Homework due 10/25

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Sec. 15.1

9) $\int_0^3 \int_0^5 (15-3x)\,dx\,dy = \frac{225}{2}$

$\int_0^5 (15-3x)\,dx = \frac{75}{2}$ $\quad\int_0^3 \frac{75}{2}\,dy = \frac{225}{2}$

15) $\int_0^5 \int_{-4}^4 (x^3)\,dx\,dy = 0$

$\int_{-4}^4 (x^3)\,dx = 0$ $\quad\int_0^5 0\,dy = 0$

21) $\int_4^9 \int_{-3}^8 1\,dx\,dy = 55$

$\int_{-3}^8 1\,dx = 11$ $\quad\int_4^9 11\,dy = 55$

23) $\int_{-1}^{1}\int_{0}^{\pi}(x^2 \sin y)\,dy\,dx = \frac{4}{3}$

$\int_{0}^{\pi}(x^2 \sin y)\,dy = 2x^2 \qquad \int_{-1}^{1} 2x^2\,dx = \frac{4}{3}$

25) $\int_{2}^{6}\int_{1}^{4} x^2\,dx\,dy = 84$

$\int_{1}^{4} x^2\,dx = 21 \qquad \int_{2}^{6} 21\,dy = 84$

31) $\int_{1}^{2}\int_{0}^{4} \frac{dy\,dx}{x+y} \simeq 1.317$

$\int_{0}^{4} \frac{dy}{x+y} = \ln(x+4) - \ln(x) \qquad \int_{1}^{2} \ln(x+4) - \ln(x)\,dx = 1.317$

33) $\int_{0}^{4}\int_{0}^{5} \frac{dy\,dx}{\sqrt{x+y}} = \frac{76}{3} - \frac{20}{3}\sqrt{5} \simeq 10.426$

$\int_{0}^{5} \frac{dy}{\sqrt{x+y}} = 2\sqrt{x+5} - 2\sqrt{x} \qquad \int_{0}^{4} 2\sqrt{x+5} - 2\sqrt{x}\,dx = \frac{76}{3} - \frac{20}{3}\sqrt{5}$

35) $\int_{1}^{2}\int_{1}^{3} \frac{\ln(xy)\,dy\,dx}{y} \simeq 1.028$

$$\int_1^3 \frac{\ln(xy)}{y}\,dy = \frac{\ln(3)^2}{2} + \ln(3)\ln(x)$$

$$\int_1^2 \left(\frac{\ln(3)^2}{2} + \ln(3)\ln(x)\right)dx = -\ln(3) + \frac{\ln(3)^2}{2} + 2\ln(3)\ln(2)$$

$$3)\ \int_1^3 \int_{-2}^4 \frac{x}{y}\,dx\,dy = 6\ln(3) \simeq 6.592$$

$$\int_{-2}^4 \frac{x}{y}\,dx = \frac{6}{y} \qquad \int_1^3 \frac{6}{y}\,dy = 6\ln(3)$$

$$41)\ \int_0^{\pi/4}\int_0^2 e^x \sin y\,dx\,dy \simeq 1.871$$

$$\int_0^2 e^x \sin y\,dx = e^2\sin y - \sin y$$

$$\int_0^{\pi/4} \left(e^2\sin y - \sin y\right)dy = \left(2-\sqrt{2}\right)\frac{e^2-1}{2}$$

15.2

$$3)\ \left\{(x,y)\,\middle|\ 0 \leq x \leq 1,\ 0 \leq y \leq 1-x^2\right\}$$

$$\int_0^1\int_0^{1-x^2} xy\,dy\,dx = \int_0^1 \frac{x(-x^2+1)^2}{2}\,dx = \frac{1}{12}$$

$$\{(x,y) \mid 0 \leq x \leq \sqrt{1-y},\ 0 \leq y \leq 1\}$$

$$\int_0^1 \int_0^{\sqrt{1-y}} xy \, dx \, dy = \int_0^1 \frac{y-y^2}{2} \, dy = \frac{1}{12}$$

5) $$\int_0^4 \int_{2-\frac{x}{2}}^2 x^2 y \, dy \, dx = \int_0^4 x^3 - \frac{x^4}{8} \, dx = \frac{192}{5}$$

