# State the Area

Since the borders for the state of Idaho include lines of latitude and longitude, a river, and a mountain range, determining its area requires an approximation technique. A grid process can be used; however, the counting of grids is time consuming and tedious, so a process which involves summing the area of rectangles with a constant width can be used. Superimposing parallel rectangles which have the same width, and then measuring the heights of the rectangles on either the left side or the right side allows for a simple calculation process. As the number of rectangles increases, the area determined from calculating the areas of rectangles and summing them approaches the actual area of the state.

1. One method of approximating the area is to use "left-hand rectangles." Since the lower border of Idaho is on a line of latitude, this line is used as the lower side for all of the rectangles. Six equally-spaced vertical lines are drawn on the map to begin to form five rectangles. The tops of the left-hand rectangles are drawn on the map beginning where each vertical line intersects Idaho's left-most boundary line. For each left-hand rectangle, measure the length and width to the nearest tenth of a centimeter. Complete the table for each of the five rectangles.
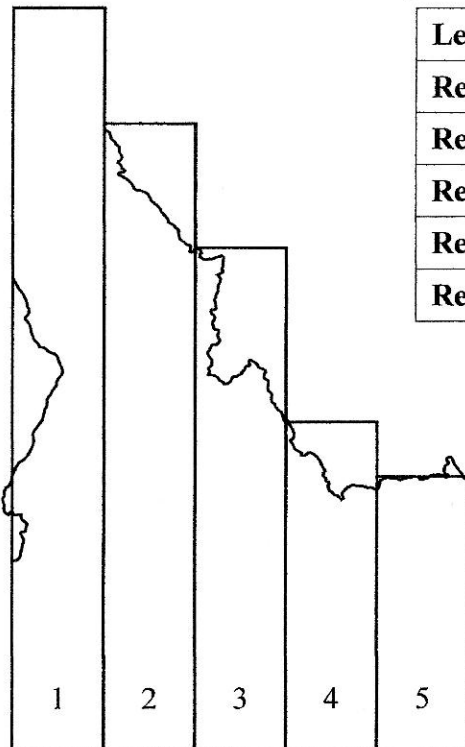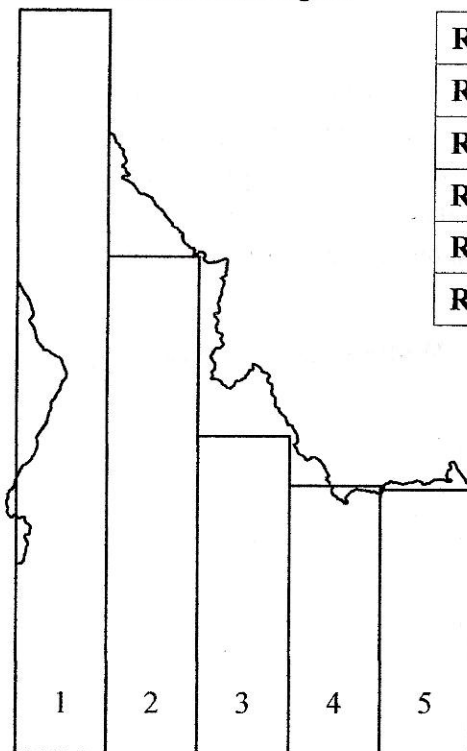
Left-hand	Length in cm	Width in cm	Area in sq cm
Rectangle 1			
Rectangle 2			
Rectangle 3			
Rectangle 4			
Rectangle 5			

Map scale: 1 cm = 48.5 miles

2. Using five left-hand rectangles, the total approximate area of the region is _____ square centimeters. Using the map scale, the total area of Idaho is _____ square miles. Show the work that leads to this area.

3. Consider the approximate area of Idaho determined by using left-hand rectangles. Is the total area overestimated or underestimated? Defend your answer by using the appearance of the graph.

