1.

Let $S$ be the portion of the sphere with $y \geq 0$, and oriented with the outward normal. Which way is the boundary oriented? (Describe it by starting at the north pole, and deciding whether you should travel in the positive or negative $x$ direction first.)

(a) Positive $x$ direction first.
(b) Negative $x$ direction first.
T/F: For any \((C^1)\) vector field \(F\),
\[
\iint_{S_1} \nabla \times F \cdot dS = \pm \iint_{S_2} \nabla \times F \cdot dS.
\]

(a) True  
(b) False
3. Orientation matters. If we pick “inward” orientations for $S_1$ and $S_2$, then which is true?

(a) $\int \int_{S_1} \nabla \times F \cdot dS = \int \int_{S_2} \nabla \times F \cdot dS$

(b) $\int \int_{S_1} \nabla \times F \cdot dS = - \int \int_{S_2} \nabla \times F \cdot dS$
A sphere can be parameterized by \((\theta, \phi)\) with the normal formulas, on the domain \([0, 2\pi] \times [0, \pi]\). Which of these describes the boundary of the sphere parameterized this way, using the idea for boundary we just described?

(a) The four sides of the rectangle \([0, 2\pi] \times [0, \pi]\).
(b) The line from the north pole to the south pole at \(\theta = 0\).
(c) There is no boundary.
(d) We need more information.
(e) None of these are correct.
Stokes’ Theorem says that $\int \int_S \nabla \times F \cdot dS = \int_{\partial S} F \cdot d\vec{s}$. For $S$ a [surface of the] sphere, what is $\int \int_S \nabla \times F \cdot dS$?

(a) We can’t calculate it because $S$ has no boundary.
(b) We need more information.
(c) 0
(d) None of these are correct.