

Mechanics Based Problems

1. Calculate the following iterated integrals without technology. Then check your answers using technology:

(a) $\int_1^3 \int_0^1 (1 + 4xy) dx dy$

10
ans

(b) $\int_1^4 \int_1^2 \left(\frac{x}{y} + \frac{y}{x} \right) dy dx$

7.278
ans

2. Use Mathematica to calculate the following double integrals:

(a) $\iint_R ((6x^2y^3 - 5y^4) dA, R = \{(x, y) | 0 \leq x \leq 3, 0 \leq y \leq 1\}$

10.5
ans

(b) $\iint_{\mathfrak{R}} x(\sin(x + y)) dA, \mathfrak{R} = [0, \pi/6] \times [0, \pi/3]$

0.10422
ans

Problem Solving Problems

1. Plot the solid whose volume is given by the iterated integral:

$$\int_0^1 \int_0^1 (4 - x - 2y) dx dy \quad \text{and then calculate its volume.}$$

$2\frac{1}{2}$
 units

2. Use Mathematica to compute the following iterated integrals:

$$\int_0^1 \int_0^1 \frac{x-y}{(x+y)^3} dy dx \quad \text{and} \quad \int_0^1 \int_0^1 \frac{x-y}{(x+y)^3} dx dy$$

Do the answers contradict Fubini's Theorem? Can you explain what is happening.

yes function is not continuous @ (0,0)

3. Find the volume of the solid bounded by the surface $z = x\sqrt{x+y}$ and the planes $x = 0$, $x = 1$, $y = 0$, $y = 1$, $z = 0$.

$$\underline{\underline{0.532212}} \quad \text{ans}$$

4. Find the average value of $f(x,y) = e^y\sqrt{x+e^y}$ over the region $R = [0, 4] \times [0, 1]$

$$\underline{\underline{f_{\text{avg}} = 3.327}} \quad \text{ans}$$

5. A productivity model for the Handy Gadget Company is $p = 10000x^{0.3}y^{0.7}$, where p is the number of gadgets the company turns out each month, x is the number of employees at the company, and y is the operating budget in thousands of dollars. Because the company hires part time workers, it uses anywhere between 45 and 55 workers each month, and its operating budget varies from \$8,000 and \$12,000 per month. What is the average of the possible numbers of gadgets it can turn out each month?

$$\underline{f_{\text{Avg}} = 161,780.58 \text{ avg gadgets turned out each month}}$$