



DRAFT – Fourth Grade – DRAFT
Mathematics Routine
Developing Effective Strategies for
Multiple Choice Tests

Purpose

- To teach students strategies for selecting correct responses on multiple choice tests.
- To teach students to use reasoning skills as they solve multiple choice items.
- To provide students opportunities to develop and use mathematical language as they discuss mathematical problems.
- To give students practice with math problems presented in a multiple choice format.
- To provide students the opportunity to review and expand on important mathematical ideas.
- To improve students' number and operational sense.

Rationale

Some students with solid mathematical understanding do not do as well as they should on multiple choice tests. Through explicit teaching using the multiple choice format, students can improve their test-taking skills and enhance their understanding of important mathematical ideas and standards.

An important aspect of this process is that students take the time to think and reason about the problem before they choose an answer. Thinking and reasoning must become a “habit of mind” that students use whenever they are confronted with a problem to solve. Through weekly experiences with strategies designed to improve achievement, students can “break” the habit of guessing answers for test items and improve performance on multiple choice tests.

Success on multiple choice assessments requires:

1. A solid understanding of the mathematical concepts, skills, and applications that will be tested.
2. Familiarity with the kinds of tasks and language that will be seen on the test.
3. Strategies for approaching those tasks so that students can show what they know.
4. Ability to demonstrate understanding in a variety of ways.

Description

- The teacher poses a multiple choice problem to the students.
- The problem might be taken from any of the previously administered End-of-Module Multiple Choice Assessments, Cumulative Benchmark Assessments, Harcourt multiple choice assessments, or California Standards Test (CST) released items.
- The students think about the problem in a way that makes sense to them, decide on the answer, and then find and select the correct A, B, C, or D response.
- Students share their thinking with a partner.
- The teacher leads students in a conversation focused on the mathematical content as well as possible strategies for determining the correct response.
- Students analyze the reasonableness of each of the responses.
- This is an opportunity for students to re-visit mathematics concepts and also to learn the strategies and self-questions necessary for analyzing and successfully completing the test.

Strategies

Multiple choice questions have one, and only one, correct response. The task is to uncover the one right choice hidden among several wrong choices. Consider the following strategies as you “unpack” the problem and question students.

Understanding and Solving the Problem

1. Read the problem.
What is being asked?
2. What do you know?
What information do you need to know?
What information is not important?
3. What do you need to solve the problem?
4. Solve the problem.

Estimating

Estimating is a way of finding an approximate answer when working with numbers and operations. Estimation helps you:

- Eliminate wrong answer choices.
- Narrow the number of reasonable answers.
- Save time by avoiding lengthy calculations.
- Check your answer.

Eliminating Unreasonable Answers

- Rule out answer choices that you know are not reasonable, do not make sense, or are just wrong.
- Even though you may not understand all of the words, you may still understand the mathematics. Do not give up.

Working Backwards

When solving for the value of an empty square, as in $35 + 6 = 35 + \square$, one strategy is to work backwards from your answer choices. You can find the correct answer by substituting the numbers one at a time into the equation.

1. Select an answer choice and substitute it for the empty square.
2. Work the problem to see if both sides of the equal sign are the same.
3. If both sides of the equal sign are not the same, eliminate that choice and try another.
4. If they are the same, you are finished.

Using Models

A model for a mathematical concept refers to any mental image, object, picture, or drawing that represents the concept or onto which the relationship for that concept can be imposed.

Models are a testing ground for emerging ideas:

- Models may help students develop new concepts or relationships.
- Models may help students make connections between concepts and symbols.
- Models may help students to show their understanding without words.
- Models may help the teacher assess students' understanding.

Models could include:

- Drawing pictures.
- Using concrete objects.
- Writing symbols.
- Using oral language.
- Relating to real-world situations.

A variety of models should be available to help students make meaning of the important mathematical idea. Students select models that make sense to them. While the teacher can offer a model, he/she must remember that this is the way the teacher makes sense of the idea and it may not be the way the student makes sense of the idea.

Suggested Materials

- Chart paper, document camera, overhead projector, white board or chalkboard.
- Individual white boards, scratch paper, graph paper or journals.
- Items from End-of-Module Multiple Choice Assessments, Cumulative Benchmark Assessments, Harcourt assessment materials, or California Standards Test (CST) released items.

Time

- 15 minutes maximum.

Directions

Example 1: Solving Problems Before Viewing A, B, C, D Responses

REMEMBER TO THINK ABOUT THE STRATEGIES

- **Understanding and Solving the problem**
- **Selecting an appropriate answer**
- **Estimating**
- **Working Backward**

Example 1: Solving Problems Before Viewing A, B, C, D Responses

1. Write a problem on chart paper, overhead transparency, or a piece of paper (for document camera). The problem should be a multiple choice problem. Do not show the students the A, B, C, D responses. Sample items are attached.

For example: CST Released Item

$$\begin{array}{r} 2489 \\ + 1678 \\ \hline \end{array}$$

“Think about how you would begin this problem.”

2. Give students time to think about how they would solve the problem. Students may want to write the equation on their white board, scratch paper, graph paper, or in their journal.
3. After the students have had time to think about the problem, show four possible answers using an A, B, C, D format. Students are to select the answer that they feel is the correct answer (or closest to their thinking). Students write the letter on their white board, scratch paper, graph paper, or in their journal.

For example:

- A. 3057
- B. 4067
- C. 4167
- D. 5157

Problem:

$$\begin{array}{r} 2489 \\ + 1678 \\ \hline \end{array}$$

4. Ask students to turn to a partner to justify why they believe their answer is the correct answer.

“I chose letter (A, B, C or D) because...”

