AER210—Fluids

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Contents

1 Tutorial 1

- 15.1 #15

$$\int_1^4 \int_0^2 (6x^2y - 2x)\mathrm{d}y\mathrm{d}x \tag{1.1}$$
$$= \int_1^4 (12x^2 - 4x)\mathrm{d}x \tag{1.2}$$
$$= (256 - 32) - (4 - 2) \tag{1.3}$$
$$= 222 \tag{1.4}$$

- 15.1 #29

$$\iint_R \frac{xy^2}{x^2+1}\mathrm{d}A, R = \{(x,y)|0 \le x \le 1, -3 \le y \le 3\} \tag{1.5}$$
$$= \int_0^1 \int_{-3}^3 \frac{xy^2}{x^2+1}\mathrm{d}y\mathrm{d}x \tag{1.6}$$
$$= 18\int_0^1 \frac{x}{x^2+1}\mathrm{d}x \tag{1.7}$$
$$= 18 \times \frac{1}{2}\log\left(x^2+1\right)\Big|_0^1 \tag{1.8}$$
$$= 9\log 2 \tag{1.9}$$

- 15.1 #31

$$\iint_R x\sin(x+y)\mathrm{d}A, R = [0, \frac{\pi}{6}] \times [0, \frac{\pi}{3}] \tag{1.10}$$
$$= \int_0^{\frac{\pi}{6}} \int_0^{\frac{\pi}{3}} x\sin(x+y)\mathrm{d}y\mathrm{d}x \tag{1.11}$$
$$= \int_0^{\frac{\pi}{6}} x\cos(x) - x\cos\left(x+\frac{\pi}{3}\right) \tag{1.12}$$
$$= x\left(\sin x - \sin\left(x+\frac{\pi}{3}\right)_0^{\frac{\pi}{6}}\right) - \int_0^{\frac{\pi}{6}} \sin x - \sin\left(x+\frac{\pi}{3}\right)\mathrm{d}x \tag{1.13}$$
$$= \frac{\pi}{6}(\frac{1}{2} - 1) - \left(-\cos x + \cos\left(x+\frac{\pi}{3}\right)\right)_0^{\frac{\pi}{6}} \tag{1.14}$$
$$= \frac{\sqrt{3}-1}{2} - \frac{\pi}{12} \tag{1.15}$$