2. Evaluate the following integrals.

a. $\iint_D x\,dA$ where $D = \{(x,y) : 1 \le x+y \le 2,\ x \ge 0 \text{ and } y \ge 0\}$

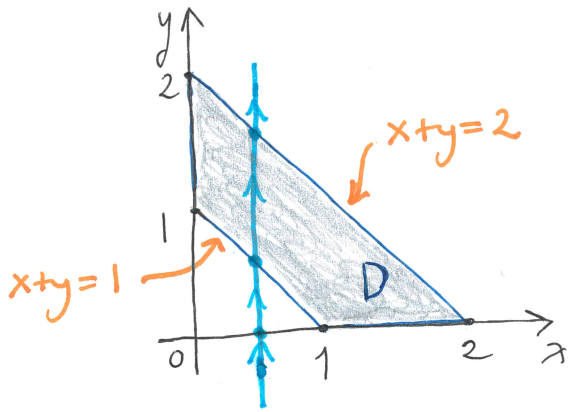
$$\iint_D x\,dA = \int_0^2 \int_0^{2-x} x\,dy\,dx - \int_0^1 \int_0^{1-x} x\,dy\,dx$$

$$= \int_0^2 [xy]_{y=0}^{y=2-x}\,dx - \int_0^1 [xy]_{y=0}^{y=1-x}\,dx$$

$$= \int_0^2 (2x-x^2)\,dx - \int_0^1 (x-x^2)\,dx$$

$$= \left[x^2 - \frac{1}{3}x^3\right]_0^2 - \left[\frac{1}{2}x^2 - \frac{1}{3}x^3\right]_0^1$$

$$= \frac{4}{3} - \frac{1}{6} = \frac{7}{6}$$



b. $\iiint_E \frac{1}{\sqrt{x^2+y^2+z^2}}\,dV$ where $E = \{(x,y,z) : x^2+y^2+z^2 \le 4 \text{ and } z \ge 1\}$

$$\iiint_E \frac{1}{\sqrt{x^2+y^2+z^2}}\,dV = \int_0^{2\pi} \int_0^{\pi/3} \int_{\sec\phi}^{2} \frac{1}{\rho} \cdot \rho^2 \sin\phi\,d\rho\,d\phi\,d\theta$$

$$= \int_0^{2\pi} \int_0^{\pi/3} \left[\frac{1}{2}\rho^2\right]_{\rho=\sec\phi}^{\rho=2} \sin\phi\,d\phi\,d\theta = \int_0^{2\pi} \int_0^{\pi/3} \left(2\sin\phi - \frac{1}{2}\tan\phi\sec\phi\right) d\phi\,d\theta$$

$$= \int_0^{2\pi} \left[-2\cos\phi - \frac{1}{2}\sec\phi\right]_{\phi=0}^{\phi=\pi/3} d\theta$$

$$= 2\pi \cdot \left(-1-1+2+\frac{1}{2}\right) = \pi$$