**Grade 7 | Unit 5, Lesson 15**

**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.
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| 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.
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| 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.
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| 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.
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| **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 solve problems involving area of scale drawings of figures by finding areas or scale factors
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| **Conjecture** |
| * The area of a scaled figure is the original area multiplied by the scale factor squared
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| **Standard** |
| 7.G.1Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale. |
| **State Test Alignment**  |
| *Taken From Previous AF IA – No Aligned State Released Problems* |
| **Assessment** |
| **Exit Ticket:**1. A parallelogram has an area of 48 square millimeters. Jorge applied a scale factor of 1/4 to produce a new parallelogram. What is the area of the new parallelogram?
2. The area of triangle A is 20 square inches. The area of triangle B is 5 square inches. What scale factor was applied to triangle A to create triangle B?

**Student Work:** 1. Scaled area = (scale factor)2 x original area

n = (¼)2 x 48n = (1/16)48n = 3 square millimeters1. Scaled area = (scale factor)2 x original area

20 = (scale factor)2 x 54 = r2r = 2 |
| **Connection to learning And Conceptual Understanding** |
| * How does this lesson connect to previous lessons?
	+ In the previous lesson, students determined the area of scaled figures by determining the scale factor that exists between two figures and finding the corresponding measurements to apply an area formula. Students come to the conclusion that a scale factor cannot multiply an area to get a scaled area like you can with side lengths. In this lesson, students determine that they can multiply the area by the scale factor squared in order to find the scaled area and use this to determine scaled areas and scale factors given two areas of scaled figures.
* 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: Students understand that the scaled area of a figure can be determined by multiplying the original area by the squared scale factor because area has two dimensions, so you are applying the scale factor twice.
	+ Do: Students determine the scaled area by applying the squared scale factor. Students determine the scale factor given two areas of scaled figures.
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| **How** |
| * Key Strategy
	+ Write out the equation Scaled = Original x c2
	+ Substitute known information
	+ Solve for the unknown value
	+ Check using the scale factor
* CFS for top quality work
	+ Scaled area formula is written
	+ Work is shown to evaluate for the unknown value
	+ Work is checked using the scale factor
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| **Anticipated Misconceptions and Errors** |
| * Students might try to directly apply the scale factor to the area of the original figure.
* Students might multiply by 2 instead of squaring the scale factor
* Students might not square fractional values of scale factors.
* When solving for a scale factor given two areas, students might leave the scale factor as the squared term.
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| **Key Vocabulary** |
| * **Constant of Proportionality:** the constant value of the ratio of two proportional quantities x and y; usually written y = mx or y = cx, where m and c are the constant of proportionality
* **Scale drawing**: A magnified or reduced drawing of an object that is similar to the actual object.
* **Scale factor**: The ratio that compares a length in a drawing corresponding to the length in another magnified or reduced drawing.
* **Ratio**: A comparison of two quantities by division.
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| **Materials** |
| * Handout
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| **Opening – Prompt for work time, Circulate, Debrief, Synthesis, & Frame – 12-15 min** |
| **THINK ABOUT IT!** The table below shows an original figure and its area, a scale factor, and the scaled figure. Determine the area of the scaled figures. What relationship do you see that exists between the scaled areas and the original areas?  |
| **Prompt for Work Time (<30 sec)***T sets timing for work and sets work expectations.* **Circulate (≤ 5 min)**While circulating, collect data on the following:

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| **Scholar thinking (correct and erroneous)** | **Scholar Initials - Work to show call** |
| S correctly finds the areas of the scaled figures |  |
| S says that the relationship between the areas is a factor of r2 (or r x r) |  |
| S incorrectly says that the relationship is 2r (only applying the first row) |  |
| S says that a relationship does not exist |  |

