

Big Idea

SOLVE is a problem-solving paradigm that can be applied to support students in understanding and solving mathematical and real-world problems.

Vocabulary

S-Study the Problem, O-Organize the Facts, L-Line Up a Plan, addition, subtraction, multiplication, division, equals, together, add, plus, and, increase, incline, deposit, sum, total, rises, grow, above, take away, difference, minus, withdraw, write a check, decline, subtract, fewer, decrease, left over, “How much more?” below, times, product, each, of groups, items, per, double, triple, multiplied, quotient, per equal groups, cut into, divvy, split, is, divide, same, balanced, equivalent, V-Verify Your Plan with Action, E-Examine Your Results, measure, conversion, operations, fraction, mixed number, rules about how numbers work, equations, unknown, remainders, reasonableness, mental computation, estimation, rounding, place value, greater than (>), less than(<), equal to

Prior Learning

Standards for Mathematical Practice as applied to Grade 4 Content Standards (SMP 1, 2, 7 and 8)

Essential Questions

- Why is it important to have a problem-solving strategy?
- Why is it essential to understand the steps of solving a problem and not just give an answer?
- How can SOLVE be used to solve problems other than contextual or real-world situations?

Competencies

Apply SOLVE as a problem-solving paradigm to support integration of the Standards for Mathematical Practice throughout all Grade 5 Content Standards.

S: Underline the question.
This problem is asking me to find _____.

O: Identify the facts.
Eliminate the unnecessary facts.
List the necessary facts.

L: Write in words what your plan of action will be.
Choose an operation or operations.

V: Estimate your answer.
Carry out your plan.

E: Does your answer make sense? (Compare your answer to the question.)
Is your answer reasonable? (Compare your answer to the estimate.)
Is your answer accurate? (Check your work.)
Write your answer in a complete sentence.

SOLVE Modifications for ELL or ESL students:
(Example shown)

Jason has 345 model cars and 487 model trucks. How many model vehicles does he have in all?

S: TPIAMTF (this problem is asking me to find) – the **total vehicles**.
(The students cannot just restate the question if the response starts with “the.”)

O: Be as brief as possible and teach the students abbreviations right away (\$, #, lb., cm, pkg, etc..)

L: # of cars + # of trucks = total
 345 + 487 = 832

V: Estimate (use familiar strategies) then fill in blanks in the “L” step **About 800**

E: No modifications necessary

Misconceptions

- Students may attempt to solve word problems by computing with given values instead of reading and applying a step-by-step problem-solving paradigm.
- Students may think that SOLVE can only be used with real world problems.
- Students may not understand the importance of a problem-solving paradigm that can be used at any grade level and with any concept.

Resources from The Key Elements to Mathematics Success - KEMS Grade 5 for Building the Conceptual Understanding of this Module

LESSON 1 – SOLVE – S AND O

Additional Activities: Quiz – T18-T21
Foldable: “SOLVE” (5 flap foldable)

LESSON 2 – SOLVE – L
Additional Activities: Quiz – T41-43
Foldable: “SOLVE” (5 flap foldable)

LESSON 3 – SOLVE – V AND E
Additional Activities: Quiz – T68-69
Foldable: “SOLVE” (5 flap foldable)

Standards for Mathematical Practice	Examples:
1. Make sense of problems and persevere in solving them.	In grade 5, students solve problems by applying their understanding of operations with whole numbers, decimals, and fractions including mixed numbers. They solve problems related to volume and measurement conversions. Students seek the meaning of a problem and look for efficient ways to represent and solve it. They may check their thinking by asking themselves, “What is the most efficient way to solve the problem?”, “Does this make sense?”, and “Can I solve the problem in a different way?”
2. Reason abstractly and quantitatively.	In grade 5, student should recognize that a number represents a specific quantity. They connect quantities to written symbols and create a logical representation of the problem at hand, considering both the appropriate units involved and the meaning of quantities. They extend this understanding from whole numbers to their work with fractions and decimals. Students write simple expressions that record calculations with numbers and represent or round numbers using place value concepts.
3. Construct viable arguments and critique the reasoning of others.	In grade 5, students may construct arguments using concrete referents, such as objects, pictures, and drawings. They explain calculations based upon models and properties of operations and rules that generate patterns. They demonstrate and explain the relationship between volume and multiplication. They refine their mathematical communication skills as they participate in mathematical discussions involving questions like “How did you get that?” and “Why is that true?” They explain their thinking to others and respond to others’ thinking
4. Model with mathematics.	In grade 5, experiment with representing problem situations in multiple ways including numbers, words (mathematical language), drawing pictures, using objects, making a chart, list, or graph, creating equations, etc. Students need opportunities to connect the different representations and explain the connections. They should be able to use all of these representations as needed. Students should evaluate their results in the context of the situation and whether the results make sense. They also evaluate the utility of models to determine which models are most useful and efficient to solve problems.
5. Use appropriate tools strategically.	In grade 5, students consider the available tools (including estimation) when solving a mathematical problem and decide when certain tools might be helpful. For instance, they may use unit cubes to fill a rectangular prism and then use a ruler to measure the dimensions. They use graph paper to accurately create graphs and solve problems or make predictions from real world data.
6. Attend to precision.	In grade 5, students continue to refine their mathematical communication skills by using clear and precise language in their discussions with others and in their own reasoning. Students use appropriate terminology when referring to expressions, fractions, geometric figures, and coordinate grids. They are careful about specifying units of measure and state the meaning of the symbols they choose. For instance, when figuring out the volume of a rectangular prism they record their answers in cubic units.
7. Look for and make use of structure.	In grade 5, students look closely to discover a pattern or structure. For instance, students use properties of operations as strategies to add, subtract, multiply and divide with whole numbers, fractions, and decimals. They examine numerical patterns and relate them to a rule or a graphical representation.
8. Look for and express regularity in repeated reasoning.	In grade 5, students use repeated reasoning to understand algorithms and make generalizations about patterns. Students connect place value and their prior work with operations to understand algorithms to fluently multiply multi-digit numbers and perform all operations with decimals to hundredths. Students explore operations with fractions with visual models and begin to formulate generalizations.