5. Facilitate a conversation about the reasonableness of each choice. Possible teacher questions and possible student responses might include the following (not in any particular order):

Note: Ask follow-up questions that will support student thinking and will promote as many strategies as possible to be shared publicly (i.e., “Can you explain how you know? How did you think about it? Does anyone have another idea or approach?”)

It is also advisable to take time to analyze what common mistakes are represented in the answer choices. Test writers often anticipate common student errors and include them as answer choices.

- **Question:**
What choices could you eliminate immediately? Why?

Possible Response:

I can eliminate 5157 (D) immediately because there is no way that the answer would be more than 5000.

- **Question:**
How do you know that the answer will be less than 5000?

Possible Response:

I know that $3000 + 2000$ is 5000. 2489 isn't yet 3000, and 1678 isn't yet 2000. That means that there is no way that the answer will be more than 5000. It will be less than 5000.

- **Question:**
Why would A not be a reasonable answer as well?

Possible Response:

I can use the same strategy. 3057 (A) is only a little bit more than 3000. If I were to add just the thousands from the two numbers (2000 + 1000) I would get 3000. If I were to add the hundreds from the two numbers (400 + 600) I would get another thousand. That would make at least 4000. 3057 (A) is not a reasonable answer because it is too small.

• **Question:**

There is another reason why A wouldn't be the answer. It has to do with regrouping. Can you see the error that would give you this answer?

Possible Response:

If kids don't regroup at all then the answer that they would get would be 3057. I guess that's why we need to pay attention to regrouping too.

Example 2: Using A, B, C, D Responses to Solve the Problem

1. Some problems do not lend themselves to students solving the problem *before* they see the A, B, C, D response. For these problems, students think about the problem and which response makes the most sense and then discuss this with a partner before the group discussion.

For example:

**The letters S and T stand for numbers. If
 $S - 100 = T - 100$, which statement is true?**

- A. $S = T$
- B. $S > T$
- C. $S = T + 100$
- D. $S > T + 100$

2. Ask students to turn to a partner to justify why they believe their answer is the correct answer.
3. Facilitate a conversation about the reasonableness of each choice. Questions might include the following:

Note: Ask follow-up questions that will support student thinking and will promote as many strategies as possible to be shared publicly (i.e., "Can you explain to us how you know? How did you think about it? Does anyone have another idea or approach? Could you give an example?")

It is also advisable to take time to analyze what common mistakes are represented in the answer choices. Test writers often anticipate common student errors and include them as answer choices.

- **Question:**
What does it mean to ask “which statement is true?”

Possible Response

It means that one of the four statements is true if $S - 100 = T - 100$ is true. The other three cannot be true.

- **Question:**
How can you begin to find the correct choice for this question?

Possible Response:

It looks like there are two kinds of answers: those that compare S to T, and those that compare S to $T + 100$. I can test them in order to see which one is still true when $S - 100 = T - 100$.

- **Question:**
How can you make sense of the problem in order to answer it?

Possible Response:

Since it says that $S - 100$ is the same as $T - 100$, then I think that I can eliminate C and D that say that you have to add 100 to T to make it the same as S.

- **Question:**
So if you have only choices A and B left, how do you make a decision about one of them?

Possible Response

In this case I'm going to work backwards by actually trying out the choices, one at a time.

Choice B says $S > T$. I'm going to use 300 as S and 200 as T.

If $S - 100 = T - 100$, then $300 - 100$ should be the same as $200 - 100$.

That's not true, so I'll say that B is not the correct choice.

Choice A says $S = T$. I'm going to use 300 as S and 300 as T.

If $S - 100 = T - 100$, then $300 - 100$ should be the same as $300 - 100$.

That **is** true, so I'll say that A **is** the correct choice.

Which Multiple Choice Items to Use

As you select items for the multiple choice routine, think about the following:

- Which multiple choice item will help students build a solid understanding of a mathematical concept, skill or application with which students are struggling?
- Which multiple choice item will help students become familiar with the kinds of tasks and language that will be seen on tests?
- Which multiple choice item will help students learn strategies for approaching tasks so that they can show what they know?

Sources for multiple choice items could include:

- Items from End-of-Module Multiple Choice Assessments (following administration).
- Items from Cumulative Benchmark Assessments (following administration).
- Multiple Choice Items from Harcourt.
- Released test items from the California Standards Test.

End-of-Module Multiple Choice Assessments

For the 2007-2008 school year, End-of-Module multiple choices tests will be available for each module. Analyzing how students respond to the items will give an indication about the mathematical ideas with which students continue to grapple. Select items from the End-of-Module Multiple Choice Assessment (following administration) that indicate fragile student understandings.

Cumulative Benchmark Assessments

For the 2007-2008 school year, Benchmark Assessments (given quarterly) will be in multiple choice format and will be cumulative. Analyzing how students respond to the items will give an indication about the mathematical ideas with which students continue to grapple. Select items from the Cumulative Benchmark Assessment (following administration) that indicate fragile student understandings.

Harcourt

Harcourt provides the following assessment resources in multiple choice format:

- Chapter Tests (Form A) in the Assessment Guide.
- Unit Tests (Form A) in the Assessment Guide.
- Cumulative Review in the textbook.

Released Test Questions from the California Standards Test

- The California Department of Education has released a sample of California Standards Test questions. The state has provided guidelines for use of released items. In summary, these guidelines discourage the use of test items as a practice test or to predict performance on the CST. However, the use of the items as a teaching tool (as described in this routine) is a practice that is encouraged.
- The released items can be examples of the kinds of tasks and language that will be seen on the test. Individual test items can be used to help students learn strategies for approaching tasks so they can show what they know.
- To assist the teacher in selecting items for multiple choice routines, the released items have been organized by module. The released items organized by module are attached.