**Debrief (≤ 8-10 min)****Fencepost 1:**  *The scale factor cannot be directly applied to the area of scaled figures*Show Call: S work correctly finds the area of the first two scaled figures**Do you agree with this scholar’s work? Vote. CC.** SMS: I agree because they used the area formula on the scaled figure and determined the area correctly by substituting and evaluating.**Can the scale factor be applied to find the scaled area? CC.** SMS: Our previous conjecture said that we cannot use the scale factor and this holds true. For example, with the rectangle the original area is 8 but the scaled area is 32 which is not twice the original area. **Name the fencepost: Recap our previous conjecture.** SMS: The scale factor cannot be directly applied to the area of the scaled figures. **Conjecture:** *The area of a scaled figure is the original area multiplied by the scale factor squared*Show Call: S work has correct areas for the first two figures and an area of 60c2 or 60 x c x c. ***[Planner’s Note – S might not come up with the correct area of the third figure. This can be used as a demonstrated visual proof for scholars once they have named the relationship.*]****What is the relationship between the area of the original and scaled rectangle? CC.** SMS: The scaled rectangle has an area that is 4 times as large as the original area.**What is the relationship between the area of the original triangle and scaled triangle? CC.** SMS: The scaled triangle is 9 times as large as the original area.**What relationship do you see between the scale factor and the areas of the figure?** **TT. CC. Discuss.** SMS: The area of the scaled rectangle is 4 times the original and the scale factor was 2. The area of the scaled triangle was 9 times the original and the scale factor was 3. The area of the scaled figured can be determined by multiplying the scale factor by itself, or squaring it, and multiplying the original area by it.**Key Learning Synthesis (≤ 2 min)****CONJECTURE**:*The area of a scaled figure is the original area multiplied by the scale factor squared*Yesterday we said that the scale factor does not directly apply to area of figures yet we have found a relationship here.**Let’s form our conjecture for today. With your partner, come up with a conjecture about determining the area of scaled figures.** ***[Planner’s Note – Teacher should take the conjecture and express it as an equation in the form of scaled area = original area x r2]*****Frame (≤ 30 sec) –**You have just formed our Conjecture for today. While the previous conjecture holds true that the scale factor does not directly apply to the area, we can apply the scale factor squared to solve problems involving area of scaled figures. Like we saw with the last figure, the scale factor is applied to all dimensions of a figure. When the area is found, two of the dimensions are multiplied together to find the area which means that the scale factor is also multiplied by itself which creates the relationship of r2. |

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| **Test the Conjecture – 10 min** |
| **Post the Conjecture in visible place for student reference:** *The area of a scaled figure is the original area multiplied by the scale factor squared*Let’s go ahead and test our conjecture to make sure that it is a true statement all the time! **What will we be able to do if our conjecture is true? TT. CC.**  We will be able to determine the areas of scaled figures by multiplying the original area by the squared scale factor.**TEST THE CONJECTURE #1****A rectangle has an area of 54 square units. A scale factor of 1/3 is applied to the rectangle to create a scaled figure. What is the area of the scaled figure?*** 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 find the area of the scaled figure.
* **How can we apply our conjecture to solve the problem? CC.** SMS: We can multiply the original area by the squared scale factor to determine the scaled area.
* **What equation can we write? CC.** SMS: We can write Scaled Area = Original Area x c2.
* **What is our next step? CC.** SMS: We should substitute the known values into the equation. Since we don’t know the scaled area we can write Scaled Area = 54 (1/3)2
* **How can we simplify? CC.** SMS: With order of operations we need to apply the exponent first. (1/3)2 is the same as (1/3)(1/3) which is 1/9 so we can write Scaled Area = 54(1/9).
* Independently finish evaluating. **What is the scaled area? Call it!** SMS: 6 units squared!
* **How can we prove that our conjecture worked? CC.** SMS: We can apply the scale factor to the side lengths to produce a scaled figure and use the area equation of a=lxw to test that the area is 6.
* With your partner, label the dimensions and determine the area. Show Call exemplar. **Do you agree with this work? CC.** SMS: Yes I agree with this work. The student applied the scale factor to the side lengths and got the same area.
* **So far, does our conjecture hold up? Vote. CC.** SMS: Yes our conjecture holds up. We were able to find the correct area by multiplying the original area by the scale factor squared.

**TEST THE CONJECTURE #2****Figure A has an area of 6 square units. Figure B was created by scaling Figure A and it has an area of 96 square units. What was the scale factor that was applied to Figure A to create Figure B?*** 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 find the scale factor that was applied to go from Figure A to Figure B.
* **What is different about this problem? CC.** SMS: We are given two areas and are asked to determine the scale factor.
* **How can we apply our conjecture to solve the problem? CC.** SMS: We can use the equation Scaled Area = Original Area x r2 to substitute the original area and the scaled area and solve for the scale factor.
* Independently set up your equation. Show Call Exemplar.
* **How do I isolate the variable? CC.** SMS: In the equation 96 = 6c2, we have to use inverse operations to eliminate the 6 so we should divide both sides by 6.
* Independently complete this step.
* **How can we determine the scale factor? CC.** SMS: We are left with 16 = c2 so we have to think of a number that when multiplied by itself will give us 16. 4x4 is 16 so the scale factor is 4.
* **How can we prove that our conjecture worked?** **CC.** SMS: We could apply the scale factor to the side lengths of Figure A to determine the side lengths of Figure B and check that the area is equivalent.
* Independently determine the side lengths given the scale factor we found and test the area.Show Call exemplar. **Do you agree with this work? CC.** SMS: Yes I agree with this work because s/he correctly applied the scale factor to the side lengths of Figure A and got the correct side lengths of Figure B.
* **So far, does our conjecture hold up? Vote. CC.** SMS: Yes our conjecture holds up. The area of the second figure was found by multiplying the first figure by the scale factor squared.

**Stamp the Learning*** Point to the written conjecture. **Did our conjecture hold up against the two problems we just did? How do you know?** **TT. CC**. Yes our conjecture holds up. We were able to find the correct area by multiplying the original area by the scale factor squared.

