

1. This is true by Fubini's Theorem.

2. False. $\int_0^1 \int_0^x \sqrt{x+y^2} dy dx$ describes the region of integration as a Type I region. To reverse the order of integration, we must consider the region as a Type II region: $\int_0^1 \int_y^1 \sqrt{x+y^2} dx dy$.

3. True by Equation 12.1.11.

4. $\int_{-1}^1 \int_0^1 e^{x^2+y^2} \sin y dx dy = \left(\int_0^1 e^{x^2} dx \right) \left(\int_{-1}^1 e^{y^2} \sin y dy \right) = \left(\int_0^1 e^{x^2} dx \right) (0) = 0$, since $e^{y^2} \sin y$ is an odd function. Therefore the statement is true.

5. True. By Equation 12.1.11 we can write $\int_0^1 \int_0^1 f(x) f(y) dy dx = \int_0^1 f(x) dx \int_0^1 f(y) dy$. But $\int_0^1 f(y) dy = \int_0^1 f(x) dx$ so this becomes $\int_0^1 f(x) dx \int_0^1 f(x) dx = \left[\int_0^1 f(x) dx \right]^2$.

6. This statement is true because in the given region, $(x^2 + \sqrt{y}) \sin(x^2 y^2) \leq (1+2)(1) = 3$, so $\int_1^4 \int_0^1 (x^2 + \sqrt{y}) \sin(x^2 y^2) dx dy \leq \int_1^4 \int_0^1 3 dA = 3A(D) = 3(3) = 9$.

7. True: $\iint_D \sqrt{4-x^2-y^2} dA =$ the volume under the surface $x^2 + y^2 + z^2 = 4$ and above the xy -plane
 $= \frac{1}{2}$ (the volume of the sphere $x^2 + y^2 + z^2 = 4$) $= \frac{1}{2} \cdot \frac{4}{3}\pi(2)^3 = \frac{16}{3}\pi$

8. True. The moment of inertia about the z -axis of a solid E with constant density k is

$$I_z = \iiint_E (x^2 + y^2) \rho(x, y, z) dV = \iiint_E (kr^2) r dz dr d\theta = \iiint_E kr^3 dz dr d\theta.$$

9. The volume enclosed by the cone $z = \sqrt{x^2 + y^2}$ and the plane $z = 2$ is, in cylindrical coordinates,

$$V = \int_0^{2\pi} \int_0^2 \int_r^2 r dz dr d\theta \neq \int_0^{2\pi} \int_0^2 \int_r^2 dz dr d\theta, \text{ so the assertion is false.}$$