DATA 605 - Homework 13

Omer Ozeren

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library(ggplot2)

## Question 1.

Use integration by substitution to solve the integral

### Answer

Let . Then .

Our integral is now . Taking out the constants: .

Replacing with our original substitution: .

## Question 2.

Biologists are treating a pond contaminated with bacteria. The level of contamination is changing at a rate of bacteria per cubic centimeter per day, where is the number of days since treatment began. Find a function to estimate the level of contamination if the level after day 1 was 6530 per cubic centimeter.

### Answer

To find , we can take the antiderivative, i.e. the integral.

Using the power rule for integration: .

Solving for :

.

.

## Question 3.

Find the total area of the red rectangles in the figure below, where the equation of the lines is .

### Answer

The equation is given as , and the ends of the rectangles look to be 4.5 and 8.5. Since we’re looking for the area, we can integrate this function over these boundaries.

Using the power rule for integration:

$$
(x^2 - 9x)\Big|\_{4.5}^{8.5} = \Big[(8.5)^2 - 9(8.5)\Big] - \Big[(4.5)^2 - 9(4.5)\Big]
\\
= [72.25 - 76.5] - [20.25 - 40.5] = 16
$$

## Question 4.

Find the area of the region bounded by the graphs of the given equations.

### Answer:

* Solving for x gives
* Now that I have the endpoints, I can compute and plot or graph the two functions and see that for all x .
* Both functions are continous everywhere in the region and we can find the area between curves as
* Solving the integral gives

## Question 5.

A beauty supply store expects to sell 110 flat irons during the next year. It costs $3.75 to store one flat iron for one year. There is a fixed cost of $8.25 for each order. Find the lot size and number of orders per year that will minimize inventory costs.

### Answer:

lot size = x units/order Annual Cost = Annual storage cost \* Average no. of items carried out a year Annual Cost = 3.75.x/2 =1.875x

$$y` = 1.875x + (907.5/x) = 0$$

A <- sqrt(206.25)  
A  
## [1] 14.36141

lot size =14.36/order

ordperyear <- 110/14.36  
ordperyear  
## [1] 7.660167

Orders per year = 7.6

## Question 6.

Use integration by parts to solve the integral below.

### Answer:

## Question 7.

Determine whether f(x) is a probability density function on the interval . If not, determine the value of the definite integral.

### Answer :

* Compute