**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. I’m also leaving up the exemplar work for the second TTC example we completed for your reference. CFS for top quality work* + Scaled area formula is written
	+ Work is shown to evaluate for the unknown value
	+ Work is checked using the scale factor
 |

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**CFS for top quality work**

* + Scaled area **formula is written**
	+ Work is shown to **evaluate** for the unknown value
	+ Work is checked using the scale factor

Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

UNIT 5 LESSON 15

**AIM**: SWBAT determine areas of scaled figures

**THINK ABOUT IT!**

The table below shows an original figure and its area, a scale factor, and the scaled figure. Determine the area of the scaled figures. What relationship do you see that exists between the scaled areas and the original areas?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Original Figure | Original Area | Scale Factor | Scaled Figure | Scaled Area |
|  | $$a=l×w$$$$a=4 ×2$$$$a=8in^{2}$$ | 2 |  |  |
|  | $$a=\frac{1}{2}b×h$$$$a=\frac{1}{2}(2)(3)$$$$a=\frac{1}{2}(6)$$$$a=3m^{2}$$ | 3 |  |  |
|  | $$a=b×h$$$$a=10 ×6$$$$a=60cm^{2}$$ | c | 10c6c |  |

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Test the Conjecture 1) A rectangle has an area of 54 square units. A scale factor of $\frac{1}{3}$ is applied to the rectangle to create a scaled figure. What is the area of the scaled figure?

**CFS for top quality work**

* + Scaled area **formula is written**
	+ Work is shown to **evaluate** for the unknown value
	+ Work is checked using the scale factor

 9 units

**54 Square Units**

6 units

**Area = ?**

Test the Conjecture 2) Figure A has an area of 6 square units. Figure B was created by scaling Figure A and it has an area of 96 square units. What was the scale factor that was applied to Figure A to create Figure B?

**CFS for top quality work**

* + Scaled area **formula is written**
	+ Work is shown to **evaluate** for the unknown value
	+ Work is checked using the scale factor

**96 units2**

**6 units2**

 4 units

 3 units

Conjecture

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| The area of a scaled figure is the original area \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ by the scale factor squared |

**PARTNER PRACTICE**

**CFS for top quality work**

* + Scaled area **formula is written**
	+ Work is shown to **evaluate** for the unknown value
	+ Work is checked using the scale factor

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| *Bachelor Level* |

1. The area of a rectangle is 20 square feet. If a scale factor of 3 is applied to the rectangle to form a new rectangle, what will be its area?
2. 60 square feet
3. 120 square feet
4. 180 square feet
5. 40 square feet
6. A square has an area of 10 square millimeters. If a scale factor of 3 is applied to the square, what is the area of the new square that is formed?
7. Solve the problem below



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| *Master Level* |

1. On the blueprint for Joey’s new house, his floor measures 9 square feet. The actual house will have an area of 1,296 square feet. What scale factor must be applied to create the house from the blueprint?

**INDEPENDENT PRACTICE**

**CFS for top quality work**

* + Scaled area **formula is written**
	+ Work is shown to **evaluate** for the unknown value
	+ Work is checked using the scale factor

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| *Bachelor Level* |

1. Which equation could be used to determine the area of new figure when a scale factor of 4 is applied?
	1. y = 4x
	2. y = ¼ x
	3. y = 16x
	4. y = $\frac{1}{16}x $
2. A rectangle has an area of 28 square inches. After a scale factor of $\frac{1}{2}$ is applied, what is the area of the new shape?
3. Solve the problem below:



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| *Master Level* |

1. A toy racecar has a roof with an area of 20 square mm. The real car has a roof with an area of 2,420 square mm. What scale factor was applied to the model to create the car?
2. A square has a side of $y$ inches. By applying a scale factor of 5, a new square is formed. Write an expression to represent the area of the new square.

1. The third floor of the White House in Washington, D.C. has an area of 507 square feet. A model of the White House has an area of 432 square inches. What scale factor was applied to the actual White House to create the model?

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| *PhD Level* |

1. A drawing of a room shows the floor is 2” by 3”. For the actual room, a scale factor of 100 is applied. Family is tiling the room with 8” by 4” tiles. How many tiles should they buy?

**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. A parallelogram has an area of 48 square millimeters. Jorge applied a scale factor of $\frac{1}{4}$ to produce a new parallelogram. What is the area of the new parallelogram?

**CFS for top quality work**

* + Scaled area **formula is written**
	+ Work is shown to **evaluate** for the unknown value
	+ Work is checked using the scale factor
1. The area of triangle A is 20 square inches. The area of triangle B is 5 square inches. What scale factor was applied to triangle A to create triangle B?

**CFS for top quality work**

* + Scaled area **formula is written**
	+ Work is shown to **evaluate** for the unknown value
	+ Work is checked using the scale factor