Student: Phong Vo **Date:** 05/04/18	**Instructor:** Chuck Ormsby **Course:** Multi-Variable and Vector Calculus -- Calculus III Spring 2018	**Assignment:** Section 15.8 Homework

1. Suppose div **F** = 0 in a region enclosed by two concentric spheres. What is the relationship between the outward fluxes across the two spheres?

Choose the correct answer below.

- **A.** One outward flux equals double the other one.
- **B.** The outward fluxes are equal to each other. ✔
- **C.** The outward fluxes are opposite of each other.
- **D.** There is no relationship between the outward fluxes.

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2. Evaluate both integrals of the Divergence Theorem for the following vector field and region.

$$\mathbf{F} = \langle 4x, 2y, 2z \rangle ; \quad D = \left\{(x,y,z)\colon x^2 + y^2 + z^2 \le 9\right\}$$

$\iiint_D \nabla \cdot \mathbf{F}\, dV =$ 288π

(Type an exact answer, using π as needed.)

$\iint_S \mathbf{F} \cdot \mathbf{n}\, dS =$ 288π

(Type an exact answer, using π as needed.)

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3. Evaluate both integrals of the Divergence Theorem for the following vector field and region.

$$\mathbf{F} = \langle z - y, x, -x \rangle ; \quad D = \left\{(x,y,z)\colon \frac{x^2}{16} + \frac{y^2}{18} + \frac{z^2}{27} \le 1\right\}$$

$\iiint_D \nabla \cdot \mathbf{F}\, dV =$ 0

(Type an exact answer, using π as needed.)

$\iint_S \mathbf{F} \cdot \mathbf{n}\, dS =$ 0

(Type an exact answer, using π as needed.)

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4. Find the net outward flux of the field $\mathbf{F} = \langle y + 8z, 8z - 3x, x - y \rangle$ across the sphere of radius 1 centered at the origin.

The net outward flux across the sphere is 0 .

(Type an exact answer, using π as needed.)

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5. Use the Divergence Theorem to compute the net outward flux of the field $\mathbf{F} = \langle -2x, 3y, 2z \rangle$ across the surface S, where S is the boundary of the tetrahedron in the first octant formed by the plane $x + y + z = 2$.

The net outward flux across the boundary of the tetrahedron is 4 .

(Type an exact answer, using π as needed.)

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6. Use the Divergence Theorem to compute the net outward flux of the field $\mathbf{F} = \langle x^2, y^2, z^2 \rangle$ across the surface S, where S is the sphere $\{(x,y,z): x^2 + y^2 + z^2 = 49\}$.

The net outward flux across the surface is 0 .
(Type an exact answer, using π as needed.)

7. Use the Divergence Theorem to compute the net outward flux of the following field across the given surface S.

$\mathbf{F} = \langle 8y - 2x, -7x^2 - 4y, -6y - z \rangle$
S is the sphere $\{(x,y,z): x^2 + y^2 + z^2 = 9\}$.

The net outward flux across the surface is -252π .
(Type an exact answer, using π as needed.)

8. Use the Divergence Theorem to compute the net outward flux of the field $\mathbf{F} = \langle -3x, y, 8z \rangle$ across the surface S, where S is the surface of the paraboloid $z = 2 - x^2 - y^2$, for $z \geq 0$, plus its base in the xy-plane.

The net outward flux across the surface is 12π .
(Type an exact answer, using π as needed.)

9. Use the Divergence Theorem to compute the net outward flux of the vector field $\mathbf{F} = \mathbf{r}|\mathbf{r}| = \langle x, y, z \rangle \sqrt{x^2 + y^2 + z^2}$ across the boundary of the region D, where D is the region between the spheres of radius $\sqrt{5}$ and $\sqrt{7}$ centered at the origin.

The net outward flux is 96π .
(Type an exact answer, using π as needed.)

10. Decide which integral of the Divergence Theorem to use and compute the outward flux of the vector field $\mathbf{F} = \langle 3z, 8xz, 6 \rangle$ across the surface S, where S is the boundary of the ellipsoid $x^2 + y^2/25 + z^2/25 = 1$.

The outward flux across the ellipsoid is 0 .
(Type an exact answer, using π as needed.)