Rubric: Candy Dilemma

Key APS Mathematics Performance Standards: Sixth Grade

- **Translates** hypotheses into formal and fluent fractional and decimal computations using appropriate mathematical terminology and processes.
- **Develops and tests** strategies for adding and subtracting fractions with like and unlike denominators.
- **Develops** and **tests** strategies for multiplying and dividing proper, improper, and mixed fractions.
- **Explains** that equations are symbolic representations of relationships, patterns, and functions.

Level	Understanding	Strategies, Reasoning, & Procedures	Communication
Novice	❖ **The student understands:** • That they need to find the original amount of candy in the box. • The fractions ¼ and ½, but does not represent them accurately in the problem. ❖ **The student *does not* understand:** • That the first fraction represents ¼ of the box of candy eaten, and that ½ represents ½ of ¾ of the box of candy eaten.	❖ The student has started the task using manipulatives/representations, but does not use an effective strategy to determine how much candy was eaten at each of the steps and cannot determine how many pieces of candy were in the box to begin with. ❖ The student cannot accurately represent the fractional portions of the candy eaten, because they do not understand that the whole (amount of candy) changes with each fractional representation. At the first step the fractional portion is ¼ of the entire box and at the second step the fractional portion is ½ of ¾ of the box. **Sample Strategy:** The student adds ¼ + ½ = ¾ (the amount of candy eaten). The student establishes that ¼ of the box is left, which equals 6 candies. S/he adds 6 + 6 + 6 + 6 = 24. There are 24 candies in the box.	❖ There is little or no communication, the student did not label the work, and/or their thinking is difficult to follow. ❖ **Summary:** The student cannot write his/her final answer, and/or uses little or no math language and symbols to explain (in writing) how s/he determined how much candy was eaten at each point and the total number of candies that were in the box. ❖ **Representations:** The student has no system (charts/t-tables/graphs) to track the fractional parts of the candy eaten at each point, and cannot determine how much candy was in the box when it was purchased.
Apprentice	❖ **The student understands:** • That they need to find the total amount of candy in the box. • The fractions ¼ and ½, and can graphically represent them in the problem. • That ¼ of the box was eaten and then ½ of the box was eaten, but cannot accurately demonstrate how many pieces of candy that represents from the box. ❖ **The student *may not* understand:** • That the first fraction represents ¼ of the box of candy eaten, and that ½ represents ½ of ¾ of the box of candy eaten.	❖ The student has started the task using fraction manipulatives/representations, has chosen a strategy to solve the task, but does not achieve a correct solution. ❖ The student represents the fractional portions of the candy eaten, and can graphically represent that ¼ of the box of candy was eaten and then ½ of ¾ of the box of candy was eaten. However the student cannot determine how many pieces of candy that represents from the box, and cannot accurately determine how much candy was in the original box. **Sample Strategy:** The student works backwards. 6 ÷ ½ = 6 x 2 = 12. ¼ of 12 = 3, 12 + 3 = 15. There are 15 candies in the box.	❖ The student has communicated his/her understanding of the task by labeling their work, but the task is not clearly organized and the student's thinking is hard to follow. ❖ **Summary:** The student states his/her final answer and uses some math language and symbols to explain (in writing) how s/he determined how much candy was eaten at each point and the total number of candies that were in the box. **Representations:** The student can represent the given fraction for the amount of candy eaten, using manipulatives/drawings, but has not establish an accurate system (charts/t-tables/graphs) to track the fractional parts of the candy eaten at each point. S/he cannot determine how much candy was in the box when it was purchased.

