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# Find the Area Under a Curve {Parts 1&2}

2-3, 42 minute class period

**Goals:**

- Explore methods and significance of finding area
- Discover how finding the area under a curve pertains to current research
- Understand error is associated with estimation

**Objectives:**

- Estimate the area under a curve by counting square units on a grid
- Estimate the area under a curve by summing quadrilaterals (only for higher function/faster paced classes)
- Estimate the area under a curve by weight

**Materials:**

- Transparency of the first quadrant of $y=-x+5$
- Transparency of $y=-x+5$ with shaded area from $x=0$ to $x=3$
- Handouts
- Analytical balance
- Scissors
- Transparencies and handouts printed on heavy duty card stock

**Prior Knowledge:**

- Find the area of a trapezoid, rectangle, triangle (look-up formula if needed)
- Graphing in a coordinate plane (optional, but preferred for student comfort with language of graphs)
- Difference between linear and non-linear curves
- Unit Rates (will be reviewed, but a familiarity will be helpful)

**NJCCCS:**

**4.2.7.A.1; 4.2.7.E.1; 4.5.7.B.2; 4.5.7.B.3**

**Procedure:**

1. Instructor asks the students to recall finding the area of a shape
    a. How to calculate the area
    b. What the area might represent
2. Instructor provides Figure 1 [the first quadrant of the graph of $y=-x+5$]
    a. Students should be able to identify the shape formed as a triangle
    b. Students should also be able to find the area to be **12.5 units$^2$**
3. Instructor asks how one might find the area under the line from $x=0$ to $x=3$
4. Students explore the ways they might find the area (6 min with 2 min warning). Effective methods include but may not be limited to:
    a. Estimating the area from the grid

    b. Identifying the new shape is a trapezoid
5. Discuss the advantages/disadvantages of each method.
6. Provide the students with the first handout
7. Students discuss how each method would be used to find the area.
8. Discuss the error involved with the "better" method.

**{Part 2}**

9. Instructor asks the students to recall finding the area from **Part 1**
    a. Counting squares
    b. Seeing the geometric shape
    c. Splitting the composite shape into smaller polygons
10. Instructor shows the slideshow demonstrating each method
11. Use the grid estimation to approximate the area under curve on handout
12. Pose the question: "if one of the squares on the grid weighs 2 gram, how much does the whole thing weigh?"
13. Guide the discussion so that the students begin to make the connection between the area and the relationship between the mass of the whole to the mass of the unit square.

    *Area = mass whole/mass of one square*

5. Using an analytic balance and cardstock copy of the curve (in quadrant I) from the handout, show that this relationship is consistent with the grid estimation.
14. Discuss the advantages/disadvantages of each method.
15. Explain that there is one more method that mathematicians and scientists use in research and in their careers.
    a. If we know an equation that describes a curve, we can use calculus to find the exact area underneath the curve
    b. Using calculus, the approximate area under the curve is 6.9643

