

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.

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 $\nabla f = \mathbf{F}$.

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