

# Unit 4 - Week 2

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## Assignment 2

The due date for submitting this assignment has passed. **Due on 2019-08-21, 23:59 IST.**  
 As per our records you have not submitted this assignment.

1) The figures show the diagrammatic representation of  $\vec{P}$ ,  $\vec{Q}$ ,  $\vec{R}$  respectively. Which of the following choices is true? **1 point**

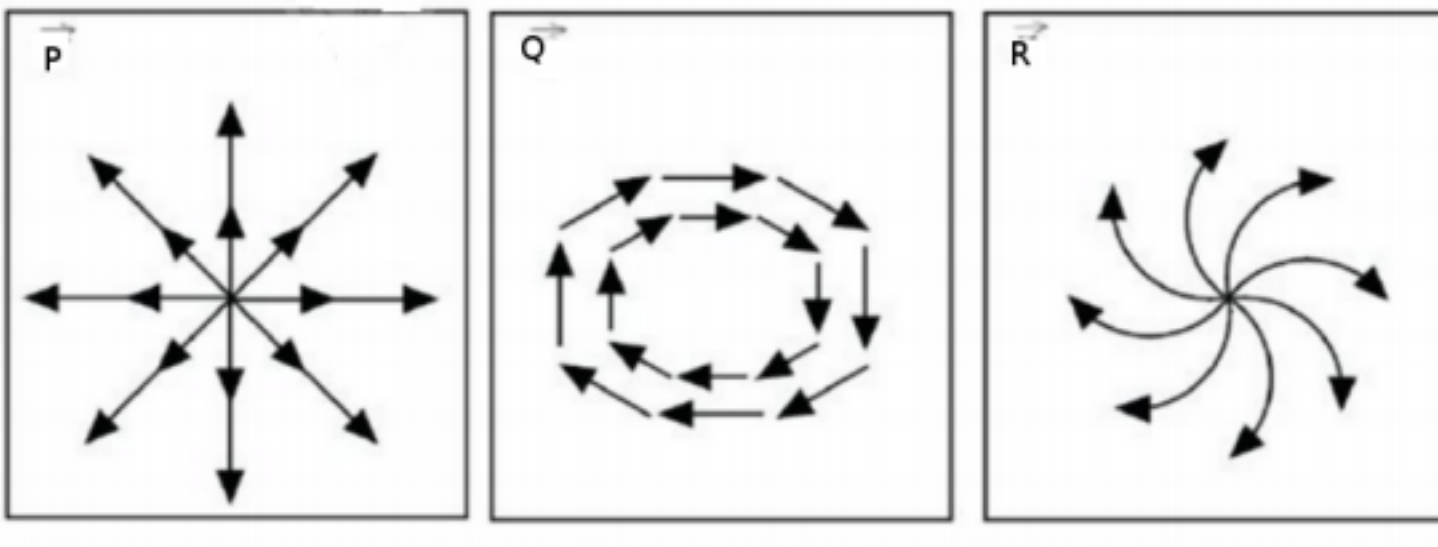


Figure 1: Vector fields

- $\nabla \cdot \vec{P} = 0, \nabla \times \vec{Q} \neq 0, \nabla \times \vec{R} = 0$
- $\nabla \cdot \vec{P} \neq 0, \nabla \times \vec{Q} = 0, \nabla \times \vec{R} \neq 0$
- $\nabla \cdot \vec{P} \neq 0, \nabla \times \vec{Q} \neq 0, \nabla \times \vec{R} \neq 0$
- $\nabla \cdot \vec{P} = 0, \nabla \times \vec{Q} = 0, \nabla \times \vec{R} = 0$

No, the answer is incorrect. Score: 0

Accepted Answers:  $\nabla \cdot \vec{P} \neq 0, \nabla \times \vec{Q} \neq 0, \nabla \times \vec{R} \neq 0$

2) If T is the transformation matrix and  $b_x = T_{pi}T_{qj}T_{rk}T_{sl}a_{ijkl}$ , then the indices that should be present in place of x are **1 point**

- ikjkl
- pi
- pqrsijkl
- pqrs

No, the answer is incorrect. Score: 0

Accepted Answers: pqrs

3) The dyadic product of 2 vectors results in a tensor of order \_\_\_\_\_

No, the answer is incorrect. Score: 0

Accepted Answers: (Type: Numeric) 2

4) The double dot product of 2 tensors results in a tensor of order \_\_\_\_\_

No, the answer is incorrect. Score: 0

Accepted Answers: (Type: Numeric) 0

5) Use quotient theorem, to find the maximum possible indices in the place of x in  $A_{ij} = R_x B_{klm}$  **1 point**

- ij
- ijk
- ijkl
- ijklm

No, the answer is incorrect. Score: 0

Accepted Answers: ijklm

6) Match the following. **Order of tensor**

- Properties**
- Thermal Conductivity
  - Viscosity
  - Piezoelectric coefficient

- Order of tensor**
- Four
  - Three
  - Two

- 1-B,2-C,3-A
- 1-C,2-A,3-B
- 1-A,2-C,3-B

No, the answer is incorrect. Score: 0

Accepted Answers: 1-C,2-A,3-B

7) The relationship which connects a cause and an effect is called as? **1 point**