Works Referenced in the Development of the Module	
Common Core State Standards Initiative www.corestandards.org	Ohio Department of Education http://education.ohio.gov/Topics/Learning-in-Ohio/Mathematics
Illustrative Mathematics Project https://illustrativemathematics.org/	North Carolina Math Tools for Teachers https://tools4ncteachers.com/
Mathematics Assessment Project https://www.map.mathshell.org/index.php	Smarter Balanced Assessment Consortium https://smarterbalanced.org/
PARCC http://parconline.org/	Utah Education Network https://www.uen.org/core/math/
NOYCE Foundation: https://www.insidemathematics.org/	
Other Strategies for using SOLVE problems	
<ul style="list-style-type: none"> • Pass Back Activity: This activity works if students are sitting in rows or it can be adapted to sitting in groups. Each row or group is given a SOLVE problem. The first student completes the S Step and then passes the paper back or to the next student. The second student checks the “S” Step and then marks it with their initials and completes the “O” Step. The SOLVE problem is then passed to the next person who checks and initials the “S” and “O” steps and completed the “L” step. This continues until the problem goes back to the first person who reviews all steps. Student groups can then share their responses as a whole group. • Have students work in groups of 4 or 5 and assign them one of the SOLVE problems to complete as a group. Students can then transfer answers to chart paper and present to the whole group for discussion and feedback. • Have a copy of one of the SOLVE problems at each table or group (5 groups). Have students complete the S Step and then pass the problem on to the next group when you give a signal. Students will continue this process until they get back their original problem. • SOLVE Gallery Walk: Post each SOLVE problem on a chart around the room. Have students work in 5 different groups, each group having a different color marker. Student groups can start at one poster and complete the “S” step. After a few minutes, have student groups move to the next poster, read the “S” step (noting any corrections as necessary with their marker), and then complete the “O” step. (Note: Each time a group moves to a new station they should read the steps that were completed by the previous group(s) and note any comments/corrections using their color marker. This helps to guide the discussion of any differences at the end of the activity.) After a few minutes, have students move to the next poster, read the “S” and “O” steps, and complete the “L” step. Continue with this procedure until student groups have returned to their original problem. Students can also present their problem to the whole group and guide the discussion about student responses. 	

Additional problems to use for SOLVE

1. Tyler wants to buy a new game system that costs \$240. Tyler has already saved \$32, but he needs to make a plan so he can save the rest of the money he needs. He decides to save the same amount of money, x dollars, each month for the next four months. Write an equation that helps Tyler determine the amount of money he must save each month. Solve the equation to find the amount of money he must save each month to meet his goal of buying a new game system. (4.OA.3)

2. Candace got to school at 8:25 AM. It took Candace 35 minutes to get to school. What time did she leave for school? (4.MD.2)

3. A circle measures 360° . If the circle were divided into 4 equal parts, what would be the angle measurement of each part? (4.MD.5a,b)

4. A dime is $\frac{1}{10}$ of a dollar, and a penny is $\frac{1}{100}$ of a dollar. What fraction of a dollar is 7 dimes and 4 pennies? Write your answer in both fraction and decimal form. (4.NF.6)

5. Levi and Jake are in swim class together. They challenged each other to see who could hold their breath underwater the longest. Levi and Jake's coach, Coach Foster, timed them with a stopwatch when they went underwater. Levi stayed underwater for $10\frac{1}{4}$ seconds, while Jake was able to stay under for 14 seconds. How much longer did Jake stay underwater than Levi? (4.NF.3c,d)

6. During the past week, Kammi ran 3 miles during practice for a track meet. How many feet did she run? (1 miles = 5,280 feet) (4.MD.2)

7. There were 387 people waiting in line to audition for a talent show. The people in line were divided into groups of 9. How many people were in each group? (4.OA.3)

8. Mrs. Landes gives her students a math challenge riddle every day. The following problem was given to her students on Tuesday.

“What’s My Name?”

- I am a number greater than 60 but less than 90.
- I am an odd number.
- I am a prime number.
- The sum of my digits is 8

What number is the answer to the math challenge riddle? (4.OA.4)

9. Shane and Tanisha are both saving money to buy a new video game. Shane has saved \$17.31, and Tanisha has saved \$17.97. Who has saved the most money? Write and compare the two decimals. (4.NF.7)

10. The fifth grade is going on a field trip. There are a total of 135 students and 15 adults going on the trip. If each bus carries 46 people, how many buses will they need for the trip? (4.OA.3)

11. The cafeteria buys oranges in crates with 100 oranges in each crate. The cafeteria manager needs to order 486 oranges for the week. How many crates of oranges does she need? Round 486 to the nearest hundred to determine the number of crates needed. (4.OA.3, 4.NBT.3)

12. Jenny’s mom is making costumes for the class play. Each costume needs $1\frac{3}{8}$ yards of red material and $2\frac{4}{8}$ yards of blue material. How many total yards of material are needed for each costume? (4.NF.3c,d)

13. At the store, a pound of bananas costs 68 cents. Alex’s mom buys 4 pounds of bananas. If she pays for the bananas with a \$10.00 bill, how much will the clerk give her in change? (4.MD.2)

14. Mr. Simpson is constructing a new garage. In order to have a large enough garage to fit his car, his lawn mower and all his tools it must have an area of 720 square feet. If the length of the garage is 40 feet, what is the perimeter of the garage?(4.MD.3)