



DRAFT – Fifth 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 a variable, as in $8 \times 37 = (8 \times 30) + (8 \times z)$, 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 variable.
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 Response

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

What is $\frac{3}{8}$ written as a percent?

“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. 26.7%
- B. 30%
- C. 37.5%
- D. 50%

Problem:

What is $\frac{3}{8}$ written as a percent?

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 immediately eliminate 50% (D) because I know that $\frac{4}{8}$ is 50%.

- **Question:**

What answer makes sense to you?

Possible Response:

I know that $\frac{2}{8}$ is 25%. I see that 26.7% (A) is a little more than 25%. It might be the answer, but I’m not sure.

- **Question:**

What is a strategy that would help you figure out if this is the answer or not?

Possible Response:

I can say that if $\frac{2}{8}$ is 25%, then $\frac{1}{8}$ is 12.5%. That would mean that it can’t be 26.7% (A) because 25% plus 12.5% is not 26.7% (A).

- **Question:**
Why do you think that 30% (B) is one of the choices?

Possible Response:

If kids just look at the numerator and see the 3, they might think that it would be 30% (B). That's why it is also important to look at the denominator.

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:

$$5^3 =$$

- A. $5 \times 5 \times 5$
- B. $5 + 5 + 5$
- C. $3 \times 3 \times 3 \times 3 \times 3$
- D. $3 + 3 + 3 + 3 + 3$

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 is the question asking you to do?

Possible Response

It's asking us to rewrite 5^3 showing what it represents.

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

Possible Response:

I see that it is either adding or multiplying numbers. I don't remember ever having to add the numbers when I see exponents used. I think that I can eliminate the ones that use addition (B and D).

- **Question:**
Since it is multiplication, how can you narrow down the two choices (A and C) to one choice?

Possible Response:

I remember that the 5 is the number that is multiplied by itself 3 times. That would leave only $5 \times 5 \times 5$ (A) as the correct answer.

- **Question:**
Think about the other answer: $3 \times 3 \times 3 \times 3 \times 3$ (C). Why do you think that it is one of the choices?

Possible Response

If kids mistake what 5^3 means, then they might think that it means 3 multiplied by itself five times. The choice is there to catch kids who don't remember how to find what 5^3 means.

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 choice 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.