4D’s Problem Solving Routine Instructions

A problem is not necessarily solved because the correct answer has been made. A problem is not truly solved unless the learner understands what he has done and knows why his actions were appropriate.”
— William A. Brownell, The Measurement of Understanding (1946)

The 4D’s of Problem Solving: This document is a problem solving recording sheet. The students should be taught how to fill out this form with hope that this will help the students organize the information, their thinking, and their way of showing their solution. This will hopefully help the student use the problem solving process and strategies.

The 4D’s of Problem Solving: Questioning page: These are guiding questions that teachers can use to model the thought process as students work through each section of the problem solving routine.

4D’s Problem solving Model: Connection to the Process Standards: This document shows how each of the guided questions relates to the new process standard.

Math Talk Starters: These are used to encourage discussion, debate and clarification throughout the problem solving routine. They can provide opportunities for students to share ideas with partners, in small groups (turn and talk), and in whole-class discussions. Students need to use and understand the language of math. Though discussion students can begin to explore a variety of solutions and discover generalizations at their own level of thinking, rather than limited questions which allow for only one answer.

Math Talk Card Ring: These are similar to the Math Talk Starters, except put in a different format. (Card Ring)
## The 4D’s of Problem Solving

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<th>Define the Problem</th>
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<td>How will you solve the problem?</td>
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### Do the work
Show your work.

### Defend you answer
Explain why your answer makes sense. Check for reasonableness.
# 4D’s of Problem Solving

**Define the problem in your own words**
- What is the question asking?
- What is the key information?
- What do you know about the problem?
- Explain what the problem is about.
- Do you have all the information you need to solve the problem?
- What facts do you know? Who, what, when, where, how, and why?
- Have you ever solved a problem like this on before?
- Make an estimate or prediction for the solution.

**Develop a plan**

Suggestions...
- Brainstorm. Think about similar problems you have solved in the past.
- How do you plan to solve the problem?
- Choose a strategy.
- Would it help to use a graph, table, or chart? Explain.

**Do the problem**

Suggestions...
- Use the strategy selected and demonstrate all steps.
- Solve the problem and write a solution.
- Can you use mental math?
- Can you estimate the answer?
- Study results and prepare to reach a conclusion.
- Is there a need for a new plan?
- Did you use the appropriate mathematical language?

**Defend your work with a summary of your solution...**
- Why is your solution reasonable?
- How have you checked your solution?
- Explain how you solved the problem and justify why your solution makes sense.
- How did you defend your plan and solution?
- If you do not agree with how the problem was solved, explain why your strategy and justify why it is better.
- Is there another way, which method is the most efficient? Explain.
- How is your solution different or similar to what other groups did?
4D’s Problem solving Model
Connection to the Process Standards:

1. **Define** the given information.
   - Do you have all the information you need to solve the problem? (A)
   - Explain what the problem is about. (A)
   - Have you ever solved a problem like this one before? (A)

2. **Develop** a plan.
   - How do you plan to solve the problem? (D)
   - Would it help to use a graph, table, or chart? Explain. (E)

3. **Do** the problem (determine the solution)
   - What do the numbers in the problem mean? (D)
   - Can you write a number sentence to help you solve the problem? (D),(E)
   - Can you use mental math? (C)
   - Can you estimate the answer? (C)
   - Did you use the appropriate mathematical language? (D),(F)

4. **Defend** your answer (justify the solution)
   - Explain how you solved the problem and justify why your solution makes sense (B), (D), (F)
   - How is your solution different or similar to what other groups did? (F)
   - If you do not agree with how the problem was solved, explain why your strategy and justify why it is better. (B)
   - Is there another way, which method is the most efficient? Explain (F)
   - Is the answer reasonable? Explain (F)
Math Talk Starters

- Why did you choose this method?
- How did you get this answer?
- How did you know which operation to use?
- Why is that the answer?
- Prove your answer is correct
- Did anyone think of doing this another way?
- Have you seen a problem like this before?
- How are these problems different?
- What is the same about these problems?
- So you are saying........
- I agree/disagree because.....
- Would you share how to solve this problem?

Explain * Question * Justify * Defend
Math Talk Questions and Sentence Stems

The following questions and sentence starters can be used during the Explain-Question-Justify-Defend strategies.

Why did you choose this method?

How does your method relate to the method that __________ just explained?

Did anyone think of this problem in a different way?

Who has the same answer, but solved it in a different way?
Does anyone have a different answer?  
How did you get this answer?

What is the same/different about these problems?  
How did you know which operation to use to solve the problem?

Tell me what __________ means.  
Why is that the answer?

Prove your answer is correct.  
How did you solve this problem?

Have you seen a problem like this before?  
What observations can you make?
What conclusion can you draw?

Well, this is complicated. I am still not sure I understand. Can you put what _____________ said in your own words?

Well, I guess we have not really understood your contribution. See if you can work on it and try later. I will come back to you.

So, you are saying...

Can you repeat what ______ said in your own words? __________, is that what you intended to say?

What’s your reasoning?

Take your time. We’ll wait.

This is my solution/strategy. I think ____________ is saying that...

I agree/disagree because...

I would like to build on the idea that _____shared.
I don’t understand your drawing. Can you share why you did your drawing like that?

How did you know to add? I thought you should subtract?

Your solution reminds me of __________.