

15.1

9.  $\iint_R (15-3x) dx dy$   $R = [0,5] \times [0,3]$

$$= \int_0^3 \int_0^5 (15-3x) dx dy$$

$$\int_0^5 (15-3x) dx$$

$$= 15x - \frac{3x^2}{2} \Big|_0^5$$

$$= \frac{75}{2}$$

$$\int_0^3 \frac{75}{2} dy$$

$$= \frac{75y}{2} \Big|_0^3$$

$$= \frac{225}{2}$$

15.  $\iint_R x^3 dx dy$   $R = [-4,4] \times [0,5]$

$$\int_{-4}^4 x^3 dx$$

$$= \frac{x^4}{4} \Big|_{-4}^4$$

$$= \frac{4^4}{4} - \frac{(-4)^4}{4} = 0$$

$$\int_0^5 0 dy = 0$$

21.  $\int_4^9 \int_{-3}^8 1 dx dy$

$$\int_{-3}^8 1 dx$$

$$= x \Big|_{-3}^8$$

$$= 8 - (-3) = 11$$

$$\int_4^9 11 dy$$

$$= 11y \Big|_4^9$$

$$= 55$$

23.  $\int_{-1}^1 \int_0^\pi x^2 \sin y dy dx$

$$\int_0^\pi x^2 \sin y dy$$

$$= x^2 \int_0^\pi \sin y dy$$

$$= x^2 \cdot (-\cos y) \Big|_0^\pi$$

$$= x^2 (1 - 1) = 0$$

$$\int_{-1}^1 0 dx$$

$$= 0 \Big|_{-1}^1 = 0$$

25.  $\int_2^6 \int_1^4 x^2 dx dy$

$$\int_1^4 x^2 dx$$

$$= \frac{x^3}{3} \Big|_1^4$$

$$= 21$$

$$\int_2^6 21 dy$$

$$= 21y \Big|_2^6$$

$$= 84$$

31.  $\int_1^4 \int_0^y \frac{1}{x+y} dx dy$

$$\int_0^y \frac{1}{x+y} dx$$

$$= \ln(x+y) \Big|_0^y$$

$$= \ln(x+y) - \ln x$$

$$\int_1^4 (\ln(x+y) - \ln x) dx$$

$$= 1.317$$

33.  $\int_0^4 \int_0^5 \frac{1}{\sqrt{x+y}} dy dx$

$$\int_0^5 \frac{1}{\sqrt{x+y}} dy$$

$$= 2(\sqrt{x+y}) \Big|_0^5$$

$$= 2(\sqrt{x+5}) - 2\sqrt{x}$$

$$\int_0^4 (2(\sqrt{x+5}) - 2\sqrt{x}) dx$$

$$= 10.426$$

35.  $\int_1^2 \int_1^3 \frac{\ln(xy)}{y} dy dx$

$$\int_1^3 \frac{\ln(xy)}{y} dy$$

$$= \ln x \int_1^3 \frac{1}{y} dy$$

$$= \ln x \cdot y \Big|_1^3$$

$$= 2 \ln x - \ln x = \ln x$$

$$\int_1^2 \ln x dx$$

$$= 1.317$$



$$37. \iint_R \frac{x}{y} dA, R = [-2, 6] \times [1, 3]$$

$$\int_1^3 \int_{-2}^6 \frac{x}{y} dx dy$$

$$\int_{-2}^6 \frac{x}{y} dx$$

$$= \frac{1}{y} \cdot \int_{-2}^6 x dx$$

$$= \frac{1}{y} \cdot \frac{x^2}{2} \Big|_{-2}^6$$

$$= \frac{8}{y} - \frac{2}{y} = \frac{6}{y}$$

$$\int_1^3 \frac{6}{y} dy$$

$$= 6 \int_1^3 \frac{1}{y} dy$$

$$= 6 \ln y \Big|_1^3$$

$$= 6 \ln 3 - 6 \ln 1$$

$$= 6 \cdot 1.0986$$

$$41. \iint_R e^x \sin y dA \quad R = [0, 2] \times [0, \frac{\pi}{4}]$$

$$\int_0^{\frac{\pi}{4}} \int_0^2 e^x \sin y dx dy$$

$$\int_0^2 e^x \sin y dx$$

$$= \sin y e^x \Big|_0^2$$

$$= \sin y e^2 - \sin y e^0$$

$$= \sin y e^2 - \sin y$$

$$\int_0^{\frac{\pi}{4}} \sin y e^2 - \sin y dy$$

$$= \int_0^{\frac{\pi}{4}} \sin y e^2 dy - \int_0^{\frac{\pi}{4}} \sin y dy$$

$$= e^2 \int_0^{\frac{\pi}{4}} \sin y dy + \cos y \Big|_0^{\frac{\pi}{4}}$$

$$= -e^2 \cos y \Big|_0^{\frac{\pi}{4}} + \cos y \Big|_0^{\frac{\pi}{4}}$$

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

$$= 1.871$$



15.2

3. as a vertically simple region:

