

HW 15.3 # 3, 5, 7, 9, 11, 13, 15, 17 due 11/01

$$3.) \int_0^2 \int_0^1 \int_0^1 x e^{y-2z} dz dy dx = \int_0^2 \int_0^1 \left. -\frac{x}{2} e^{y-2z} \right|_0^1 dy dx = \int_0^2 \int_0^1 \left(-\frac{x}{2} e^{y-2} + \frac{x}{2} e^y \right) dy dx$$

$$= \int_0^2 \left. -\frac{x}{2} e^{y-2} + \frac{x}{2} e^y \right|_0^1 dx = \int_0^2 \left(-\frac{x}{2e} + \frac{xe}{2} + \frac{x}{2e^2} - \frac{x}{2} \right) dx = -\frac{x^2}{4e} + \frac{x^2 e}{4} + \frac{x^2}{4e^2} - \frac{x^2}{4} \Big|_0^2$$

$$= -\frac{1}{e} + e + \frac{1}{e^2} - 1$$

$$5.) \int_0^1 \int_0^3 \int_0^3 xy - xz - y^2 + yz dz dy dx = \int_0^1 \int_0^3 \left. xyz - x \frac{z^2}{2} - y^2 z + y \frac{z^2}{2} \right|_0^3 dy dx$$

$$= \int_0^1 \int_0^3 \left(3xy - \frac{9}{2}x - 3y^2 + \frac{9}{2}y \right) dy dx = \int_0^1 \left. 3x \frac{y^2}{2} - \frac{9}{2}xy - y^3 + \frac{9}{4}y^2 \right|_0^3 dx$$

$$= \int_0^1 \left(\frac{27}{2}x - \frac{27}{2}x - \frac{27}{4}x^2 \right) dx = -\frac{27}{4}x^2 \Big|_0^1 = -\frac{27}{4}$$

$$7.) \int_0^a \int_0^b \int_0^c x^3 + 3zx^2 + 3xz^2 + z^3 dz dx = \int_0^a \left. zx^3 + \frac{3}{2}z^2x^2 + xz^3 + \frac{z^4}{4} \right|_0^c dx$$

$$= \int_0^a \left(bcx^3 + \frac{3}{2}bc^2x^2 + bc^3x + \frac{bc^4}{4} \right) dx = \frac{bc}{4}x^4 + \frac{bc^2}{2}x^3 + \frac{bc^3}{2}x^2 + \frac{bc^4}{4}x \Big|_0^a$$

$$= \frac{a^4bc + 2a^3bc^2 + 2a^2bc^3 + abc^4}{4}$$

$$9.) \int_0^1 \int_0^x \int_0^x x+y dz dy dx = \int_0^1 \int_0^x \left. xz + yz \right|_0^x dy dx = \int_0^1 \int_0^x (x^2 - y^2) dy dx = \int_0^1 \left. yx^2 - \frac{y^3}{3} \right|_0^x dx$$

$$= \int_0^1 \left(\frac{2}{3}x^3 \right) dx = \frac{1}{6}x^4 \Big|_0^1 = \frac{1}{6}$$

$$11.) \int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^1 xyz dz dy dx = \int_0^1 \int_0^{\sqrt{1-x^2}} \frac{xy}{2} dy dx = \int_0^1 \left. \frac{xy^2}{4} \right|_0^{\sqrt{1-x^2}} dx = \int_0^1 \frac{x-x^3}{4} dx$$

$$= \frac{x^2}{8} - \frac{x^4}{16} \Big|_0^1 = \frac{1}{16}$$

$$13.) \int_0^1 \int_0^{1-x} \int_0^1 e^z dz dy dx = \int_0^1 \int_0^{1-x} \left. e^z - 1 \right|_0^1 dy dx = (e-1) \int_0^1 (1-x) dx = (e-1) \left(x - \frac{x^2}{2} \right) \Big|_0^1 = \frac{e-1}{2}$$

$$15.) \int_0^1 \int_0^x \int_0^3 z dz dy dx = \int_0^1 \frac{9}{2}x dx = \frac{9}{4}x^2 \Big|_0^1 = \frac{9}{4}$$

