

## Estimating Calories in a Cookie with Riemann Sums – Class Handout

Make four traces of the cookie, one per quadrant of the  $1/4$  inch graph paper. Each time you trace the cookie, line up the straight edge with a horizontal line and the left corner touching a vertical line. The horizontal edge will be your  $x$ -axis, and the line the cookie touches on the left is the  $y$ -axis.

1. On the first sketch of the cookie, draw in rectangles that represent a left sum. Use rectangles whose width is the width of the boxes,  $1/4$  inch.
  - (a) Use a left sum to calculate the number of  $1/4$  inch boxes inside the curve. The units will be  $1/4$  inch boxes.
  - (b) Convert your answer to square inches.
2. On the second sketch of the cookie, draw in rectangles that represent a right sum. Use rectangles whose width is the width of the boxes,  $1/4$  inch.
  - (a) Use a right sum to calculate the number of  $1/4$  inch boxes inside the curve. The units will be  $1/4$  inch boxes.
  - (b) Convert your answer to square inches.
3. On the third sketch of the cookie, draw in rectangles that represent the midpoint rule. Use rectangles whose width is the width of the boxes,  $1/4$  inch.
  - (a) Use the midpoint rule to calculate the number of  $1/4$  inch boxes inside the curve. The units will be  $1/4$  inch boxes.
  - (b) Convert your answer to square inches.
4. On the fourth sketch of the cookie, draw in trapezoids that represent the trapezoid rule. Use trapezoids whose width is the width of the boxes,  $1/4$  inch.
  - (a) Use the trapezoid rule to calculate the number of  $1/4$  inch boxes inside the curve. The units will be  $1/4$  inch boxes.
  - (b) Convert your answer to square inches.
5. Look over your four answers as well as the sketches you have drawn.
  - (a) Based on your sketches, which method(s) do you believe would provide the best estimate of surface area? Why?
  - (b) What possible errors do you see in using these estimation techniques?
6. Typically these cookies contain around  $14 \text{ cal/in}^2$ .
  - (a) Use your best surface area estimation to approximate the number of calories in your cookie.
  - (b) What possible errors do you see in estimating calories in this way?