**Grade 6 | Unit 8, Lesson 6**

**Intellectual Preparation Cover Sheet**

**Directions: Complete the IPP Cover Sheet for every lesson due for submission.**

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| **Step** | **Action:** |
| 1. Understand the concept and/or big ideas at play in the lesson and be able to articulate them clearly and crisply. | * Read the entire Lesson Plan and identify the key concepts/big ideas students need to understand. Create a **lesson summary** annotation that describes, in your own words, the purpose of the lesson (why), the key concepts students need to understand (big ideas/what), and how they will come to understand these within the lesson. |
| 1. Do the core tasks of the lesson to develop/refine exemplar work and clear CFS for anticipated strategies. | * Print the classwork and complete this step directly in the student packet for the TAI, INM/TTC problem (include exemplar annotations), and all GP/IP problems. |
| 1. Anticipate misconceptions and create questions/supports to address these misconceptions. | * For each core task, annotate to describe expected errors on the tasks and back pocket questions to respond to these errors * Identify the questions in the TAI debrief and INM/TTC that elicit the most important understandings and annotate with the following:   + The exemplar student responses   + 1-2 misconceptions or errors that could surface in response to these questions   + BPQs and/or the instructional strategy to address these misconceptions. |
| 1. Optional/As needed: Adjust the plan for any individualized AOTY or intellectual preparation goals. | * As determined with coach, you might:   + Script MVP directions into lesson plans   + Script in additional planned investment moves   + Create rapid & batched feedback forms to capture data   + Determine additional points for differentiation (especially for very high and very low performance during the lesson) * If you will meet in person to scrimmage this lesson, your coach may also ask you to submit a proposed practice objective and identify the lesson segment to practice. |
| **Submit annotated plans and any additional work as per IPP expectations in soft copy of LPs to your coach weekly (and at least 48 hours in advance of the IPP meeting). Implement any feedback from coach prior to the phase 2 meeting.** | |
| 1. Rehearse and Refine:    1. Meet with coach to further internalize and practice executing the plan. Refine plan as needed.    2. Refine plan as needed based on practice and/or student exit ticket data.    3. If possible, prior to teaching the day of, analyze student work from TAI administered at end of CR block; select S work to show call to drive TAI debrief discussion to land Fence Posts and key point. | |

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| **Lesson Type: Conjecture Based Lesson** |
| **Aim** |
| * SWBAT derive, explain and apply the area formula for a trapezoid |
| **Conjecture** |
| * The area of a trapezoid is measured using the formula A = ½h(b1 + b2) |
| **Standard** |
| **Solve real-world and mathematical problems involving area, surface area, and volume.**  6.G.1 – Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems. |
| **State Test Alignment** |
| *From 2014 NYSE*  Noah wants to make the kite shown below out of cloth.    He wants to determine how much cloth he needs. What is the area, rounded to the nearest square centimeter, of Noah’s Kite?   1. 531 2. 1,063 3. 1,430 4. 2,126 |
| **Assessment** |
| **Exit Ticket:**   1. Leslie is painting the wing of a model airplane she is making. A drawing of the wing is below. If she paints the top of the wing dark gray, how many square centimeters will she paint dark gray?   8.4 cm  9.2 cm  **Student Work:**   * + - 1. A = 61.64 square cm   A = ½h(b1 + b2)  A = ½(9.2)(5 + 8.4)  A = ½(9.2)(13.4)  A = 4.6(13.4)  A = 61.64 |
| **Connection to Learning and Conceptual Understanding** |
| * How does this lesson connect to previous lessons?   + In the previous lesson, students derived the formula for measuring the area of an obtuse triangle using what they know about measuring the area of acute and right triangles. In this lesson, students derive the area formula for trapezoids using their understanding of the triangle area formula. Students decompose a trapezoid into two triangles in order to measure the area of a trapezoid and derive the formula. * What do we want every student to take away or do as a result of this lesson? How will a teacher know if students have met this goal?   + Understand: As a result of this lesson, every student understands that the area of a trapezoid can be found by using the formula A = ½h(b1 + b2) because measuring the area is the same as finding the sum of two triangles that make up the trapezoid. The trapezoid can be decomposed into two triangles with the same height and different bases, thereby leading to expression ½hb1 + ½hb2, which can be simplified to ½h(b1 + b2) using the distributive property. Ss also apply their understanding that decomposing a shape into non-overlapping shapes does not add or subtract area.   + Do: As a result of this lesson, every student is able to prove that A = ½h(b1 + b2) can be used to measure the area of trapezoids and they are able to measure the area of any trapezoid using the formula as well as decomposition. Students use two methods to show that the formula works. |
| **How** |
| * Key Strategy/ies   + Annotate the problem with margin notes   + Model is drawn (as needed)   + Identify the base 1, base 2, and height on model   + Write the formula A = ½h(b1 + b2)   + Calculate the area   + Write an answer statement * CFS for top quality work   + Problem is annotated with margin notes to provide additional meaning   + Model is drawn accurately and labeled   + Formula is written   + All calculations are shown, neatly organized, and labeled   + Answer statement is provided |
| **Anticipated Misconceptions and Errors** |
| * Ss may misidentify the bases and/or height * Ss forget to combine the two bases and just find the area using one base |
| **Key Vocabulary** |
| * **Area:** Measures the number of square units that cover the inside space of a 2-dimensional figure. * **Dimension**: Measurement in length, width and thickness (i.e. length, width, base, height) * **Trapezoid:** A two-dimensional shape that has four sides and one pair of parallel sides. * **Decompose**: To split a shape up into readily determinable areas while maintaining the original area of the shape |
| **Materials** |
| * Handout |

