

# Online Homework

**Problem 1** Compute the curl of the vector field  $\mathbf{F}(x, y, z) = (-2y \cos(3x), 3x \sin(-2y), 0)$ .

$$\nabla \times \mathbf{F} = \boxed{(0, 0, 2 \cos(3x) - 3 \sin(2y))}$$

Find the curl of  $\mathbf{F}$  at the point  $(x, y, z) = (\pi, \pi, \pi)$ .

$$(\nabla \times \mathbf{F})(\pi, \pi, \pi) = \boxed{(0, 0, -2)}$$

Is  $\mathbf{F}$  a conservative vector field?

**Multiple Choice:**

- (a) Yes.
- (b) No. ✓
- (c) Not enough information.

Justify your answer.

**Free Response:**

**Problem 2** Compute the curl of the vector field  $\mathbf{F}(x, y, z) = (yz, 2xz, 3xy)$ .

$$\nabla \times \mathbf{F} = \boxed{(x, -2y, z)}$$

Find the curl of  $\mathbf{F}$  at the point  $(x, y, z) = (0, 0, 0)$ .

$$\nabla \times \mathbf{F} = \boxed{(0, 0, 0)}$$

Is  $\mathbf{F}$  irrotational?

**Multiple Choice:**

- (a) Yes.

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Learning outcomes:  
Author(s):

- (b) No. ✓  
 (c) Not enough information.
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**Problem 3** Compute the curl of the vector field  $\mathbf{F}(x, y, z) = (x^2, y^3, z^4)$ .

$$\nabla \times \mathbf{F} = \boxed{(0, 0, 0)}.$$

Find the curl of  $\mathbf{F}$  at the point  $(x, y, z) = (1, 2, 3)$ .

$$(\nabla \times \mathbf{F})(1, 2, 3) = \boxed{(0, 0, 0)}.$$

Is  $\mathbf{F}$  irrotational?

**Multiple Choice:**

- (a) Yes. ✓  
 (b) No.  
 (c) Not enough information.
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**Problem 4** Compute the two-dimensional curl of the vector field  $\mathbf{F}(x, y) = (-xy, xy)$ .

$$\nabla \times \mathbf{F} = \left( 0, 0, \boxed{x + y} \right)$$

Describe the local rotation of  $\mathbf{F}$  at the point  $(1, 1)$ .

**Multiple Choice:**

- (a) Counterclockwise. ✓  
 (b) Clockwise.  
 (c) No rotation.

Describe the local rotation of  $\mathbf{F}$  at the point  $(-1, 1)$ .

**Multiple Choice:**

- (a) Counterclockwise.  
 (b) Clockwise.

- (c) No rotation. ✓

Describe the local rotation of  $\mathbf{F}$  at the point  $(-1, -1)$ .

**Multiple Choice:**

- (a) Counterclockwise.  
 (b) Clockwise. ✓  
 (c) No rotation.

**Problem 5** Compute the curl of the vector field  $\mathbf{F}(x, y) = (2x - y, -x + 4y)$ .

$$\nabla \times \mathbf{F} = (0, 0, \boxed{0})$$

Is  $\mathbf{F}$  conservative?

**Multiple Choice:**

- (a) Yes. ✓  
 (b) No.

**Problem 5.1** Find a potential function  $f$  for  $\mathbf{F}$ , so that  $\nabla f = \mathbf{F}$ .

$$f(x, y) = \boxed{x^2 - xy + 2y^2}$$

**Problem 6** Compute the curl of the vector field  $\mathbf{F}(x, y) = (2y, 3x)$ .

$$\nabla \times \mathbf{F} = (0, 0, \boxed{1})$$

Is  $\mathbf{F}$  conservative?

**Multiple Choice:**

- (a) Yes.  
 (b) No. ✓

**Problem 7** Compute the curl of the vector field  $\mathbf{F}(x, y) = (2x, 3y)$ .

$$\nabla \times \mathbf{F} = (0, 0, \boxed{0})$$

Is  $\mathbf{F}$  conservative?

**Multiple Choice:**

- (a) Yes. ✓
- (b) No.

**Problem 7.1** Find a potential function  $f$  for  $\mathbf{F}$ , so that  $\nabla f = \mathbf{F}$ .

$$f(x, y) = \boxed{x^2 + \frac{3}{2}y^2}$$

**Problem 8** Compute the curl of the vector field  $\mathbf{F}(x, y) = (-4x + y \cos(x), \sin(x))$ .

$$\nabla \times \mathbf{F} = (0, 0, \boxed{0})$$

Is  $\mathbf{F}$  conservative?

**Multiple Choice:**

- (a) Yes. ✓
- (b) No.

**Problem 8.1** Find a potential function  $f$  for  $\mathbf{F}$ , so that  $\nabla f = \mathbf{F}$ .

$$f(x, y) = \boxed{-2x^2 + y \sin(x)}$$

**Problem 9** Compute the curl of the vector field  $\mathbf{F}(x, y, z) = (\sin(x), y^2, e^z)$ .

$$\nabla \times \mathbf{F} = \boxed{(0, 0, 0)}$$

Is  $\mathbf{F}$  conservative?

**Multiple Choice:**

- (a) Yes. ✓
- (b) No.

**Problem 9.1** Find a potential function  $f$  for  $\mathbf{F}$ , so that  $\nabla f = \mathbf{F}$ .

$$f(x, y, z) = \boxed{-\cos(x) + \frac{1}{2}y^2 + e^z}$$

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