**Grade 7 | Unit 5, Lesson 13**

**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: Exercise Based Lesson** |
| **Aim** |
| * Given the scale factor, SWBAT determine the unknown length in a drawing or map by using an equation in the form of y = cx or a proportion * SWBAT determine the scale factor, given actual and scaled measurements by using an equation in the form of y = cx or a proportion |
| **Key Point** |
| * We can use proportions and equations to solve scale drawing problems |
| **Standard** |
| 7.G.1  Solve 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.  7.RP.2  Recognize and represent proportional relationships between quantities. |
| **State Test Alignment** |
| *Taken From SmarterBalance Released Items 2016 – Note to teacher, this item does not directly align to this lesson. The problem would have to give the side lengths of all sides and ask if one triangle was a scale drawing of the other and why?* |
| **Assessment** |
| **Exit Ticket:**   * + 1. A Cadillac Escalade is 16 ft. long. The engineers are trying to create a model by using a scale of 1 inch of the model corresponds to 4 feet on the actual car. Select all of the statements below that are true.   a. The model is 4 times smaller than the actual car  b. The actual car is 4 times smaller than the model  c. The model will be 64 inches long  d. The model will be 4 inches long   * + 1. The distance from Town A to Town B on a map is 3 inches. The actual distance from Town A to Town B is 8 miles. Write an equation and use it to determine the actual distance from Town A to Town C if the distance on the map is 5 inches.   **Student Work:**  a & d   1. Output = c(Input)   Input = inches  8 miles = c(3 inches)  c = 8miles/3inches  y = 8/3x  y = 8/3(5) = 40/3 = 13 1/3 miles |
| **Connection to learning And Conceptual Understanding** |
| * How does this lesson connect to previous lessons?   + In the previous lesson, students learned about scale drawings and that two scaled figures have proportional side lengths. In this lesson, students apply proportional reasoning to determine a missing length given a scale factor or given a context in which the scale factor can be determined. Students use two different methods for solving; writing and solving proportions, and writing a proportional equation in the form of y=cx where y is the output, x is the input, and c is the CoP and students have to determine given the context what they are solving for. * 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 scale drawings are proportions that can be solved using proportions and proportional equations. Students understand that if given a measurement and are required to find a corresponding length, the given measurement is the input and the corresponding unknown length is the output when setting up and solving an equation.   + Do: Students setup and solve proportions given a scale factor and a missing length. Students write and solve equations in the form of y=cx where y is the output, x is the input, and c is the CoP. |
| **How** |
| * Key Strategy   + Annotate the problem for scale factor   + Identify the missing length as the output   + Setup a proportion or equation   + Solve for the missing length      * CFS for top quality work   + Problem is annotated for scale, unknown length, input, and output   + Proportion or equations is written and solved. |
| **Anticipated Misconceptions and Errors** |
| * Students might not correctly identify the scale given a drawing or context * Students might incorrectly setup a proportion with non-corresponding lengths * Students might write an equation and mix up the input and output (e.g. In ET #2 problem, students could write the equation y=3/8x and still correctly solve if they substitute 5 in for y but might instead substitute 5 in for x thinking it is the input). |
| **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. |
| **Materials** |
| * Handout * Calculator suggested to assist with computation |