- Corollary
- Constitutive relation
- Auxiliary relation
- Identity

No, the answer is incorrect. Score: 0

Accepted Answers: Constitutive relation

8) The number of independent variables needed to represent isotropic tensors of order 2, 3 and 4 respectively are **1 point**

- 1,2,3
- 9,27,81
- 1,1,3
- 2,3,4

No, the answer is incorrect. Score: 0

Accepted Answers: 1,1,3

9) The number of independent elements needed to specify the thermal conductivity tensor of a triclinic crystal is \_\_\_\_\_

No, the answer is incorrect. Score: 0

Accepted Answers: (Type: Numeric) 6

10) Given a transformation matrix,  $T_{ij} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$  which performs a symmetry operation and an arbitrary property tensor **1 point**

$K_{ij} = \begin{bmatrix} K_{11} & K_{12} & K_{13} \\ K_{21} & K_{22} & K_{23} \\ K_{31} & K_{32} & K_{33} \end{bmatrix}$  Using the transformation law and the Neumann principle ( $K_{pq} = T_{pi}T_{qj}K_{ij}$ ), which of the following components are non-zero? **1 point**

- $K_{11}; K_{22}; K_{13}; K_{23}$
- $K_{11}; K_{22}; K_{33}; K_{32}; K_{23}$
- $K_{22}; K_{33}; K_{32}; K_{13}; K_{23}$
- $K_{11}; K_{31}; K_{32}; K_{23}$

No, the answer is incorrect. Score: 0

Accepted Answers:  $K_{11}; K_{22}; K_{33}; K_{32}; K_{23}$

11) A two-dimensional velocity field given by  $\vec{v} = (10 + a_1x + b_1y)\hat{i} + (25 + a_2x + b_2y)\hat{j}$ , where  $a_1, a_2, b_1, b_2$  are constants. For the flow to be incompressible, which of the following statements should be true? **1 point**

- $a_1 + b_1 = 0$
- $a_1 + b_2 = 0$
- $a_2 + b_2 = 0$
- $a_2 + b_1 = 0$

No, the answer is incorrect. Score: 0

Accepted Answers:  $a_1 + b_2 = 0$

12) If the velocity field is given by  $\vec{u} = 10x^2y\hat{i} + 15xy^2\hat{j} + (20t - 3xy)\hat{k}$ , then find the acceleration of the fluid particle at a point (1,2,-5) at time t=1. **1 point**

- 38.6
- 55
- 1000
- 1532.51

No, the answer is incorrect. Score: 0

Accepted Answers: 1532.51

13) The unsteady temperature field  $T = x^2 + y^2 + 3t^2$  kelvin and unsteady velocity field is  $\vec{u} = y^2\hat{i} + x\hat{j} + 5t^2\hat{k}$  Find the rate of change of temperature at a point (1,1,0) at time t=1s? Hint: Use Material derivative concept. **1 point**

- 2 K/s
- 5 K/s
- 10 K/s
- 14 K/s

No, the answer is incorrect. Score: 0

Accepted Answers: 10 K/s

14) A 2-D pressure field  $p = 4x + 3y^2$  is associated with a velocity field given by  $\vec{u} = (x^2 - y^2)\hat{i} + (2xy)\hat{j}$  Calculate the rate of change of pressure at point (2,1). **1 point**

- 7
- 8
- 36
- 40

No, the answer is incorrect. Score: 0

Accepted Answers: 36

15) The velocity and density fields are given by  $u = u_0e^{-x/L}$  and  $\rho = \rho_0e^{-2x/L}$ . Find the rate of change of density at  $x = L$ . **1 point**

- 0
- $-2\rho_0e^{-2/L}$
- $-2\rho_0u_0e^{-3/L}$
- $-2\rho_0u_0e^{-3x/L}/L$

No, the answer is incorrect. Score: 0

Accepted Answers:  $-2\rho_0u_0e^{-3/L}$

16) The trace of strain rate tensor gives **1 point**

- Rate of Translation
- Rate of Dilation
- Shear stress
- Rotational field

No, the answer is incorrect. Score: 0

Accepted Answers: Rate of Dilation

17) Does the velocity field given by  $\vec{u} = 15xy^2\hat{i} - 5y^3\hat{j} + t\hat{k}$  represent a possible incompressible flow of fluid? **1 point**

- Yes
- No

No, the answer is incorrect. Score: 0

Accepted Answers: Yes

18) Which of the following set of equations represent 2D incompressible flow? **1 point**

- i)  $u = x + y; v = x - y$
- ii)  $u = xt^2; v = xt + y^2$

- i,ii
- i
- ii
- None

No, the answer is incorrect. Score: 0

Accepted Answers: i

19) In case of incompressible fluid flow (2D) near corners, if  $\frac{\partial u_1}{\partial x_1} > 0$ , then **1 point**

- $\frac{\partial u_2}{\partial x_2} = 0$
- $\frac{\partial u_2}{\partial x_2} < 0$
- Either (a) or (b)
- None of the above

No, the answer is incorrect. Score: 0

Accepted Answers:  $\frac{\partial u_2}{\partial x_2} < 0$

20) Can the set of equations represent a possible 2D incompressible flow? (use cylindrical coordinate system)  $u_r = r\sin\theta, u_\theta = 2r\cos\theta$  **1 point**

- Yes
- No

No, the answer is incorrect. Score: 0

Accepted Answers: Yes