MA153 Lesson 29

LESSON 29 - Iterated Integrals Over Polar Regions

16 RockTober, 2008

Outline

1. Admin
2. Last Class
   - Integrating over General Regions Step by Step
   - Homework Help
3. Iterated Integrals Over Polar Regions
   - Course Guide
   - Polar Coordinates
   - New Polar Coordinates Algorithm
   - Homework Help
   - Word Problems with Iterated Integrals
4. Look Forward

Admin

1. This week - Integrals
   Next Week - Guest Lecture on Monday, Triple Integrals
   Tuesday, Wednesday, and Thursday - Review on Friday!

Admin

2. WPR III on Monday, 27 October, in class

Admin

3. Quiz This Friday in Class! Will cover something similar to question 4b on WPR II and an iterated integral!

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Integrating over General Regions Step by Step

1. Sketch the region

Integrating over General Regions Step by Step

1. Sketch the region
2. Label the boundaries

Integrating over General Regions Step by Step

1. Sketch the region
2. Label the boundaries
3. Solve for and label the intersections

Integrating over General Regions Step by Step

1. Sketch the region
2. Label the boundaries
3. Solve for and label the intersections
4. Compute/Evaluate the "inside" integral

Integrating over General Regions Step by Step

1. Sketch the region
2. Label the boundaries
3. Solve for and label the intersections
4. Compute/Evaluate the "inside" integral
5. Compute/Evaluate the "outside" integral

Integrating over General Regions Step by Step

1. Sketch the region
2. Label the boundaries
3. Solve for and label the intersections
4. Compute/Evaluate the "inside" integral
5. Compute/Evaluate the "outside" integral
6. If possible, check answer in Mathematica

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Homework Help

Questions

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Course Guide

Double Integrals in Polar Coordinates - 15.4

1. Understand the definition of a polar rectangle, what is looks like, and its differential area ($rdrd\theta$).
2. Convert from rectangular to polar coordinates in a double integral.
3. Understand that some double integrals are simpler to compute in polar coordinates.
4. HOMEWORK PROBLEMS: 2, 11, 22, 30

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Polar Coordinates

1. $r^2 = x^2 + y^2$
2. $x = r\cos\theta$
3. $y = r\sin\theta$
4. $$\iint_R f(x,y)dA = \int_\alpha^\beta \int_a^b f(r\cos\theta, r\sin\theta)rdrd\theta$$

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Polar Coordinates

1. If possible create a 3D plot of the surface over the region

Polar Coordinates

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   - Study diagram to determine if this is positive, negative, or mixed.

Polar Coordinates

1. If possible create a 3D plot of the surface over the region
   - Study diagram to determine if this is positive, negative, or mixed.
   - Establish a very rough idea of the volume of the space

Polar Coordinates

1. If possible create a 3D plot of the surface over the region

2. Draw and Label the Region

Polar Coordinates

1. If possible create a 3D plot of the surface over the region

2. Draw and Label the Region
3. Determine the limits of integration

Polar Coordinates

1. If possible create a 3D plot of the surface over the region

2. Draw and Label the Region
3. Determine the limits of integration
   - Max and Min radial limits

Polar Coordinates

1. If possible create a 3D plot of the surface over the region

2. Draw and Label the Region
3. Determine the limits of integration
   - Max and Min radial limits
   - Max and Min angular limits

Polar Coordinates

1. If possible create a 3D plot of the surface over the region

2. Draw and Label the Region
3. Determine the limits of integration

4. Convert the integrand to an equivalent polar expression

Polar Coordinates

1. If possible create a 3D plot of the surface over the region

2. Draw and Label the Region
3. Determine the limits of integration

4. Convert the integrand to an equivalent polar expression
5. Set up the iterated integral

Polar Coordinates

1. If possible create a 3D plot of the surface over the region

2. Draw and Label the Region
3. Determine the limits of integration

4. Convert the integrand to an equivalent polar expression
5. Set up the iterated integral
6. Compute/Evaluate the inside integral

Polar Coordinates

1. If possible create a 3D plot of the surface over the region

2. Draw and Label the Region
3. Determine the limits of integration

4. Convert the integrand to an equivalent polar expression
5. Set up the iterated integral
6. Compute/Evaluate the inside integral
7. Compute/Evaluate the outside integral

Polar Coordinates

1. If possible create a 3D plot of the surface over the region

2. Draw and Label the Region
3. Determine the limits of integration

4. Convert the integrand to an equivalent polar expression
5. Set up the iterated integral
6. Compute/Evaluate the inside integral
7. Compute/Evaluate the outside integral
8. Look back, does it make sense?

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Word Problems with Iterated Integrals

1. A culture of brewers yeast is located precisely in the middle of a square fermenting vessel with each side of length 4 feet. If the yeast culture is placed at the point (0,0), and yeast multiplies and disperses in such a matter that the concentration at any point (x,y) in the vessel is given by $C(x, y) = 1000(24 - 3x^2 - 3y^2)$, where $C(x, y)$ is the number of yeast cells per square foot of surface per day at a point (x, y) in the vessel, then what is the average concentration of yeast in the beer each day.

Look Forward

Applications of Double Integrals - 15.5

1. Use double integrals to determine the density, mass, and center of mass of a lamina of variable density.
2. HOMEWORK PROBLEMS: 1, 4, 15, 24

Questions?

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