The Georgia Performance Standards for K-12 Mathematics

Kathy Cox
State Superintendent of Schools
Assessing for Mathematics Success
Mathematics I: Algebra/Geometry/Statistics

Group Norms and Housekeeping

**Group Norms:**
- Ask questions
- Work toward solutions
- Honor confidentiality
- Meet commitments or let others know if you are struggling

**Housekeeping:**
- Parking Lot
- Phone calls
- Restrooms
- Breaks
- Lunch

We must not separate curriculum changes from instructional changes from changes in assessment.

They can only occur concurrently!!!
Overview of the Day

- BIG ideas in Math I
- The EOCT
- Instruction that puts it all together

The Essential Questions

- How are we really using assessment?
- What are the overarching topics in Mathematics I?
- How do the tasks in the frameworks address these ideas?
- How is the EOCT constructed and scored?

What does assessment mean in OUR classrooms?
Let's take a look at NCTM former President Skip Fennell's view in his message:

**Go Ahead, Teach the Test!**

NCTM News Bulletin (December 2006)

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**What did you find in the article?**

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**Mathematics I: Algebra /Geometry/Statistics**

- Content and process standards
- Tasks
- Student work
- Commentary
Mathematics I: Algebra/Geometry/Statistics

- Family of Functions
  - Characteristics of these functions
  - \( F(x) = x^n \) (n=1,2,3), \( \sqrt{x} \), \( |x| \), and \( 1/x \)
  - Sequences as functions

-Sequences as functions
Consider the arithmetic sequence below:
5, 7, 9, 11, ...

- In 8th grade, students address the recursive formula for the sequence:
  \[ a_n = a_{n-1} + 2 \]

-Sequences as functions
5, 7, 9, 11, ...

- In Mathematics I, students are introduced to the closed (explicit) formula:
  \[ f(n) = 2n + 3 \]
Mathematics I: Algebra/Geometry/Statistics

- Algebra of Quadratics
  - Factoring of 2nd degree polynomials & cubes
  - Quadratic equations
  - Equations involving radicals
  - Simple rational equations

Mathematics I: Algebra/Geometry/Statistics

- Coordinate Geometry
  - Distance between a point and a line
  - Midpoint

Mathematics I: Algebra/Geometry/Statistics

- Triangles
  - Inductive, deductive reasoning
  - Converse, inverse, contrapositive
  - Sum of interior, exterior angles
  - Triangle inequalities
  - SSS, SAS, ASA, AAS, HL
  - Incenter, orthocenter, circumcenter, centroid
Mathematics I: Algebra/Geometry/Statistics

Statistics
  ➢ Simple permutations & combinations
  ➢ Mutually exclusive, dependent, conditional
  ➢ Expected values
  ➢ Summary statistics
  ➢ Random sample
  ➢ Mean absolute deviation

Mean absolute deviation

Example:
Given the data points 4, 6, 8, 7, 2, 9, find the mean absolute deviation.

Solution:
Step 1. Find the mean of the data points.
  • Mean = 6
Step 2. Find the distance from each data point to the mean.

Mean absolute deviation
Example:
Given the data points 4, 6, 8, 7, 2, 9, find the mean absolute deviation.

Solution (continued):
• Mean = 6
• Distance from each point to the mean:
  2 + 0 + 2 + 1 + 4 + 3
Step 3. Find the mean of the distances from the mean.
Mean absolute deviation

Example:
Given the data points 4, 6, 8, 7, 2, 9, find the mean absolute deviation.

Solution (continued):
- Mean = 6
- Distance from each point to the mean:
  \[ 2 + 0 + 2 + 1 + 4 + 3 \]
- NOW find the mean of the distances.
  So the MAD = 2

Mathematics I teachers are committed to...

- Developing ideas and concepts with skills embedded
- Working to maintain a balance between skills, concepts, and problem solving while developing students' understanding of how and why
- Not doing the same old mathematics rearranged
- Changing the way we think about mathematics as we transition students to algebraic thinking

These are NON-NEGOTIABLES

A Task, Of Course!

Video Game Learning Task
What assessment questions could you use to address the skills?
What assessment questions could you use to address the concepts?
Could you do both at once, in context? What skills and concepts are the students building in this task?

