

MA153 Lesson 31

LESSON 31 - Triple Integrals

21 RockTober, 2008

Outline

- 1 Admin
- 2 Last Class
 - Center of Mass
 - Homework Help
- 3 Triple Integrals
 - Course Guide
 - Triple Integrals over Rectangular Regions
 - Triple Integrals over General Regions
 - Board Work
 - Homework Help
 - Word Problems with Iterated Integrals
- 4 Look Forward

Admin

- 1 This week - Triple Integrals and a Review
- Next Week - WPR III on Monday, 27 October, in class.
Tuesday WE HAVE CLASS, not a drop, Vector Fields.
Wednesday - Line Integrals I. Thursday - Line Integrals II.
Friday, Halloween, we have a drop, I travel with the wrestling team.

Admin

- 2 Homework 6 is due this Friday, 24 October, in class

Admin

8 Guess what today is!

Admin

- 3 Guess what today is!
- 4 National Pumpkin Cheesecake Day? Wow! Every food has its day!

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Center of Mass

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

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- 2 Compute Mass where $m = \iint_D \rho(x, y) dA$

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

- 4 Finally compute \bar{x} and \bar{y} which are the exact coordinates of the center of mass.

$$\bar{x} = \frac{M_y}{m} = \frac{1}{m} \iint_D x\rho(x, y) dA, \quad \bar{y} = \frac{M_x}{m} = \frac{1}{m} \iint_D y\rho(x, y) dA$$

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Homework Help

Questions

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Course Guide

Triple Integrals - 15.6

- 1 Be able to set up the limits of triple integrals and change the order of integration.
- 2 Use projections to assist in sketching the general region bounded by multiple surfaces.
- 3 Use triple integrals to determine the volume of a general region bounded by multiple surfaces.
- 4 Understand the definition of type I, type II, and type III solid regions.
- 5 Use triple integrals to determine the density, mass, and center of mass of a solid of variable density.
- 6 Use triple integrals to determine the charge on a solid region.
- 7 **HOMEWORK PROBLEMS: 5, 13, 24, 34**

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Triple Integrals over Rectangular Regions

- 1 Just like when we went from single to double integrals

Triple Integrals over Rectangular Regions

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- 2
$$\iiint_B f(x, y, z) dV = \int_r^s \int_c^d \int_a^b f(x, y, z) dx dy dz$$

Triple Integrals over Rectangular Regions

1 Just like when we went from single to double integrals

2
$$\iiint_B f(x, y, z) dV = \int_r^s \int_c^d \int_a^b f(x, y, z) dx dy dz$$

3 We make little squares with a volume of $dx dy dz$

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Triple Integrals over General Regions

- 1 Again just like when we went from double integrals over square regions to general regions. Now we have three different Types.

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2
$$\int_a^b \int_{g_1(x)}^{g_2(x)} \int_{u_1(x,y)}^{u_2(x,y)} f(x, y, z) dz dy dx = \int \int \int_E f(x, y, z) dV =$$

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Board Work

- 1 Problem 11, Page 998 - $\int \int \int 6xy \, dV$
- 2 Set the integral up by hand then use Mathematica to solve.

Board Work

- 3 Problem 19, PAGE 998 - A tetrahedron.
- 4 Again, set up the integral then use Mathematica.

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Word Problems with Iterated Integrals

- 1 The next step in the brewing process is to transfer the beer from the square fermenter to a cylindrical fermenter called a carboy whose surface can be described by $x^2 + y^2 \leq \left(\frac{10.5}{2}\right)^2$. When this is done the baking soda is removed so the yeast covers the entire surface and has turned most of the sugar in the wort into alcohol. However, the yeast needs another week to complete the process. The concentration of yeast cells is now given by $C(x, y) = 1000000(300 - 5x^2 - 5y^2)$. Find the total concentration of yeast and plot it as a density or contour plot.

Look Forward

Triple Integrals in Cylindrical Coordinates - 15.7

- 1 Understand cylindrical coordinates as an extension of polar coordinates.
- 2 Understand the basic shapes of solids in cylindrical coordinates.
- 3 Convert from rectangular to cylindrical coordinates in a triple integral.
- 4 Understand that some triple integrals are simpler to compute in cylindrical coordinates.
- 5 HOMEWORK PROBLEMS: 2, 12, 15, 27

Questions?

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