6) $$\int_0^4 \int_{\frac{x}{2}}^2 x^2 y \, dy \, dx = \int_0^4 2x^2 - \frac{x^4}{8} \, dx = \frac{256}{15}$$

7) $$\int_0^2 \int_0^x x^2 y \, dy \, dx + \int_2^4 \int_0^2 x^2 y \, dy \, dx = \frac{1168}{15}$$

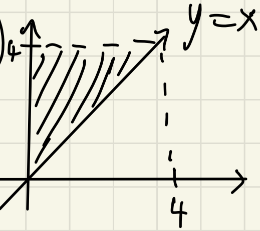
$$\int_0^2 \int_0^x x^2 y \, dy \, dx = \int_0^2 \frac{x^4}{2} \, dx = \frac{16}{5}$$

$$\int_2^4 \int_0^2 x^2 y \, dy \, dx = \int_2^4 2x^2 \, dx = \frac{224}{3}$$

11) $$\int_1^2 \int_0^{\sqrt{4-x^2}} \frac{y}{x} \, dy \, dx = \int_1^2 \frac{-x^2+4}{2x} \, dx = 2\ln(2) - \frac{3}{4}$$

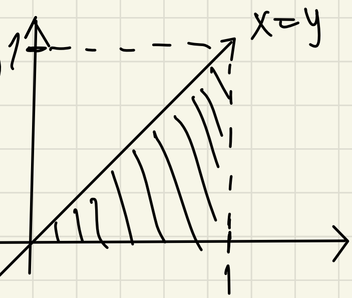
19) $$\int_0^1 \int_1^{e^{x^2}} x \, dy \, dx = \int_0^1 x(e^{x^2}-1) \, dx = \frac{e}{2} - 1$$

21) $\int_0^1 \int_{y^2}^{y} 2xy \, dx \, dy = \int_0^1 y^3 - y^5 \, dy = \frac{1}{12}$

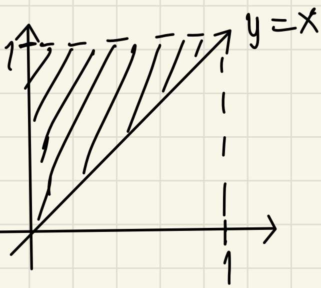
25) 

$$\int_0^4 \int_0^y f(x,y) \, dx \, dy$$

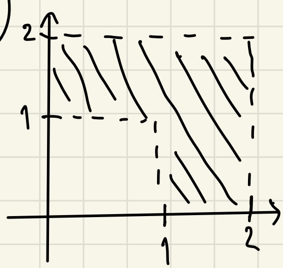
31) $\int_1^e \int_{(\ln y)^2}^{\ln y} (\ln y)^{-1} \, dx \, dy = \int_1^e (\ln y)^{-1} \cdot \left(\ln y - (\ln y)^2\right) dy = e-2$

33) 

$$\int_0^1 \int_0^x \frac{\sin x}{x} \, dy \, dx = \int_0^1 \sin x \, dx =$$
$$1 - \cos(1)$$

35) 

$$\int_0^1 \int_0^y x e^{y^3} \, dx \, dy = \int_0^1 \frac{y^2 e^{y^3}}{2} \, dy = \frac{e-1}{6}$$

37) 

$$\int_0^2 \int_0^2 e^{x+y} \, dy \, dx - \int_0^1 \int_0^1 e^{x+y} \, dy \, dx$$
$$= (1 - 2e^2 + e^4) - (1 - 2e + e^2) = e^4 - 3e^2 + 2e$$

43) $\int_1^2 \int_y^{2y} \frac{\sin y}{y}\, dx\, dy = \int_1^2 \sin y\, dy = \cos(1) - \cos(2)$

49) $x^2 + y^2 = 8 - x^2 - y^2$

$2x^2 + 2y^2 = 8$

$x^2 + y^2 = 4$

$y = \pm\sqrt{4 - x^2}$

$x = \pm 2$

$$\int_{-2}^{2} \int_{-\sqrt{4-x^2}}^{\sqrt{4-x^2}} (8 - 2x^2 - 2y^2)\, dy\, dx$$