrect.
Score: 0
Accepted Answers:
Statement 1 is true, statement 2 is false.

10) Consider the following 2D flow in a box of size $\pi \times \pi$, $\mathbf{u} = 4A(\hat{x} \sin x \cos y - \hat{y} \cos x \sin y)$. The average enstrophy of the flow is: *1 point*

- A^2
- $2A^2$
- $4A^2$
- $8A^2$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$8A^2$