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| **Opening – Prompt for work time, Circulate, Debrief, Synthesis, & Frame – 12-15 min** |
| **THINK ABOUT IT!**  Part A: Consider what you have learned about measuring area of different shapes to measure the area of the figure below.  Part B: Write an expression to represent the strategy you used to measure the area of the figure. |
| **Prompt for Work Time (<30 sec)**  You will have 5 minutes to work on this Think About It. Please use the entire 5 minutes. Please show and explain all of your thinking clearly.  **Circulate (≤ 5 min)**  T should prompt some Ss to try to use a different decomposition method than using a rectangle and triangle in order to get second desired strategy in table below.  While circulating, collect data on the following:   |  |  | | --- | --- | | **Scholar thinking (correct and erroneous)** | **Scholar Initials - Work to show call** | | (1) S decomposes the figure into a rectangle and triangle |  | | (2) S decomposes the figure into two triangles (T should prepare this in advance in case Ss do not use the strategy) |  | | S writes correct expression for strategy 2 (above) |  |   **Debrief (≤ 8-10 min)**  ***Planner’s Note: This is going to be very tricky for Ss. Be prepared with your own exemplar work to show call and land the plane when needed.***  **FENCEPOST #1:** *We can use decomposition to measure the area of trapezoids*  **What kind of shape is this? How do you know? CC.** SMS: This is a trapezoid because it has 4 sides, and one set of opposite parallel sides.  Show call student work for part A showing decomposition into a rectangle and triangle  **Did this student measure the area of the trapezoid correctly? How do you know? Vote. CC**. SMS: This S did measure the area correctly because s/he decomposed the figure into a rectangle and a triangle without changing the area of the shape. S/he found that the area of the rectangle is 120 sq. ft. and the area of the triangle is 20 sq. ft. using the formulas A = bh and A = ½bh. Then, s/he combined the areas to get the total area of 140 sq. ft.  Show call S work for part A showing decomposition into two triangles  **Did this student measure the area of the trapezoid correctly? How do you know? Vote. CC**. SMS: This S also found the area correctly because s/he decomposed the figure into two triangles without adding or subtracting area. Then, s/he measure the area of each triangle, 80 sq. ft. and 60 sq. ft., and combined the areas to get 140 sq. ft.  **What is one strategy we can use to measure the area of trapezoids?**  **Name the fencepost:** We can use decomposition to measure the area of trapezoids  **CONJECTURE:** *The area of a trapezoid is measured using the formula A = ½h(b1 + b2)*  Show call the expression for strategy 2: ½(10)(16) +½(10)(12)  **Does this expression correctly model the second strategy we looked at? Why? TT. Vote. CC.** SMS: The expression does because you can represent the area of the right triangle with a base of 16 and a height of 10 using ½(10)(16), and you can represent the area of the obtuse triangle with a base of 12 feet and a height of 10 feet using ½(10)(12).  **Is there a simpler way we could have written this expression?** CC. SMS: We could have written ½(10)(16 + 12) using the distributive property because you can factor out the ½ and the height of 10 from each expression.  **BPQ: What do both parts of the expression have in common?**  **NOTE: If you don’t get to this after 2 BPQs, NAME IT for students.**  **Key Learning Synthesis (≤ 2 min)**  **Conjecture**: *The area of a trapezoid is measured using the formula A = ½h(b1 + b2)*  **Let’s form our conjecture for the day and make a more generalized statement about measuring the area of trapezoids. With your partner, call the height, h, the base of 16 ft. b­1 and the base of 12 ft. b2, and come up with a conjecture about a formula we could use for measuring the area of trapezoids.** TT. CC.  **NOTE: If you don’t get to this after 2 BPQs, NAME IT for students.**  **Frame (≤ 30 sec)**  You all just came up with today’s conjecture. The area of a trapezoid is measured using the formula A = ½h(b1 + b2). We’ve only applied this formula to one trapezoid so let’s apply our conjecture to another problem to see if it is true! |