Using Assessment to Plan Instruction

Sample Assessment Items – Set 1

1. The distance from point (-7,3) to (3,y) is:
   a. 10
   b. 4
   c. 0
   d. 7

2. What is the distance between (-3, 4) and (2, 7)?
   a. 7√2
   b. 7
   c. 5
   d. 9

3. The distance between (a, 4) and (-2, 7) is 5√2. What is one possible value for a?
   a. -3
   b. 10
   c. 5
   d. -10

4. What is the distance between the origin and (-4, 8)?
   a. 10
   b. 9
   c. 16
   d. 8√2
Sample Assessment Items – Set 2

1. Given the center of a circle $(2, -3)$ and a point on the circle $(-1, -2)$, what is the radius of the circle?
   a. 3
   b. 8
   c. 10
   d. 11

2. Find all points $(x, y)$ that are 10 units from the point $(3, -1)$.
   a. $(4, 4)$ and $(4, 6)$
   b. $(2, 5)$ and $(4, 2)$
   c. $(0, 6)$ and $(8, 5)$
   d. $(4, 3)$ and $(4, 7)$

3. The coordinates of rectangle $ABCD$ are $A(8,3), B(4,8), C(7,8)$ and $D(3,3)$.
   a. Which method would you use to show that the diagonals are equal in length?
   b. Find the slope of $AB$ and $CD$.
   c. Find the slope of $AC$ and $BD$.
   d. Find the distance from $A$ to $B$ and $C$ to $D$.

4. Let $A = (-1, 3)$ and $B = (3, -1)$. Point $P(0, 4)$ is equidistant from $A$ and $B$. Describe all such points $P$.
   a. A line through $P$ parallel to $AB$.
   b. Any line parallel to $AB$.
   c. A line through $P$ that is the perpendicular bisector of $AB$.
   d. Any line parallel to $AB$. 

Informed Instruction

EOCT
for
Mathematics I
Algebra/Geometry/Statistics
How is the test constructed?

GEORGIA ASSESSMENT DEVELOPMENT PLAN

How many questions?

Algebra & Geometry 90
  field test 12
  active 78

Mathematics I 72
  field test 12
  active 60

How are the three strands weighted?

- Algebra 35%
- Geometry 35%
- Data Analysis 30%
So, let’s do some MATH

How many in each strand?

How are the questions categorized?

Questions are coded by DOK Depth Of Knowledge

- Based on the rigor of our Georgia Performance Standards Mathematics Curriculum,
  - 55% of the questions on the test must be at DOK 2 or above.
Depth of Knowledge Levels

Given the equation below, find the x and y intercepts.

\[ y = \frac{4}{7} |x| - 42 \]

Depth of Knowledge Levels

In the adjacent figure, a camera is positioned in front of a mural on a wall. Letting the wall represent the x axis and the camera lens lie on the y axis, the line of sight for the photographer can be modeled by the function 

\[ y = \frac{4}{7} |x| - 42 \]

How far from the mural is the camera?
How wide is the part of the mural the photograph will capture?

Where do I find sample assessments?

- OAS Mathematics I Midterm
- Mathematics I Teacher Edition
  - NAEP Sample Items
  - Unit Assessments
- GaDOE Testing Site – EOCT Study Guide
- Released Test Items on Massachusetts and Virginia state websites
- Phillip Exeter website
### GPS Implementation and Testing

#### Subject (Grade 3)

<table>
<thead>
<tr>
<th>Subject</th>
<th>QCC ( \rightarrow ) GPS</th>
<th>GPS ( \rightarrow ) GPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>92 ( \rightarrow ) 83 ( = -9 )</td>
<td>63 ( \rightarrow ) 85 ( = +4 )</td>
</tr>
<tr>
<td>English/Lang. Arts</td>
<td>87 ( \rightarrow ) 82 ( = -5 )</td>
<td>82 ( \rightarrow ) 86 ( = +5 )</td>
</tr>
<tr>
<td>Math</td>
<td>90 ( \rightarrow ) 71 ( = -19 )</td>
<td>NA</td>
</tr>
<tr>
<td>Science</td>
<td>85 ( \rightarrow ) 70 ( = -15 )</td>
<td>70 ( \rightarrow ) 75 ( = +5 )</td>
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#### Subject (Grade 4)

<table>
<thead>
<tr>
<th>Subject</th>
<th>QCC ( \rightarrow ) GPS</th>
<th>GPS ( \rightarrow ) GPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>87 ( \rightarrow ) 81 ( = -6 )</td>
<td>81 ( \rightarrow ) 85 ( = +6 )</td>
</tr>
<tr>
<td>English/Lang. Arts</td>
<td>94 ( \rightarrow ) 79 ( = -5 )</td>
<td>79 ( \rightarrow ) 84 ( = +7 )</td>
</tr>
<tr>
<td>Math</td>
<td>78 ( \rightarrow ) 70 ( = -8 )</td>
<td>NA</td>
</tr>
<tr>
<td>Science</td>
<td>88 ( \rightarrow ) 72 ( = -16 )</td>
<td>72 ( \rightarrow ) 74 ( = +2 )</td>
</tr>
</tbody>
</table>