4. A second method to approximate the area is to use "right-hand rectangles." Six equally spaced vertical lines are drawn on the map to form five rectangles. The tops of the right-hand rectangles are drawn on the map beginning where each vertical line intersects Idaho's right-most boundary line. For each right-hand rectangle, measure the length and width to the nearest tenth of a centimeter. Complete the table for each of the five rectangles.
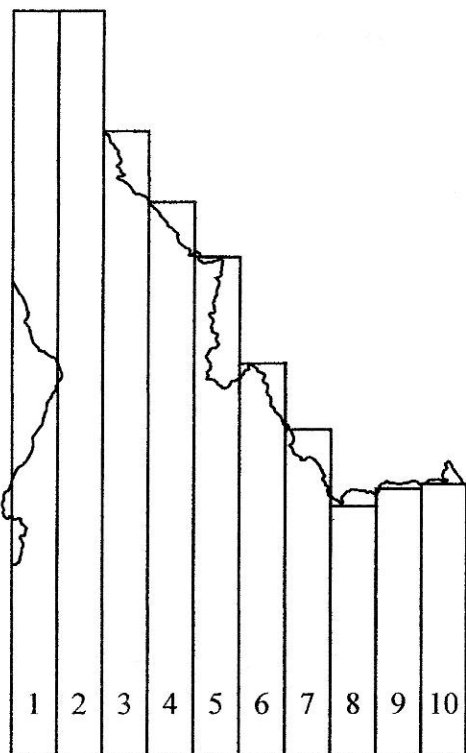
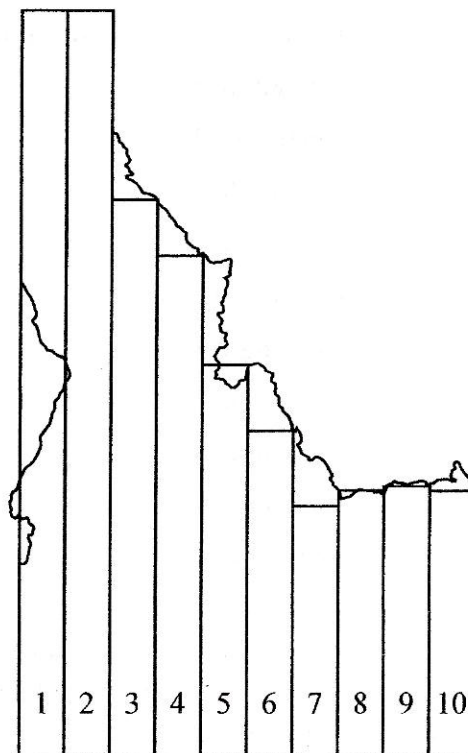| Right-hand	Length in cm	Width in cm	Area in sq cm
Rectangle 1			
Rectangle 2			
Rectangle 3			
Rectangle 4			
Rectangle 5			

Map scale: 1 cm = 48.5 miles

5. Using right-hand rectangles, the total approximate area of the region is _____ square centimeters. Using the map scale, the total area of Idaho is _____ square miles. Show the work which leads to this area.

6. Consider the approximate area of Idaho determined by using right-hand rectangles. Using the appearance of the graph, is the total area overestimated or underestimated?

7. According to netstate.com, the area of Idaho is approximately 83,574 square miles. Is the estimate using five left-hand rectangles or the estimate using five right-hand rectangles closer to this area? For the better of the two estimates, what is the difference between the approximate area and the given area?

8. Work with a partner to determine the approximate area using 10 rectangles. One partner will calculate the area using right-hand rectangles and the other using left-hand rectangles. Record both sets of answers in the tables provided.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

Left-hand rectangles

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

Right -hand rectangles

For each left-hand rectangle, measure the length and width to the nearest tenth of a centimeter. Complete the table for each of the ten rectangles.

Left-hand	Length in cm	Width in cm	Area in sq cm
Rectangle 1			
Rectangle 2			
Rectangle 3			
Rectangle 4			
Rectangle 5			
Rectangle 6			
Rectangle 7			
Rectangle 8			
Rectangle 9			
Rectangle 10			

9. Using ten left-hand rectangles, the total approximate area of the region is _____ square centimeters. Using the map scale, the total area of Idaho is _____ square miles. Show the work which leads to the area.

10. For each right-hand rectangle, measure the length and width to the nearest tenth of a centimeter. Complete the table for each of the ten rectangles.

Right-hand	Length in cm	Width in cm	Area in sq cm
Rectangle 1			
Rectangle 2			
Rectangle 3			
Rectangle 4			
Rectangle 5			
Rectangle 6			
Rectangle 7			
Rectangle 8			
Rectangle 9			
Rectangle 10			

11. Using ten right-hand rectangles, the total approximate area of the region is _____ square centimeters. Using the map scale, the total area of Idaho is _____ square miles. Show the work which leads to the area.

12. Using the information from netstate.com, that the area of Idaho is approximately 83,574 square miles, which estimate is closer to this area, the estimate using the ten left-hand rectangles or the estimate using the ten right-hand rectangles? For the better of the two estimates, what is the difference between the approximate area and the area given by netstate.com?

13. Consider the diagrams of the four area approximations with 5 left- and right-hand rectangles and 10 left- and right-hand rectangles. Which appears to be a more accurate approximation? Explain your thinking by referring to the diagrams.