Practitioner	**Proficiency** ❖ **The student understands:** • That they need to find the original amount of candy in the box. • The fractions ¼ and ½, and can graphically represent them in the problem. • That ¼ of the entire box was eaten, then ½ of ¾ of the box was eaten, and then can accurately demonstrate how many pieces of candy that represents from the box. • How to calculate the total number of pieces of candy in the box.	**Proficiency** ❖ The student must have a correct solution and demonstrate one strategy that will determine how much candy was originally in the box, using fraction manipulatives/representations. ❖ The student represents the fractional portions of the candy eaten, and can graphically represent that ¼ of the box of candy was eaten and then ½ of ¾ of the box of candy was eaten. The student can determine how many pieces of candy that represents from the box and can accurately determine how much candy was in the original box. **Sample Strategy:** The student works backwards. **Step 1:** 6 ÷ ½ = 6 x 2 = 12. So ¾ of the box of candy is 12 pieces. **Step 2:** Each of the 3 quarters holds 4 pieces of candy. So the fourth quarter also holds 4 candies. **Step 3:** 4 + 4 + 4 + 4 = 16 total pieces of candy in the box.	**Proficiency** ❖ The student can represent his/her work in a clear, organized manner. ❖ **Summary:** The student states his/her final answer and uses appropriate math language and symbols to explain (in writing) how s/he determined how much candy was eaten at each point and the total number of candies that were in the box. **Representations:** The student can represent the given fraction and the amount of candy eaten, using manipulatives/drawings, and has established an accurate system (charts/t-tables/graphs) to track the fractional parts of the candy eaten at each point. S/he can determine how much candy was in the box when it was purchased.
Expert	❖ **The student understands:** • That they need to find the original amount of candy in the box. • The fractions ¼ and ½, and can graphically represent them in the problem. • That ¼ of the entire box was eaten, then ½ of ¾ of the box was eaten, and then can accurately demonstrate how many pieces of candy that represents from the box. • How to calculate the total number of pieces of candy in the box. **Task Extension:** The student includes a rule, equation, generalization, and/or observation (in writing) about their understanding of fractions, ratios (part-whole & part-part), and algebraic reasoning.	❖ The student must have a correct solution and demonstrate more than one strategy that will determine how much candy was originally in the box, using fraction manipulatives/representations. ❖ The student represents the fractional portions of the candy eaten, and can graphically represent that ¼ of the box of candy was eaten and then ½ of ¾ of the box of candy was eaten. The student can determine how many pieces of candy that represents from the box and can accurately determine how much candy was in the original box. **Sample Strategy:** Students will use proportions to solve the problem. Step 1: 6 candies = ½ x ¾ = 3/8 Step 2: The whole box is 8/8, so 3/8 = 6/*x* 3*x* = 48 48÷3 = 16 There were 16 pieces of candy in the box. **Task Extension:** It is easy to assume that there are 24 pieces of candy in the box because ½ + ¼ = ¾, so the last ¼ leaves 6 pieces of candy. However, the 6 candies represent ½ of ¾ of the box of candy which is 3/8. 3/8 represents 6 pieces of candy, so 1/8 represents 2 pieces of candy. 8 x 2 = 16.	❖ The student can represent his/her work in a clear, organized manner. ❖ **Summary:** The student states his/her final answer and uses appropriate math language and symbols to explain (in writing) how s/he determined how much candy was eaten at each point and the total number of candies that were in the box. **Representations:** The student can represent the given fraction and the amount of candy eaten, using manipulatives/drawings, and has established an accurate system (charts/t-tables/graphs) to track the fractional parts of the candy eaten at each point. S/he can determine how much candy was in the box when it was purchased. **Task Extension:** The student includes a rule, equation, generalization, and/or observation (in writing) about their understanding of fractions, ratios (part-whole & part-part), and algebraic reasoning.

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Key APS Mathematics Performance Standards: Seventh Grade

- **Explains** the relationship that can be expressed as ratios of part-to-whole (e.g., 5 red apples out of a total of 8 apples, expressed as 5/8).
- **Explains** the relationship that can be expressed as part-to-part (e.g., 5 red apples, 3 green apples, expressed as 5/3).
- **Translates** hypotheses into formal methods of solving algebraic equations.

Key APS Mathematics Performance Standards: Eighth Grade

- **Shows** flexibility using multiple number representations; **identifies** relationships involving the subsets of the real number system (e.g., order, least to greatest: 1, $\sqrt{2}$, $\sqrt{3}$, 2).
- **Manipulates** all real numbers, their properties, and operations.
- **Develops and evaluates** arguments involving real numbers, their patterns and operations.
- **Develops and tests** strategies for solving multi-step equations.