$$0 \leq x \leq 1 \quad 0 \leq y \leq 1-x^2$$

as a horizontally simple region:

$$0 \leq y \leq 1 \quad 0 \leq x \leq \sqrt{1-y}$$

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

11.

21.  $f(x,y) = xy^2$   $x=y$   $x=y^2$

$$x=y \quad x=y^2$$

$$x=0 \quad y=0 \quad x=1 \quad y=1$$

$$\int_0^1 \int_0^1 xy^2 dy dx$$

$$\int_0^1 xy^2 dy = xy^2 \Big|_0^1 = x$$

$$\int_0^1 x dx = \frac{x^2}{2} \Big|_0^1 = \frac{1}{2}$$

5.

6

7.

19.  $f(x,y) = x$   $0 \leq x \leq 1$   $1 \leq y \leq e^{x^2}$

$$\int_0^1 \int_1^{e^{x^2}} x dy dx$$

$$\int_1^{e^{x^2}} x dy$$

$$= xy \Big|_1^{e^{x^2}} = xe^{x^2} - x$$

$$\int_0^1 xe^{x^2} - x dx = 0.359$$

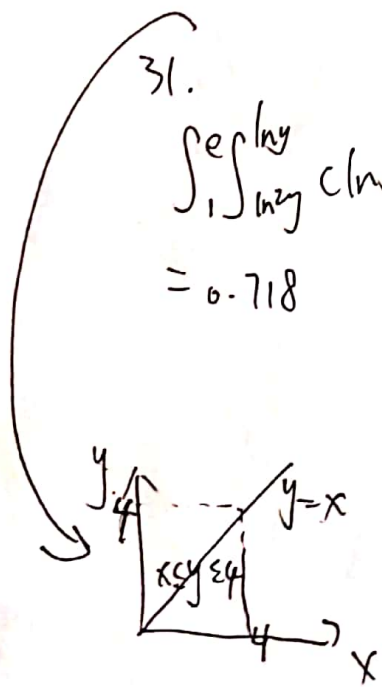
25.  $\int_0^4 \int_x^4 f(x,y) dy dx$

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

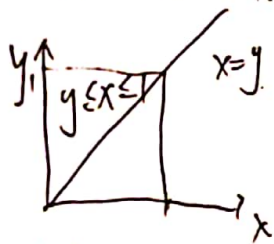
31.

$$\int_1^{e^4} \int_{\ln y}^4 (\ln y)^{-1} dx dy$$

$$= 0.718$$

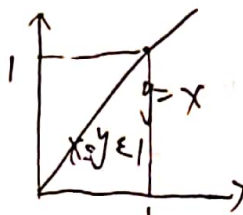


$$33. \int_0^1 \int_y^1 \frac{\sin x}{x} dx dy$$

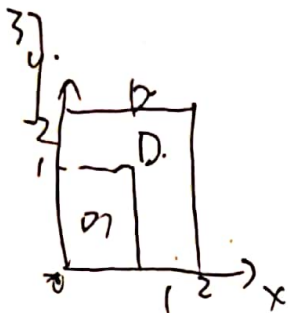


$$\int_0^1 \int_0^x \frac{\sin x}{x} dy dx = 0.46.$$

$$35. \int_0^1 \int_{y=x}^1 x e^{y^3} dy dx$$



$$\int_0^1 \int_0^y x e^{y^3} dx dy = 0.286.$$



$$\iint_D e^{xy} dA = e^4 - 2e^2 + 2e = 37.878$$

$$43. f(x,y) = \frac{\sin y}{y} \quad y=x \quad y=\frac{x}{2}$$

$$\iint_D \frac{\sin y}{y} dA = \cos 1 - \cos 2 = 0.956$$

49.

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