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| **Test the Conjecture – 10 min** |
| **Post the Conjecture in visible place for student reference:** The area of a trapezoid is measured using the formula A = ½h(b1 + b2).  Let’s go ahead and test our conjecture to see if our conjecture continues to be true!  **What will we be able to do if our conjecture is true? TT. CC.** We will be able to measure the area of trapezoids by using the formula A = ½h(b1 + b2).  ***Planner’s Note: There is only 1 TTC problem for time.***  **TEST THE CONJECTURE #1**  **Caleb is painting a picture that has the dimensions of the shape below. How many square centimeters of paint will he need to cover the entire canvas?**  Take 30 seconds to read and annotate the problem.  **What is the question asking us to do? CC.** SMS: The question is asking us to measure the area of the trapezoid because we are covering the entire shape and we are measuring the amount of paint in square centimeters.  **What will be true if our conjecture is correct? CC.** SMS: We will be able to find the area of the trapezoid using the formula A = ½h(b1 + b2).  **How should we go about solving this problem? CC.** SMS: We should first identify the base 1, base 2, and the height in the picture.  **On your own, label the model with the two bases and height.**  Show call correctly labeled model. **Is this labeled correctly? How do you know? Vote. CC.**  **Why are the non-parallel sides not used for one of the bases or the height? CC.** SMS: Because they are neither the perpendicular distance between bases, nor the side that the shape rests on (they are not parallel).  **What do we do next? CC.** SMS: Next, we substitute the values for the b1, b2, and the h into the formula and write A = ½h(b1 + b2). Then we evaluate the expression on the right.  **On your own, take 90 seconds to do that.** *T circulates.* **What did you get for the area?** *Show call exemplar work.* SMS: 84 sq. in.  **How can we prove that our conjecture is true? CC.** SMS: We can find the area of the trapezoid by decomposing it into shapes, finding the area of each shape, and combining the areas to find the total area.  **How can we decompose this figure? With your partner, decompose the figure and label all dimensions we would need to measure the area.** **TT.** Show call work. **How did this S decompose the shape? CC**. SMS: The student decomposed the trapezoid into two triangles and one rectangle. S/he labeled the rectangle as 7 cm by 8 cm, one triangle as 6cm by 7 cm and then the second triangle as 2 cm by 7 cm. For the second triangle, the S had to use properties of the rectangle to figure out that the height is also 7 cm and s/he had to subtract 8 cm and 6 cm from 14 cm to determine the base.  **On your own, find the area of the two triangles and the rectangle, and then the total area.** *T circulates to check work.*  Show call correct work.  **Stamp the Learning**  Point to the written conjecture. **So far, does our conjecture hold true? How do you know?** TT. CC. SMS: Yes our conjecture holds up because we were able to find the area of a trapezoid using the formula A = ½h(b1 + b2).  **STAMP THE CONJECTURE**  **Frame for PP/IP**  For the next 5 minutes, you’ll be working with your partner applying the conjecture that we just stamped. While working, make sure that you are meeting our CFS for top quality work.  CFS for top quality work   * + Problem is annotated with margin notes to provide additional meaning   + Model is drawn accurately and labeled   + Formula is written   + All calculations are shown, neatly organized, and labeled   + Answer statement is provided |

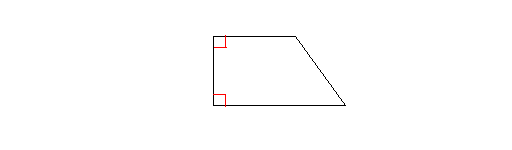
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UNIT 8 LESSON 6

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| AIM: | SWBAT solve area problems with trapezoids |

**THINK ABOUT IT!**

Part A: Consider what you have learned about measuring area of different shapes to measure the area of the figure below.



