

Definite Integrals, Part 2

The density of oil in a circular oil slick on the surface of the ocean at a distance r meters from the center of the slick is given by $\delta(r) = \frac{50}{1+r^{3/2}}$ gallons/m².

1. Approximate the number of gallons of oil in the spill extending from $r = 0$ to $r = 10,000$ m. Can you tell if this is an underestimate or overestimate? Explain.
2. Draw a detailed picture of the situation and the quantities you used to create your approximation.
3. Refine your approximation using a value of Δr half the size that you used in Question 1. What happens to your approximation? Do this two more times. What do you hypothesize about the convergence of your technique?
4. Express the exact amount of oil in the spill extending from $r = 0$ to $r = 10,000$ m using a definite integral. Describe the meaning of each factor of your integral and give the units it is measured in.