*WE WILL LEAD THE NATION IN IMPROVING STUDENT ACHIEVEMENT*

#### Subject (Grade 5)

<table>
<thead>
<tr>
<th>Subject</th>
<th>QCC ( \rightarrow ) GPS</th>
<th>GPS ( \rightarrow ) GPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>89 ( \rightarrow ) 81 ( = -8 )</td>
<td>81 ( \rightarrow ) 85 ( = +6 )</td>
</tr>
<tr>
<td>English/Lang. Arts</td>
<td>88 ( \rightarrow ) 85 ( = -3 )</td>
<td>85 ( \rightarrow ) 88 ( = +5 )</td>
</tr>
<tr>
<td>Math</td>
<td>88 ( \rightarrow ) 72 ( = -16 )</td>
<td>NA</td>
</tr>
<tr>
<td>Science</td>
<td>89 ( \rightarrow ) 67 ( = -22 )</td>
<td>67 ( \rightarrow ) 71 ( = +4 )</td>
</tr>
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</table>

#### Subject (Grade 6)

<table>
<thead>
<tr>
<th>Subject</th>
<th>QCC ( \rightarrow ) GPS</th>
<th>GPS ( \rightarrow ) GPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>84 ( \rightarrow ) 87 ( = +3 )</td>
<td>87 ( \rightarrow ) 89 ( = +4 )</td>
</tr>
<tr>
<td>English/Lang. Arts</td>
<td>76 ( \rightarrow ) 84 ( = +8 )</td>
<td>84 ( \rightarrow ) 86 ( = +7 )</td>
</tr>
<tr>
<td>Math</td>
<td>74 ( \rightarrow ) 62 ( = -12 )</td>
<td>62 ( \rightarrow ) 65 ( = +3 )</td>
</tr>
<tr>
<td>Science</td>
<td>83 ( \rightarrow ) 61 ( = -22 )</td>
<td>61 ( \rightarrow ) 66 ( = +5 )</td>
</tr>
<tr>
<td>Social Studies</td>
<td>83 ( \rightarrow ) 29 ( = -54 )</td>
<td>NA</td>
</tr>
</tbody>
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*WE WILL LEAD THE NATION IN IMPROVING STUDENT ACHIEVEMENT*
GPS Implementation and Testing

<table>
<thead>
<tr>
<th>Subject (Grade 7)</th>
<th>QCC ± GPS</th>
<th>GPS ± GPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>87 ± 80 = -7</td>
<td>80 ± 85 ± 88 = +8</td>
</tr>
<tr>
<td>English/Lang. Arts</td>
<td>84 ± 83 = -1</td>
<td>83 ± 88 ± 89 = +6</td>
</tr>
<tr>
<td>Math</td>
<td>81 ± 74 = -7</td>
<td>74 ± 80 = +6</td>
</tr>
<tr>
<td>Science</td>
<td>84 ± 63 = -21</td>
<td>63 ± 70 ± 75 = +12</td>
</tr>
<tr>
<td>Social Studies</td>
<td>86 ± 24 = -62</td>
<td>NA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Subject (Grade 8)</th>
<th>QCC ± GPS</th>
<th>GPS ± GPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>83 ± 90 = +7</td>
<td>90 ± 89 ± 91 = +1</td>
</tr>
<tr>
<td>English/Lang. Arts</td>
<td>80 ± 87 = -7</td>
<td>87 ± 85 ± 93 = +2</td>
</tr>
<tr>
<td>Math</td>
<td>81 ± 62 = -19</td>
<td>NA</td>
</tr>
<tr>
<td>Science</td>
<td>74 ± 60 = -14</td>
<td>NA</td>
</tr>
<tr>
<td>Social Studies</td>
<td>85 ± 59 = -26</td>
<td>NA</td>
</tr>
</tbody>
</table>

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Results show the GPS is working

Mathematics
In every grade and content area where the GPS has been implemented more than one year (25) the results are up!

