Classroom Voting Questions: Multivariable Calculus

19.2 Flux Integrals For Graphs, Cylinders, and Spheres

1. The flux of the vector field $\vec{F} = 4\hat{\rho}$ through a sphere of radius 2 centered on the origin is:

   (a) 0
   (b) 8π
   (c) 16π
   (d) 32π
   (e) 64π
   (f) None of the above

2. The flux of the vector field $\vec{F} = 3\hat{\rho} + 2\hat{\theta} + \hat{\phi}$ through a sphere of radius $1/2$ centered on the origin is:

   (a) 0
   (b) 3π
   (c) 9π
   (d) 27π
   (e) 72π
   (f) None of the above

3. The flux of the vector field $\vec{F} = 4\hat{\theta} + 2\hat{z}$ through a cylinder of radius 1 centered on the z axis, between $z = 0$ and $z = 2$:

   (a) 0
   (b) π
   (c) 2π
   (d) 3π
   (e) 4π

4. The flux of the vector field $\vec{F} = r\hat{r} + r\hat{\theta}$ through a cylinder of radius 2 centered on the z axis, between $z = 0$ and $z = 2$:

   (a) 0

   (b) 2π

   (c) 4π

   (d) 8π

   (e) 16π

5. The flux of the vector field $\vec{F} = z\hat{r}$ through a cylinder of radius $1/2$ centered on the z axis, between $z = 0$ and $z = 3$ is

   (a) 0

   (b) 2π

   (c) 3π

   (d) $\frac{9}{2}\pi$

   (e) 9π

6. All but one of the flux calculations below can be done with just multiplication, but one requires an integral. Which one?

   (a) $\vec{F} = 3\hat{\rho} + 2\hat{\phi}$ through a sphere of radius 4.

   (b) $\vec{F} = \rho\hat{\rho} + \theta\hat{\phi}$ through a sphere of radius 3.

   (c) $\vec{F} = r\hat{r} + r\hat{z}$ through a disk of radius 2, centered on the z axis, in the $z = 2$ plane.

   (d) $\vec{F} = r^2\hat{r} + z\hat{\theta}$ through a cylinder of radius 1, between $z = 1$ and $z = 3$.