

## Multiple Representations

### Procedural Skills Item Formats

**Procedural Representations specifically apply to standards that reference the verbs including compute, solve, identify, interpret, use, make and find solutions. Procedural representations are most often MCQs that require students to apply and identify mathematic processes in various ways.**

**P) These items are conceptualized so that students:**

- Pa. Solve problems that involve forward computation, procedures, or process involving
- Pb. Solve problems that involve non-forward computation, procedures, or process involving
- Pc. Solve problem using numbers organized in different ways (horizontally, vertically in lists, tables)
- Pd. Interpret and solve problems requiring the manipulation of numbers among different forms or from one form to another.
- Pe. Relate or evaluate two or more pieces of information to solve a problem vs. more directed stems not relating multiple pieces of information found within the problem context
- Pf. Make or Interpret Conditional Statements: "If, then" (Student could identify example or create)
- Pg. Identify extraneous information.
- Ph. Identify missing information that is required in-order-to fulfill claim of stem
- Pi. Incorporate new information introduced in stem to information given in accompanying table, graph, or picture.
- Pj. Find values that make a process/principle/rule or relationship true
- Pk. Modify, manipulate, or mark provided graphic to demonstrate concept or respond to claim in stem.
- Pl. Use provided values to demonstrate a process/principle/rule
- Pm. Use symbols as place holders to capture or emphasize the process/principle/rule
- Pn. Recognize repetition of calculations and make use of shortcuts
- Po. Illustrate/Demonstrate the correct process/principle/rule without calculating the answer (or sets of correct processes/principles/rules)
- Pp. Identify and explain errors in procedures
- Pq. Relate new information from stem into information given in table or graph.

## **Conceptual Understanding Item Formats**

**Conceptual Understanding representations are applied to standards using verbs including understand, explain, represent and describe. The resulting item types require different combined mathematical practices depending on the given item type or item.**

C1) Explanation of Process/Principle/Rule: *These types of items require students to identify or explain a component of math or mathematic understanding. Items that successfully assess conceptual understanding with this type of representation can be formatted in at least the following ways: (meaning)*

- C1a. Verbal explanation of process/principle/rule
- C1b. Verbal explanation of result of process/principle/rule
- C1c. Verbal description of undoing the process/principle/rule.
- C1d. Identification of missing steps.
- C1e. Show meaning of procedure, strategy, or reasoning process, using examples.
- C1f. Show meaning of procedure using counterexamples.
- C1g. Explain errors in process/principle/rule.
- C1h. Explanation of choice in process/principle/rule.
- C1i. Select the most appropriate strategy to represent information
- C1j. Undue Formulaic Strategies
- C1k. Differentiate between strategies

C2) Patterns and Relationships: *These types of items require students to identify, define, and create patterns and relationships using numeric, abstract, geometric, and graphical information. Item formats that deal with patterns and relationship may include:*

- C2a. Generate similarities and differences between processes, graphs, tables, and patterns
- C2b. Draw connections between numerical concepts and geometric scenarios
- C2c. Explain the relationship between different numerical representations
- C2d. Discern and articulate patterns represented numerically, graphically, or with symbols.
- C2e. Create patterns from a rule, concept, visual, or verbal description.
- C2f. Make Inferences using data

C3. Transforming and Connecting Models: *These items require students interpret between multiple contextualized and decontextualized informational sources. Item formats that deal with Transformation and Connection Models include:*

- C3a. Translate between visual models and verbal descriptions.
- C3b. Use visual models to explain and represent numerical concepts
- C3c. Create problem scenarios that illustrate mathematical concepts, processes, and procedures.
- C3d. Use mathematical processes, principles or rules to verify a model.
- C3e. Justify choice of particular model to fulfill a particular task or model a situation.
- C3f. Classify and Organize information

## Application Item Formats

Application standards and items are unique within the core. There can be standards that reference application that are represented by application tasks, and applications tasks that are used to represent standards where application is not explicitly called for. Broadly speaking, application items require students to marshal both procedural and conceptual knowledge to complete a task. More specifically, application items require students to:

- make assumptions and simplifications
- model situations
- select appropriate knowledge and processes
- validate answers as reasonable or make generalizations within the problem-solving context.

To successfully represent standards that reference application OR represent standards through application, item formats include:

**A1. Prediction:** Items may require to make assumptions, select appropriate information, and create

**A2. Planning:** Items require students to organize and select salient information in order to plan and respond to multi-faceted demand. Often students will need to simplify the problem and determine the reasonableness of their solutions in the context of the problem.

**A3. Proof:** These items are intended for students to make assumptions, consider simpler cases of the problem, and construct a logical argument. Items will require students to judge the reasonableness or coherence of their results.

**A4. Create Models:** Items require students to make assumptions and apply appropriate knowledge and process to create models or problem scenarios.

**A5. Solve Models:** Items require students to make assumptions and apply appropriate knowledge and process to create solve real world issue/problems.

**A6. Evaluate:** Infer truth or fallacy of statements based on outcome of procedures using given and missing information.