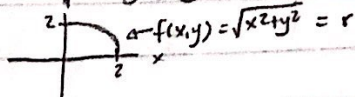
$$17.) \int_0^2 \int_0^{\sqrt{4-x^2}} \int_{y^2}^{8-2x^2-y^2} x dz dy dx = \int_0^2 \int_0^{\sqrt{4-x^2}} (8x - 2x^3 - 2xy^2) dy dx = \int_0^2 \left. 8xy - 2yx^3 - \frac{2}{3}xy^3 \right|_0^{\sqrt{4-x^2}} dx$$

$$\int_0^2 (8x\sqrt{4-x^2} - 2x^3\sqrt{4-x^2} - \frac{2}{3}x(\sqrt{4-x^2})^3) dx = 8.53$$

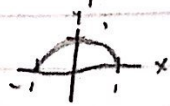
HW 15.4 # 1, 5, 9, 19, 27, 31, 47, 51

due 11/1

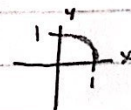
$$1.) \int_0^{\frac{\pi}{2}} \int_0^2 r^2 dr d\theta = \int_0^{\frac{\pi}{2}} \frac{8}{3} d\theta = \frac{4\pi}{3}$$



$$5.) \int_0^{\pi} \int_0^1 \sin \theta dr d\theta = \int_0^{\pi} \sin \theta d\theta = 2$$



$$9.) \int_0^{\frac{\pi}{2}} \int_0^1 r^2 \cos \theta dr d\theta = \int_0^{\frac{\pi}{2}} \frac{1}{3} \cos \theta d\theta = \frac{1}{3}$$



$$19.) \int_0^{\frac{\pi}{2}} \int_{\frac{\pi}{4}}^{\frac{\pi}{2}} \int_0^1 r^2 (\sin \theta - \cos \theta) dr d\theta = \left(\frac{1}{3} - \frac{\pi^3}{192}\right) \int_0^{\frac{\pi}{2}} \sin \theta - \cos \theta d\theta = -\left(\frac{1}{3} - \frac{\pi^3}{192}\right) \sin \theta + \cos \theta \Big|_0^{\frac{\pi}{2}} = 0$$

$$27.) \int_0^{2\pi} \int_0^3 \int_0^5 r^2 r dz dr d\theta = \int_0^{2\pi} \int_0^3 5r^3 dr d\theta = \int_0^{2\pi} 135 d\theta = 270\pi$$

$$31.) \int_0^{2\pi} \int_0^3 \int_0^9 r^3 dz dr d\theta = \int_0^{2\pi} \int_0^3 9r^3 dr d\theta = \int_0^{2\pi} \frac{9}{4} r^4 \Big|_0^3 d\theta = \int_0^{2\pi} \frac{729}{4} d\theta = \frac{729\pi}{2}$$

$$47.) \int_0^{2\pi} \int_0^{\frac{\pi}{2}} \int_0^1 r^2 r^2 \sin \theta dr d\theta d\theta = \int_0^{2\pi} \int_0^{\frac{\pi}{2}} \frac{1}{5} \sin \theta d\theta d\theta = \int_0^{2\pi} -\frac{1}{5} \cos \theta \Big|_0^{\frac{\pi}{2}} d\theta = \int_0^{2\pi} -\frac{1}{5} d\theta$$

$$= -\frac{2\pi}{5}$$

$$51.) \int_0^{\frac{\pi}{3}} \int_0^{\frac{\pi}{2}} \int_1^2 r \cos \theta r^2 \sin \theta dr d\theta d\theta = \int_0^{\frac{\pi}{3}} \int_0^{\frac{\pi}{2}} \frac{r^4}{8} \sin 2\theta \Big|_1^2 d\theta d\theta = \int_0^{\frac{\pi}{3}} \int_0^{\frac{\pi}{2}} \frac{15}{8} \sin 2\theta d\theta d\theta$$

$$= \int_0^{\frac{\pi}{3}} -\frac{15}{16} \cos(2\theta) \Big|_0^{\frac{\pi}{2}} d\theta = \int_0^{\frac{\pi}{3}} \frac{30}{16} d\theta = \frac{30}{16} \theta \Big|_0^{\frac{\pi}{3}} = \frac{5}{8}\pi$$