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| **Opening – Prompt for work time, Circulate, Debrief, Synthesis, & Frame – 12-15 min** |
| **THINK ABOUT IT!**  On a map of the city, 2 inch represents 1 mile. Michelle is trying to plan out her trip from downtown to uptown. On the map, the distance is 16 inches. What is the actual distance that Michelle will travel from downtown to uptown? Solve for the distance in as many ways as you can. |
| **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:   |  |  | | --- | --- | | **Scholar thinking (correct and erroneous)** | **Scholar Initials - Work to show call** | | S sets up a proportion of 2in:1mi = 16in:x and solves for the distance |  | | S writes an equation y=1/2x and substitutes 16 in for x |  | | S writes an equation y = 2x and substitutes 16 in for y |  | | S writes an equation y = 2x and incorrectly substitutes 16 in for x |  |   **Debrief (≤ 8-10 min)**  **Fencepost 1:**  *Proportions can be used to solve scale drawing problems*  Show Call: S sets up and correctly solves the proportion  **What type of problem is this? CC.** SMS: This is a scale drawing problem because there is a given scale and we are asked to find a missing length  **Do you agree with this scholar’s work? Vote. CC.** SMS: I agree because the scholar set up a proportion of 2 inches for every mile and set that equal to 16 inches for an unknown number of miles and solved.  **How could we verify this is correct?** **CC.** SMS: We can make a table of values until we get to 16 inches. *Teacher should prep this for scholars to show that this method works for solving.*  **Name the fencepost: What is one way we can solve scale drawing problems? CC.** SMS: Proportions can be used to solve scale drawing problems.    **Fencepost 2:** *Proportional equations can written and solved for scale drawings*  Show Call: S work writes the equation y=1/2x and substitutes 16 in for x to solve – Or scholar divides 16 by 2 which can be used to question what equation could be used to solve.  **Do you agree with this scholar’s work? Vote. CC.** SMS: I agree because the scholar wrote an equation to solve for the missing length in the form of y=kx which is a proportional equation and ½ is k or the constant of proportionality.  **BPQ - What does ½ represent?** **CC.** SMS: ½ is the scale factor and represents that for every inch on the map, it is ½ mile in real life.  **What would you consider the input and output of this problem?** **TT. CC.** SMS: The input is the number of inches because we want to know the number of miles which is the output.  While some of us intuitively set up the equation correctly, there are many problems where this won’t be the case. **What is the given scale in terms of inputs and outputs? CC.** SMS: The input is 2 inches and that is equal to the output which is 1 mile.  **How can you apply this to the general equation of a proportional relationship? CC.** SMS: The general equation is y=cx where y is the output and x is the input and c is the CoP or scale factor so we can write 1=c2. Therefore c = ½ so the equation is y = ½x and we can substitute 16 in for x.  **BPQ – How can we use this to determine the scale factor?**  **BPQ – How does this help us set up an equation?**  ***[Planner’s Note: while you may have to use a few BPQs and name some of these pieces for students, they need to be clear what the input, output, and COP are in the context of scale drawing questions.***  **Name the fencepost:** **What else can we say about solving scale drawings?** SMS: Proportional equations can be written and solved for scale drawings  **Key Learning Synthesis (≤ 2 min)**  **KEYPOINT**:*We can use proportions and equations to solve scale drawing problems*  **Let’s form our key point for today. With your partner, come up with a key point about solving scale drawing problems.**  **Frame (≤ 30 sec) –**  You have just formed our Key Point for today. Yesterday, we verified that two figures were scaled figures by comparing the ratio of their corresponding sides. Today we are using the idea of proportionality to solve for missing lengths given a scale drawing. |
| **Interaction with New Material – 10 min** |
| **Post the Key Point in visible place for student reference:** *We can use proportions and equations to solve scale drawing problemS.*  Let’s use our key point from the TAI and apply it to solve an advanced problem!  **Ex. 1) At the Chicago museum of science, there is an exhibit that shows a scale model of Chicago with trains running through the city. The scale on the model says that every 3 inches on the model is equal to 8 feet in real life. One car of an “L” train in real-life is 36 feet long. What will be the length of the model of an “L” train if the train has 5 cars that are connected?**  **Understand**  T directs all Ss to read the prompt without making annotation.  **Without using numbers, describe what is happening in this problem. CC.** SMS: We are using a scale model to determine the length of a model train.  T directs all Ss to read the prompt a second time and annotate for meaning.  **What is our goal? CC.** SMS: Our goal is to figure out the entire length of a model L train.  **What information is known? CC.** SMS: We know that the scale is 3in = 8 feet and that one car of an “L” train 36 feet in real-life. We also know that the model has 5 cars connected together.  **What information is unknown? CC.** SMS: We don’t know the length of one of the model train cars  **How can we model this problem? CC.** SMS: We can set up a proportion or write an equation.  **What do we need to know? CC.** SMS: We need to know the length of one model car, and then the length of 5 model cars.  **Plan**  Based on our understanding of the problem, come up with a plan to solve this problem. **TT. CC.**  Write a proportion or equation with the given information  Solve for the length of one train car (model)  Find the length of five cars  **Estimate/Predict**  **Approximately how long could you estimate one car to be? CC.** SMS: Since 8 goes into 36 about 5 times, we could multiply 3 by 5 to get an approximate length of 15 inches for one car.  **Solve**  We will use your plan to solve the problem starting with an equation**. What are the inputs and outputs of this problem? CC.** SMS: The input in this problem is the number of feet in real-life and the output is the number of inches on the model.  **How is this different from the TAI problem? CC.** SMS: In the TAI, the output was actual distance because this was the unknown quantity that we needed to figure out. In this problem, the unknown quantity is the length of the model so it is the output for this problem.  **How can we use this to write an equation?** SMS: The proportional equation is y=cx so we can substitute the given scale into the equation to determine the scale factor and complete the equation.  With your partner, determine the scale factor and write an equation. *Teacher can walk scholars through this problem if they are struggling with the concept.*  Show Call Exemplar – **Do you agree with this equation? Vote. CC.** SMS: I agree because the input is 8feet and the output is 3 inches so the scale factor is 3/8 and the equation is y=3/8x where 3/8 is the constant of proportionality.  **How do we use our equation to solve? CC.** SMS: Because the output will give use the length of the model train, we can input 36 into the equation for x and evaluate.  Individually evaluate the equation. Show call exemplar.  **What does 13 ½ represent? CC.** SMS: This is the length of one of the train cars so we have to multiply it by 5 to get the total length of the model train which is 67½ inches.  **Check**  **Is our final answer reasonable?** SMS: Yes because we estimated that the length of one of the train cars would be 15 inches and our actual answer was 13 ½.  **Key Learning Synthesis**  **How did we apply our key point for today to solve this example problem? TT. CC.** SMS: We created both a proportion and an equation to help us solve this scale factor problem.  **Frame for PP/IP**  You will have 5 minutes to work with a partner on PP. Today during PP and IP, make sure your work meets each of the following  CFS   * + Problem is annotated for scale, unknown length, input, and output   + Proportion or equations is written   + Proportion or equation is solved for the missing length     ***[Planner’s Note: Review IP#3 which has students calculate the scale factor given the scale and actual values- this is the 3rd variation that Ss will see.]*** |

