

Title: Touchdown!  
Subject: Math  
Grade: 9-12

**Objectives:**

Students will utilize software to find surface area.

Students will apply mathematics to a real world problem to determine which NFL stadium offers the most room per person.

**PA Standards:**

3.7.10

Interpret how systems thinking applies logic and creativity with appropriate comprises in complex real-life problems.

2.5.11

Develop a plan to analyze a problem, identify the information needed to solve the problem, carry out the plan, check whether an answer makes sense, and explain how the problem was solved in grade appropriate contexts.

**Materials:**

Computer with Pictometry Online, Stadium address/seating capacity sheet, journals

**Instructional Accommodations:**

Pair struggling student with student who is not struggling  
Allow calculators if necessary

**Procedures**

**Introduction:**

1. Write question on the board:
  - a. What would you hypothesize if you knew that one NFL stadium had a surface area to seating capacity ratio of 5 ft<sup>2</sup> to 1, while another had a ratio of 3 ft<sup>2</sup> to 1?
2. Write hypothesis (quickly) in journals
3. Discuss
  - a. Make sure they understand that the more surface area per seat (higher ratio) means more room per person
4. Explain that today they are going to find the surface area to seating capacity ratios for 5 different NFL stadiums and do some comparing.

**Development:**

1. Model each step of how to find surface area by doing example of finding surface area and seating capacity of Heinz Field using overhead projector.
  - a. Open POL (Pictometry Online)
  - b. Type address from address sheet
  - c. Zoom/scroll as necessary
    - i. Use tools and explain
    - ii. Point out bottom right-hand small-scale picture to help scroll (you can move the shaded area, which is the area shown on your screen, by clicking on and moving it)
  - d. Find surface area:
    - i. Click on A (area)
    - ii. Put crossbars where starting and hold down left button on mouse.

- iii. When need to turn, click v and still keep holding mouse button
      - 1. DO NOT let go of mouse until done (when end and beginning meets)
      - 2. Go around whole stadium, including lights
    - iv. When meet at beginning, let go of mouse button
    - v. Answer is found in bottom left corner. (make sure in normal font)
      - 1. *About 558,402 ft<sup>2</sup>*
- 2. Break students into five equal groups.
- 3. Pass out sheet with stadium addresses and seating capacities. Assign each group a stadium.
- 4. Ask students to find the surface areas for their assigned stadium.
- 5. Have each group present their findings.
- 6. Ask students how to write a ratio and what a ratio is/tells us.
- 7. Ask how you could write a ratio of Heinz Field's surface area to its seating capacity.
  - a. *558,402 : 64,450*
- 8. Now, how could we figure out, from this ratio, how many ft<sup>2</sup> is available for each seat?
  - a. Hint: you need seating capacity value to be 1!
  - b. Divide both sides by seating capacity value.
- 9. Model finding this for Heinz Field:
  - a. *Divide both sides by 64,450*
  - b. *Ratio= 8.7 ft<sup>2</sup> : 1*
    - i. Meaning – if we were strictly looking at area and not volume, and the whole stadium were full of nothing but seats, each seat would be allotted 8.7 ft<sup>2</sup> (pretty comfy seats!)
- 10. Ask students to look at the seating capacity sheet and their surface areas and guess which will have the highest ratio
  - a. Think-pair-share within the group
- 11. Ask students to write surface area to seating capacities for all 5 stadiums (on same sheet of paper as their surface areas, to hand in)
- 12. Ask students to determine what other factors might impact the amount of room per seat.
- 13. Go back to journal and write about findings:
  - a. Was hypothesis correct?
  - b. Why or why was it not correct?
  - c. What are some things that could affect why their hypothesis was right or wrong?
- 14. Discuss findings:
  - a. Make sure to explain that our ratios do not really represent the size per seat.
  - b. What if one stadium has more rows vertically?
    - i. Surface area may be smaller (higher volume), making ratio smaller, when seats may in fact have more room than another with a larger surface area.
    - ii. What if all the seats are packed in, but there's tons of room in the stadium with restaurants, shops, etc. inside?
      - 1. Surface area may be larger, giving larger ratio, when each seat actually has a relatively small amount of space.

**Closure:**

- 1. Ask students what tools we used on POL today.
- 2. Ask students why we wanted to know the surface area to seating capacity ratio.

**Assess:**

Journal, ratios (handed in on paper), discussion