**ACE-M: Doing & Thinking Through Mathematics Tool**

**APPROACH**

**When you first tried the task, did you…?**

* Annotate the question
* Identify the given relevant information and facts that might connect *(KNOWNS)*
* Write out questions that come to mind about what properties the object, phenomena, or relationship has
* Create alternative representations (sketches, graphs, verbal descriptions)
* State the goal (*UNKNOWNS)*

**Monitor**

**When you were first thinking about the math, did you…?**

* Ask if any of the given information is irrelevant/ missing/ contradictory
* Ask how I know if my representations and given information are relevant
* Identify reasoning/procedural questions that need to be answered to clear up points of confusion
* Ask if there are different ways to understand the task
* Contrast the current problem/task to previous ones
* Consider alternative ways of interpreting the task and/ or goal
* Ask if there is an error in my facts and approach
* Ask if I need to take a step back and work more on exercises before tackling this problem

**CREATE A PLAN**

**Looking at your plan, did you…?**

* Use the givens, identify models, relationships, and/or concepts that might apply
* Symbolically relate the givens with the model (WRITE AN EQUATION/RELATIONSHIP)
* Using the model/concepts/relationships, establish connections and intermediate steps between givens and goal

**Monitor**

**Thinking through your plan, did you…?**

* Decide if any approximations or assumptions, which weren't stated in the task, need to be made
* Decide if the model(s) are compatible with each other
* Compare the plan to others used in previous tasks to determine if reasonable
* Ask if all objects that look like this have the same property
* Evaluate the plan for completeness.
* Consider alternative plans
* Ask if I can describe the relationships
* Ask if there is an error in concept knowledge

**EXECUTION**

**When executing your plan, did you…?**

* Follow the plan (SOLVE PROBLEM) until your goal is attained

**Monitor**

**When thinking through your execution, did you…?**

* Continuously examine the plan to ensure it is working
* Ask if there is an error in the procedure
* Examine the outcome of the plan for coherence (CHECK YOUR UNITS)
* Compare the result of the plan against previous experiences to test if reasonable
* Check to see if the task has been completed
* Consider if the solution pathway will always work in all cases

**What is your “Brilliant Failure” question?**

A **brilliant failure** question is the question you ask yourself when you hit an obstacle during problem solving. This one question causes you to go back and view the problem from a different perspective.

**Discussion Question Prompts**

* **Procedural**:
  + What do I know about \_\_\_\_?
  + When do I use \_\_\_\_?
  + What is happening in the problem?
  + Do we see a pattern?
  + What do these units represent?

* **Reasoning**:
  + Why \_\_\_\_?
  + What if we changed \_\_\_\_?
  + How does this (piece/part/concept) relate/connect to \_\_\_\_?
  + What else does this remind me of?
  + How can we be sure the pattern continues?
  + How do we determine which method to choose?
  + This is the best/most reasonable solution because \_\_\_\_
  + This always/sometimes/never works because \_\_\_\_
  + Can you think of a counterexample?
  + Could you reach the same result using a different approach?
  + I am deciding \_\_\_\_ because of \_\_\_\_ and \_\_\_\_, and chose \_\_\_\_ because \_\_\_\_
  + Have we ever solved a problem like this before?