

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, perimeter, length, width, compare, justify, equivalent, numerator, denominator, time, elapsed time, minutes, operations, unknown, strategies

Prior Learning

Standards for Mathematical Practice as applied to Grade 3 content standards (SMP 1, 2, 7 and 8)

Essential Questions

- Why is it important to have a problem solving strategy?
- What do the S and O in SOLVE represent?
- Why is it important to know that the problem is asking?
- Why is it important to organize the facts in a word problem?
- What does the L in SOLVE represent?
- Why is it important to write your plan in words before completing the math?
- Why is it important to determine the operation in the L Step?
- What do the V and E in SOLVE represent?
- Why is it important to estimate the answer?
- Why is it important to examine the results of your problem?
- 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 4 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 4
for Building the Conceptual Understanding of this Module**

LESSON 1 – SOLVE – S AND O

Additional Activities: Quiz – T19-T21

Foldable: “SOLVE” (5 flap foldable)

LESSON 2 – SOLVE – L

Additional Activities: Quiz –T44-T46

Foldable: “SOLVE” (5 flap foldable).

LESSON 3 – SOLVE – V AND E

Additional Activities: Quiz – T68-T70

Foldable: “SOLVE” (5 flap foldable)

Standards for Mathematical Practice	Examples:
1. Make sense of problems and persevere in solving them.	In grade 4, students know that doing mathematics involves solving problems and discussing how they solved them. Students explain to themselves the meaning of a problem and look for ways to solve it. Fourth graders may use concrete objects or pictures to help them conceptualize and solve problems. They may check their thinking by asking themselves, “Does this make sense?” They listen to the strategies of others and will try different approaches. They often will use another method to check their answers.
2. Reason abstractly and quantitatively.	In grade 4, students should recognize that a number represents a specific quantity. They connect the quantity 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 4, students may construct arguments using concrete referents such as objects, pictures, and drawings. They explain their thinking and make connections between models and equations. 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 4, students 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. Fourth graders should evaluate their results in the context of the situation and reflect on whether the results make sense.
5. Use appropriate tools strategically.	In grade 4, 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 graph paper or a number line to represent and compare decimals and protractors to measure angles. They use other measurement tools to understand the relative size of units within a system and express measurements given in larger units in terms of smaller units.
6. Attend to precision.	In grade 4, students develop their mathematical communication skills; they try to use clear and precise language in their discussions with others and in their own reasoning. They are careful about specifying units of measure and state the meaning of the symbols they choose. For instance, they use appropriate labels when creating a line plot.
7. Look for and make use of structure.	In grade 4, students look closely to discover a pattern or structure. For instance, students use properties of operations to explain calculations (partial products model). They relate representations of counting problems such as tree diagrams and arrays to the multiplication principle of counting. They generate number or shape patterns that follow a given rule.
8. Look for and express regularity in repeated reasoning.	In grade 4, students should notice repetitive actions in computation to make generalizations. Students use models to explain calculations and understand how algorithms work. They also use models to examine patterns and generate their own algorithms. For example, students use visual fraction models to write equivalent fractions.

Works Referenced in the Development of the Module

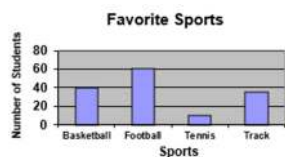
Common Core State Standards Initiative www.corestandards.org	Ohio Department of Education http://education.ohio.gov/Topics/Learning-in-Ohio/Mathematics
Illustrative Mathematics Project https://illustrativemathematics.org/	North Carolina Math Tools for Teachers https://tools4ncteachers.com/
Mathematics 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

- **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 real-world problems to use for SOLVE

- Angela has \$20 to spend at the book fair. She buys one book for \$14 and buys 3 pencils for 50 cents each. How much change does she have after going to the book fair? (3.OA.8)
- Jan has finished $\frac{4}{6}$ of her homework and Brianna has finished $\frac{4}{8}$ of her homework. Which girl has completed more of her homework assignment? Justify your answer using a fraction model. (3.NF.3d)
- Ellen has a bad cold. She has to take her medicine every 4 hours. She takes the first dose at 7:20 am. What time will she take the next two doses if she follows the medicine schedule? (3.MD.1)
- Jack is helping his mom put up a small fence around the flower garden in the backyard. The flower garden has a length of 12 feet and a width of 7 feet. What is the perimeter and area of the flower garden? (3.MD.7, 3.MD.8)
- Nate left his house for school at 7:35 am. He returned home at 3:15 pm. How much time passed between the time he left in the morning and the time he returned home? (3.MD.1)
- Sarah and Lisa are looking at a bar graph to determine the favorite sport of a group of students. How many students chose football over track? (3.MD.3)



- There were 90 people waiting in line this morning for tickets to a concert. Yesterday morning there were four times as many people. How many people were in line yesterday? (3.NBT.3)
- During math class, Mr. Harris gave the following math challenge question to students:
 “What’s My Name?”
 - I am a number greater than 54.
 - I am an even number.
 - I am less than 69.
 - I am a multiple of 7.
 What number is the answer to the math challenge question? (3.OA.7, 3.OA.9)
- John has 9 video games. His friend Tony has twice as many games as John. Tony gives away 3 of his video games to his cousin. How many games does Tony have after giving the 3 games to his cousin? (3.OA.8)
- Tom buys 9 packs of markers with 8 markers in each pack. How many markers did he buy altogether? (3.OA.7)
- The students in Mr. Harrison’s math class are working with equivalent fractions. Are the following two fractions equivalent? Use a model to support your answer. $\frac{2}{5}$ and $\frac{2}{3}$ (3.NF.3d)
- A rectangle has a perimeter of 24 inches. The length of the perimeter is 8 inches. What is the width of the perimeter? (3.MD.8)
- Chrissy’s dance class starts at the time shown on the clock. She gets to her class 35 minutes early. What time does she get to class? (3.MD.1)



- Mrs. Tomlin’s class is collecting canned food for a holiday project. Their class goal is to collect 100 cans. On Monday, they had a total of 32 cans, and on Tuesday the class brought in 26 cans. How many cans does the class still need to reach their goal? (3.OA.8)