Level	Understanding	Strategies, Reasoning, & Procedures	Communication
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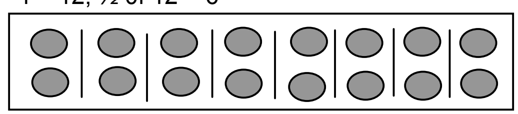
Apprentice	❖ **The student understands:** • That they need to find the total amount of candy in the box. • The fractions ¼ and ½, and can graphically represent them in the problem. • That ¼ of the box was eaten and then ½ of the box was eaten, but cannot accurately demonstrate how many pieces of candy that represents from the box. ❖ **The student *may not* understand:** • That the first fraction represents ¼ of the box of candy eaten, and that ½ represents ½ of ¾ of the box of candy eaten.	❖ The student has started the task using fraction manipulatives/representations, has chosen a strategy to solve the task, but does not achieve a correct solution. ❖ The student represents the fractional portions of the candy eaten, and can graphically represent that ¼ of the box of candy was eaten and then ½ of ¾ of the box of candy was eaten. However the student cannot determine how many pieces of candy that represents from the box, and cannot accurately determine how much candy was in the original box. **Sample Strategy:** The student works backwards. 6 ÷ ½ = 6 x 2 = 12. ¼ of 12 = 3, 12 + 3 = 15. There are 15 candies in the box.	❖ The student has communicated his/her understanding of the task by labeling their work, but the task is not clearly organized and the student's thinking is hard to follow. ❖ **Summary:** The student states his/her final answer and uses some math language and symbols to explain (in writing) how s/he determined how much candy was eaten at each point and the total number of candies that were in the box. **Representations:** The student can represent the given fraction for the amount of candy eaten, using manipulatives/drawings, but has not establish an accurate system (charts/t-tables/graphs) to track the fractional parts of the candy eaten at each point. S/he cannot determine how much candy was in the box when it was purchased.
Practitioner	**Proficiency** ❖ **The student understands:** • That they need to find the original amount of candy in the box. • The fractions ¼ and ½, and can graphically represent them in the problem. • That ¼ of the entire box was eaten, then ½ of ¾ of the box was eaten, and then can accurately demonstrate how many pieces of candy that represents from the box. • How to calculate the total number of pieces of candy in the box.	**Proficiency** ❖ The student must have a correct solution and demonstrate one strategy that will determine how much candy was originally in the box, using fraction manipulatives/representations. ❖ The student represents the fractional portions of the candy eaten, and can graphically represent that ¼ of the box of candy was eaten and then ½ of ¾ of the box of candy was eaten. The student can determine how many pieces of candy that represents from the box and can accurately determine how much candy was in the original box. **Sample Strategy:** The student solves the problem algebraically. **Step 1:** ¼ of the candy was eaten (¼c), so ¾ of the box was left. **Step 2:** ½ of the remaining candy (¾) was eaten, so ½ x ¾ = 3/8 of the box remained, which leaves 6 pieces of candy. **Step 3:** If 3/8 = 6 candies, then 1/8 = 2 candies (6 ÷ 3 = 2). The entire box represents 8/8. So 2 candies in each of the 8 sections = 16 total candies.	**Proficiency** ❖ The student can represent his/her work in a clear, organized manner. ❖ **Summary:** The student states his/her final answer and uses appropriate math language and symbols to explain (in writing) how s/he determined how much candy was eaten at each point and the total number of candies that were in the box. **Representations:** The student can represent the given fraction and the amount of candy eaten, using manipulatives/drawings, and has established an accurate system (charts/t-tables/graphs) to track the fractional parts of the candy eaten at each point. S/he can determine how much candy was in the box when it was purchased.

Expert	❖ **The student understands:** • That they need to find the original amount of candy in the box. • The fractions ¼ and ½, and can graphically represent them in the problem. • That ¼ of the entire box was eaten, then ½ of ¾ of the box was eaten, and then can accurately demonstrate how many pieces of candy that represents from the box. • How to calculate the total number of pieces of candy in the box. **Task Extension:** The student includes a rule, equation, generalization, and/or observation (verbal or written) about their understanding of fractions, ratios (part-whole & part-part), and algebraic reasoning.	❖ The student must have a correct solution and demonstrate more than one strategy that will determine how much candy was originally in the box, using fraction manipulatives/representations. ❖ The student represents the fractional portions of the candy eaten, and can graphically represent that ¼ of the box of candy was eaten and then ½ of ¾ of the box of candy was eaten. The student can determine how many pieces of candy that represents from the box and can accurately determine how much candy was in the original box. **Sample Strategy:** The student solves the problem algebraically **Step 1:** b = box of candy; ¼ b = first eating binge **Step 2:** 4/4 –1/4 = ¾ (what is left in the box) **Step 3:** ½ x 3/4b = 3/8b **Step 4:** 3/8b = 6; b = 16; There were originally 16 pieces of candy in the box. **Task Extension:** Once I knew that there were 16 pieces of candy in the box, it was easy to draw the box of candy and verify my answer. 2 pieces in each 1/8 portion. 2 x 8 = 16 OR ¼ of 16 = 4; 16 – 4 = 12; ½ 0f 12 = 6 	❖ The student can represent his/her work in a clear, organized manner. ❖ **Summary:** The student states his/her final answer and uses appropriate math language and symbols to explain (in writing) how s/he determined how much candy was eaten at each point and the total number of candies that were in the box. **Representations:** The student can represent the given fraction and the amount of candy eaten, using manipulatives/drawings, and has established an accurate system (charts/t-tables/graphs) to track the fractional parts of the candy eaten at each point. S/he can determine how much candy was in the box when it was purchased. **Task Extension:** The student includes a rule, equation, generalization, and/or observation (in writing) about their understanding of fractions, ratios (part-whole & part-part), and algebraic reasoning.