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

**CFS for top quality work**

* + Problem is annotated for **scale**, **unknown length**, **input**, and **output**
  + Proportion or equation is written
  + Proportion or equation is solved for the missing length

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

UNIT 5 LESSON 13

**AIM**: SWBAT determine missing lengths of scale drawings.

**THINK ABOUT IT!**

On a map of the city, 2 inches represents 1 mile. Michelle is trying to plan out her trip from downtown to uptown. On the map, the distance is 16 inches. What is the actual distance that Michelle will travel from downtown to uptown? Solve for the distance in as many ways as you can.

Key Point

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| We can use \_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to solve scale drawing problems |

**Interaction with New Material**

Ex.1) At the Chicago museum of science, there is an exhibit that shows a scale model of Chicago with trains running through the city. The scale on model says that every 3 inches on the model is equal to 8 feet in real life. One car of an “L” train in real-life is 36 feet long. What will be the length of the model of an “L” train if the train has 5 cars that are connected?

**CFS for top quality work**

* + Problem is annotated for **scale**, **unknown length**, **input**, and **output**
  + Proportion or equation is written
  + Proportion or equation is solved for the missing length

**PARTNER PRACTICE**

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| *Bachelor Level* |

1. On a map of the northeast United States, the map scale says that 1 centimeters = 5 miles. The distance shown on the map between New York City and Rochester is 5 cm. What is the actual distance?