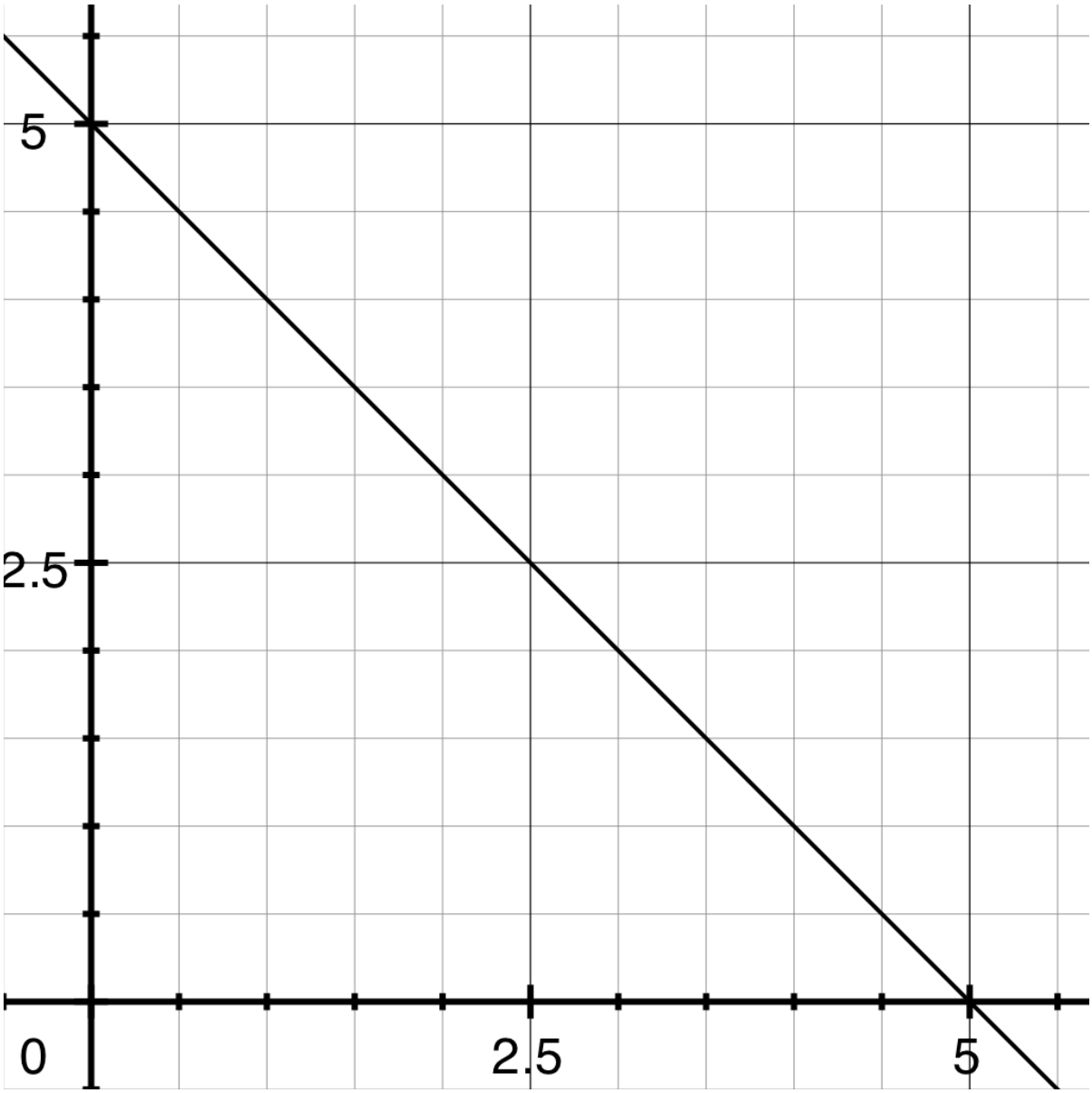



Figure 1: Transparency of $y = -x + 5$

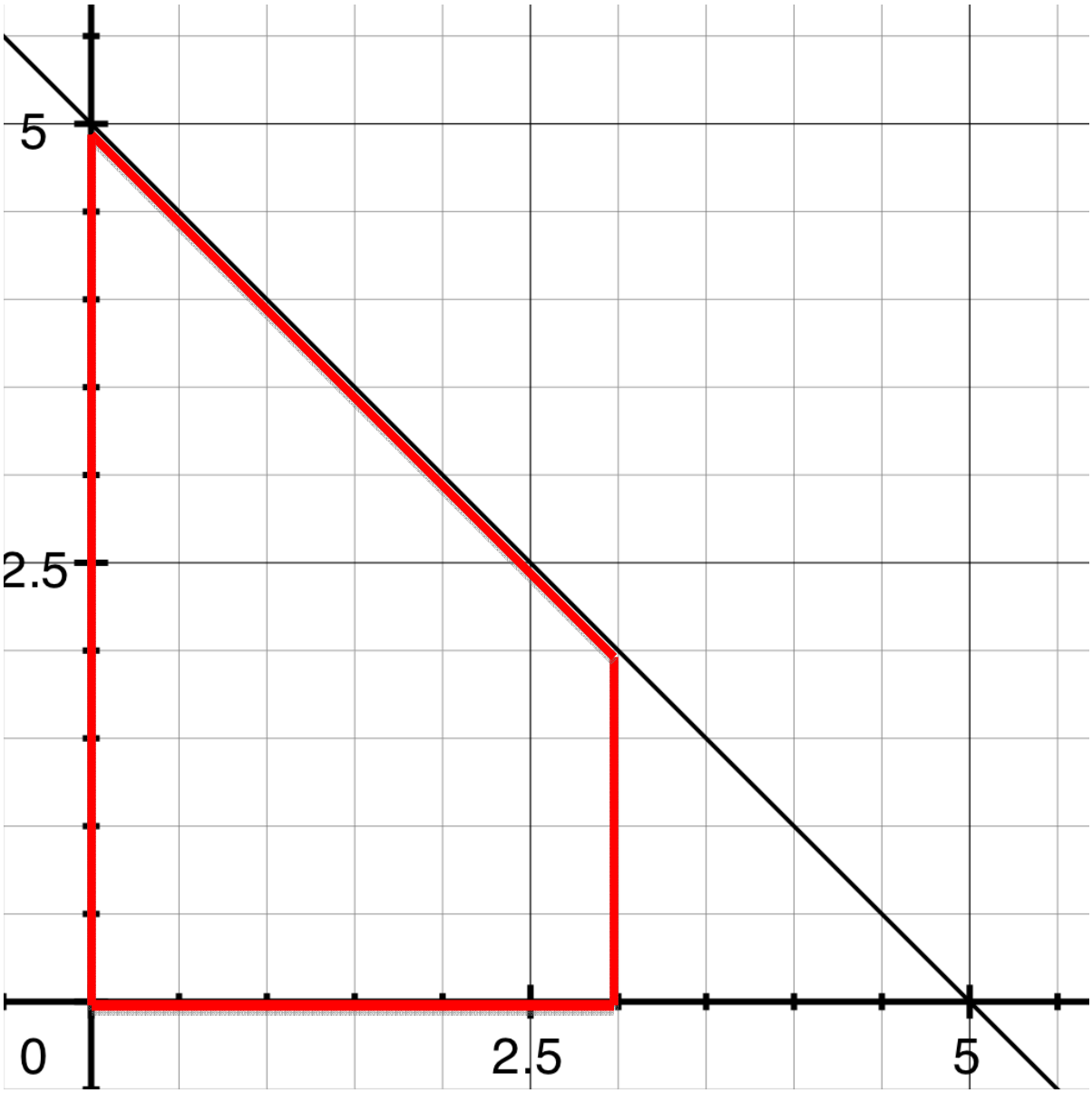
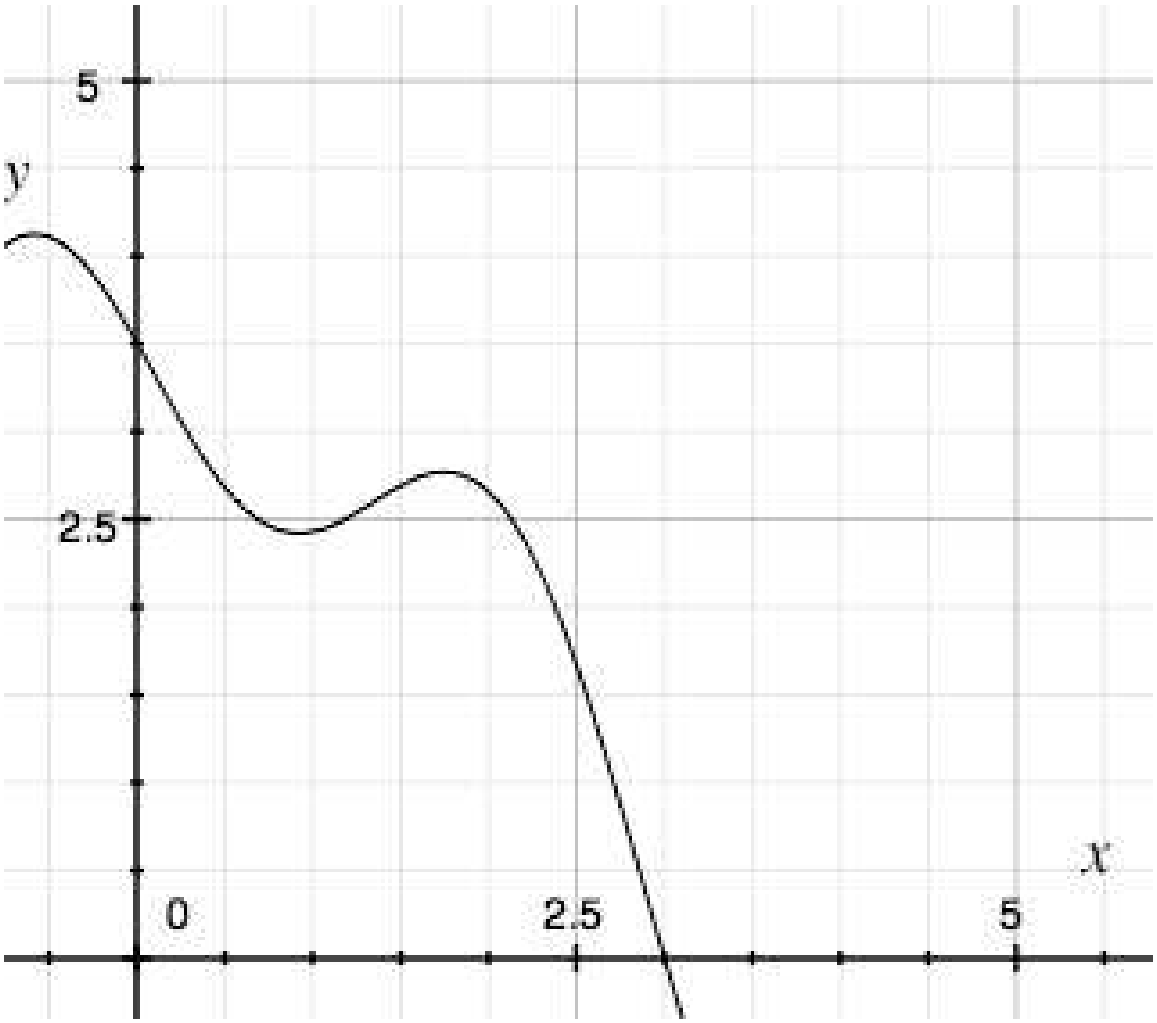



Figure 2: Transparency of $y = -x + 5$ from $x = 0$ to $x = 3$

Name: _____ Date: _____

Estimate the area under the curve.




Describe your method below. _____

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