10 feet

16 feet

12 feet

12 feet

Part B: Write an expression to represent the strategy you used to measure the area of the figure.

**Test the Conjecture**

*Test the Conjecture #1)* Caleb is painting a picture that has the dimensions of the shape below. How many square centimeters of paint will he need to cover the entire canvas?

16 cm

6 cm

* **CFS for top quality work**
  + Problem is annotated
  + Model is drawn accurately and labeled
  + Formula is written
  + All calculations are shown /Answer statement is provided

9 cm 7 cm 10 cm

8 cm

Conjecture

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| The area of a \_\_\_\_\_\_\_\_\_\_\_\_\_ is measured using the formula  A = ½h(b1 + b2) |

**PARTNER PRACTICE**

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| *Bachelor Level* |

1. Measure the area of the trapezoid using the formula and using decomposition

15 inches

* **CFS for top quality work**
  + Problem is annotated
  + Model is drawn accurately and labeled
  + Formula is written
  + All calculations are shown /Answer statement is provided

14 inches

23 inches

19 inches

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| *Master Level* |

1. Mr. Rogers wants to retile the front of his roof. The roof of a house is 8 feet tall. If each tile is 2 foot by 2 foot, how many tiles does he need to buy in order to cover the entire front of the roof?

14 feet

20 feet

**INDEPENDENT PRACTICE**

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| *Bachelor Level* |

1. Measure the area of the trapezoid using the formula and using decomposition

* **CFS for top quality work**
  + Problem is annotated
  + Model is drawn accurately and labeled
  + Formula is written
  + All calculations are shown /Answer statement is provided

16 in.

6 in. 8 in.

20 in.

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| *Master Level* |

1. Which expressions can be used to find the area of the trapezoid below? Circle all that apply.

22 cm

6 cm

18 cm

32 cm

24 cm

20 cm

1. ½(32)(18) + ½(18)(24)
2. ½(18)(20 + 22)
3. ½(18)(6) + ½(18)(2) + (24)(18)
4. ½(20)(24 + 32)
5. ½(18)(24 + 32)
6. 9(56)
7. Jabril wants to create a planter on top of AFEMS for a science project. He has 100 sqft of soil to put into his planter. If he builds the planter in the shape of a trapezoid with bases of 10 feet and 12 feet with a height of 21 feet, will he have enough soil to cover the bottom of the planter? How much soil will be left over or needed to fill the planter?

Answer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Explain how you can use triangles to derive the area formula for trapezoids. Use an example to help illustrate the explanation.

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1. Joseph wants to paint the wall of his bedroom green. His wall is shaped like a trapezoid. The base along the floor is 20 feet long. The base along the ceiling is 12 feet long and the distance from the floor to the ceiling is 9 feet.

Part A: If one can of paint will cover 75 square feet, how many full cans of paint does he need to buy?

Answer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Part B: The paint store is having a sale. Cans of paint cost 70% of what they normally cost. If paint costs $6.00 per can, how much will he spend on paint?

Answer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| *PhD Level* |

1. Mr. Roble measured the area of the trapezoid below to be 120 sq. cm. The problem is, he forgot what the height was. Determine the height of the trapezoid.

10 cm

8 cm 18 cm

10 cm

1. Determine the area of the shaded region. The length of AB is the same as CD and is 10 feet. The length of AD is 28 feet:

A B C D

10 feet

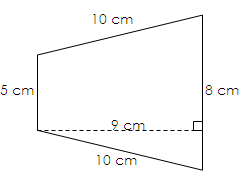
14 feet

**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**EXIT TICKET**

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| Self-assessment | I mastered the learning objective today. | I am almost there. | Need more practice and feedback. |
| Teacher feedback | You mastered the learning objective today. | You are almost there. | You need more practice and feedback. |

1. Leslie is painting the wing of a model airplane she is making. A drawing of the wing is below. If she paints the top of the wing dark gray, how many square centimeters will she paint dark gray?



8.4 cm

9.2 cm

* **CFS for top quality work**
  + Problem is annotated
  + Model is drawn accurately and labeled
  + Formula is written
  + All calculations are shown /Answer statement is provided