**CFS for top quality work**

* + Problem is annotated for **scale**, **unknown length**, **input**, and **output**
  + Proportion or equation is written
  + Proportion or equation is solved for the missing length
  1. 520 miles
  2. 502 miles
  3. 250 miles
  4. 205 miles
  5. 10 miles

1. The distance between San Diego, CA and NYC is 3,200 miles. If a United States map has a scale that says 1 inch = 400 miles, how many inches apart will San Diego and NYC be on the map?

**CFS for top quality work**

* + Problem is annotated for **scale**, **unknown length**, **input**, and **output**
  + Proportion or equation is written
  + Proportion or equation is solved for the missing length

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| *Master Level* |

1. On a map of the northeast United States, the map scale says that 1 centimeters = 5 miles. The distance shown on the map between New York City and Buffalo is 5.8 cm. Read each statement below and determine whether it is “True” or “False.”

|  |  |  |
| --- | --- | --- |
| Statement | True | False |
| The actual distance is 5.8 times less than the distance on the map |  |  |
| The actual distance can be found by dividing 5 by 5.8 |  |  |
| The actual distance can be found by multiplying 5 by 5.8 |  |  |
| The actual distance is about 30 miles |  |  |

**CFS for top quality work**

* + Problem is annotated for **scale**, **unknown length**, **input**, and **output**
  + Proportion or equation is written
  + Proportion or equation is solved for the missing length

**INDEPENDENT PRACTICE**

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| *Bachelor Level* |

1. A map has a map scale that say “1 inch = 10 miles.” The distance between two cities on the map is 5 inches. Which proportion could you use to solve for the distance between the two cities, in miles?



1. What equation could you write to solve the problem in question 1? Solve your equation and the proportion you picked to verify they are equivalent methods of solving.

Equation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Work:

1. On a map, the distance between AFBMS and Burger King is ½ foot. If the actual distance is 200 feet, what scale factor was used to create the map?
   1. 100
   2. 400
   3. 16,000

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| *Master Level* |

1. On a map of Tennessee, the map scale is 5 cm = 85 miles. The town of Murfreesboro is 2 centimeters away from Nashville on the map. How far apart are the two cities in real life?
2. Miguel is thinking of taking a road trip from Tucson, AZ to the Grand Canyon. He will need to pass through Phoenix and Flagstaff to get to the Grand Canyon. The distance on the map shows it is 3 inches from Tucson to Phoenix and 2.5 inches from Phoenix to Flagstaff. From Flagstaff, it is another 1 ¼ inches to the Grand Canyon. How many miles will he drive if the scale on the map says that 1 inch = 32miles?
3. Miguel decided that he didn’t want to drive anymore so he instead bought a plane ticket. On the plane, it showed a map of the flight. The map said that they had 215 miles to go to complete the flight. The map showed the scale of 5 miles equal to 1 centimeter on the map. If the screen is 40 centimeters long, can Miguel see his destination on the screen?

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| *PhD Level* |

1. The distance between Mr. Friedline’s hometown and NYC is 24 centimeters on the road map. The map scale indicates that 5 cm represents 100 kilometers. If Mr. Friedline drives at an average speed of 80 kilometers per hour, how long will it take him to get home from NYC?

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

**CFS for top quality work**

* + Problem is annotated for **scale**, **unknown length**, **input**, and **output**
  + Proportion or equation is written
  + Proportion or equation is solved for the missing length

**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 Cadillac Escalade is 16 ft. long. The engineers are trying to create a model by using a scale of 1 inch of the model corresponds to 4 feet on the actual car. Select all of the statements below that are true.

a. The model is 4 times smaller than the actual car

b. The actual car is 4 times smaller than the model

c. The model will be 64 inches long

d. The model will be 4 inches long

2) The distance from Town A to Town B on a map is 3 inches. The actual distance from Town A to Town B is 8 miles. Write an equation and use it to determine the actual distance from Town A to Town C if the distance on the map is 5 inches.

Equation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Actual Distance: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_