Classroom Voting Questions: Multivariable Calculus

20.4 Stokes’ Theorem

1. Which of the following facts about \( \vec{F} = \rho \hat{\rho} \) is implied by Stokes’ Theorem?

   (a) The line integral from (0,0,0) to (1,1,1) is equal to 3/2.
   (b) \( \vec{F} \) has positive divergence everywhere.
   (c) The line integral on any closed curve is zero.
   (d) The curl of \( \vec{F} \) is non-zero.

2. What can be said about the vector field \( \nabla f \) in terms of curl?

   (a) Its curl is negative.
   (b) Its curl is zero.
   (c) Its curl is positive.
   (d) Its curl depends on the function \( f \).

3. The figure below shows the vector field \( \nabla \times \vec{F} \). No formula for the vector field \( \vec{F} \) is given. The oriented curve \( C \) is a circle, perpendicular to \( \nabla \times \vec{F} \). The sign of the line integral \( \int_{\gamma} \vec{F} \cdot d\vec{r} \)
(a) is positive.
(b) is negative.
(c) is zero.
(d) can’t be determined without further information.

4. The figure below shows the vector field \( \vec{F} \). The surface \( S \) is oriented upward and perpendicular to \( \vec{F} \) at every point. The sign of the flux of \( \nabla \times \vec{F} \) through the surface

![Diagram of vector field F](image)

(a) is positive.
(b) is negative.
(c) is zero.
(d) can’t be determined without further information.

5. The vector field \( \vec{F} \) has curl \( \nabla \times \vec{F} = 3 \hat{i} + 4 \hat{j} + 2 \hat{k} \). What is the magnitude of the circulation of \( \vec{F} \) around the perimeter of the square with corners at coordinates \((1,2,3), (4,2,3), (4,2,6), \) and \((1,2,6)\)?

(a) 0
(b) 18
(c) 27
(d) 36
(e) 81
(f) None of the above