AER210 Homework Problems

Aman Bhargava

October 6, 2019

1 What is this?

I am slightly faster at writing LaTeX equations than writing by hand. I hope to get even faster and practice math even better by keeping a running formatted document of my homework problems here.

2 Pre-Midterm 1 Practice

3 Applications of Double Integrals

From section 15.4 in Stewart Calculus.

15.4.7: Find $\bar{x}, \bar{y}$ and mass for D, bounded by $y = 1 - x^2$ and $y = 0$. $\rho(x, y) = ky$

Finding mass:

$$m = \int_{-1}^{1} \int_{0}^{1-x^2} ky \, dy dx$$

$$m = \int_{-1}^{1} \frac{k}{2}(1 - x^2)^2 dx$$

$$m = \frac{k}{2} \int_{-1}^{1} (1 - 2x^2 + x^4) dx$$

$$m = \frac{k}{2}[x - \frac{2}{3}x^3 + \frac{1}{5}x^5]_{-1 \to 1}$$

$$m = \frac{k}{2}[16/15]$$

$$m = k\frac{8}{15}$$

Finding M_y:

$$M_y = \iint_D x\rho(x,y)dA$$

$$= \int_{-1}^{1}\int_{0}^{1-x^2} kxydydx$$

$$= ...\frac{kx}{2}[y^2]_{0\to 1-x^2}$$

$$= ...\frac{k}{2}[x(1-x^2)^2]$$

$$= \int_{-1}^{1} k/2(x - 2x^3 + x^5)dx$$

$$= k/2[x^2/2 - 2/4x^4 + x^6/6]_{(-1\to 1)}$$

$$= k/2[1/2 - 1/2 + 1/6] - [1/2 - 1/2 + 1/6]$$

$$M_y = 0$$

Finding M_x

$$M_x = \iint_D y\rho(x,y)dA$$

$$= \int_{-1}^{1}\int_{0}^{1-x^2} ky^2\,dydx$$

$$= \int_{-1}^{1}[ky^3/3]_{0\to 1-x^2}dx$$

$$= \int_{-1}^{1} k/3[(1-x^2)^3]_{0\to 1-x^2}dx$$

$$= k/3\int_{-1}^{1}(1 - 2x^2 + x^4)(1-x^2)dx$$

$$= k/3\int_{-1}^{1}[1 - x^2 - 2x^2 + 2x^3 + x^4 - x^6]dx$$

$$= k/3\int_{-1}^{1}[1 - 3x^2 + 2x^3 + x^4 - x^6]dx$$

$$= k/3[x - x^3 + x^4/2 + x^5/5 - x^7/7]_{-1\to 1}$$

$$= k/3([1 - 1 + 1/2 + 1/5 - 1/7] - [-1 + 1 + 1/2 - 1/5 + 1/7])$$