<table>
<thead>
<tr>
<th>Mathematics</th>
<th>2008 Percent Meeting or Exceeding</th>
<th>2006-2008 Gains</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 6</td>
<td></td>
<td>69%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+7</td>
</tr>
</tbody>
</table>

2007-2008 Gains

| Grade 1     | 86% | +3   |
| Grade 2     | 85% | +4   |
| Grade 3     | 80% | +6   |

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Closing the Achievement Gap

- The African-American/White and Hispanic/White achievement gaps closed on EVERY CRCT aligned to the new curriculum for two or more years.
  (Percent of students who met or exceeded standards)

- African-American and Hispanic students made gains on ALL 25 tests.
  - White students made gains on 21 of the 25 tests and stayed the same on 4 of the tests.

- There is still much work to be done, especially in mathematics and science, but the progress is undeniable.

WE WILL LEAD THE NATION IN IMPROVING STUDENT ACHIEVEMENT
### Mathematics Achievement Gap

**Difference in African-American and Hispanic Pass Rate Percentage Compared to White Students**

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>Decrease since GPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>African-American</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade 1</td>
<td>-</td>
<td>16</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>Grade 2</td>
<td>-</td>
<td>18</td>
<td>15</td>
<td>3</td>
</tr>
<tr>
<td>Grade 6</td>
<td>27</td>
<td>27</td>
<td>23</td>
<td>4</td>
</tr>
<tr>
<td>Grade 7</td>
<td>-</td>
<td>22</td>
<td>17</td>
<td>5</td>
</tr>
<tr>
<td>Hispanic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade 1</td>
<td>-</td>
<td>17</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td>Grade 2</td>
<td>-</td>
<td>16</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Grade 6</td>
<td>10</td>
<td>20</td>
<td>14</td>
<td>6</td>
</tr>
<tr>
<td>Grade 7</td>
<td>-</td>
<td>15</td>
<td>10</td>
<td>5</td>
</tr>
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</table>

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### Mathematics Achievement Gap

**Change in Percent Meeting and Exceeding Standards**

<table>
<thead>
<tr>
<th>Mathematics (2006-2008 Change)</th>
<th>AI Students</th>
<th>English Language Learner</th>
<th>Students with Disabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 6</td>
<td>+7</td>
<td>+11</td>
<td>+6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mathematics (2007-2008 Change)</th>
<th>AI Students</th>
<th>English Language Learner</th>
<th>Students with Disabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 1</td>
<td>+4</td>
<td>+10</td>
<td>+2</td>
</tr>
<tr>
<td>Grade 2</td>
<td>+4</td>
<td>+14</td>
<td>+3</td>
</tr>
<tr>
<td>Grade 3</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Grade 4</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Grade 5</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Grade 7</td>
<td>+4</td>
<td>+9</td>
<td>+7</td>
</tr>
<tr>
<td>Grade 8</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

WE WILL LEAD THE NATION IN IMPROVING STUDENT ACHIEVEMENT

### Eighth Grade CRCT Results

- After the summer retest, results indicate that 77% of eighth graders met the expectations required for proficiency.
- The 8th Grade GPS curriculum addressed 80% of the algebra traditionally taught in high school Algebra I.
- The 8th Grade GPS curriculum addressed 60% of the geometry traditionally taught in high school Geometry.
We Raised the Bar

And
the scores prove
our students
CAN
meet the
challenge!

Now that high school mathematics is in the
driver’s seat, will we advance the success
even further?
Like it or not, the EOCT
will be the judge!

Response to Intervention

...is defined as the
process of aligning appropriate
assessment with purposeful
instruction for all students.
**Tier 1 Non-negotiables**

**Tier 1**

**STANDARDS-BASED CLASSROOM LEARNING:**

- All students participate in general education learning that includes:
  - Universal screenings to target groups in need of specific instructional support.
  - Implementation of the Georgia Performance Standards (GPS) through a standards based classroom structure.
  - Differentiation of instruction including fluid, flexible grouping, multiple means of learning, and demonstration of learning.
  - Progress monitoring of learning through multiple formative assessments.
We Really Can Do This!!

How is the Georgia Department of Education supporting Mathematics I teachers?

- The Learning Village
- Frameworks – Teacher Editions
- Monthly Elluminate
- Coach Books
- Parent Letters
- EOCT Study Guides
- Communication with GaDOE Mathematics Team

Thank you!
President’s Message

Go Ahead, Teach to the Test!

Francis (Skip) Fennell

Since NCTM released *Curriculum Focal Points*, I have learned that columnists can say whatever they want in a headline to lure readers into their article. You have to admit, my headline grabbed you, didn’t it? Well, now that I have your attention, I’ll get serious. Let’s talk about assessment—formative assessment, to be exact.

NCTM’s Assessment Principle indicates that assessment should not be done to students; rather, assessments are for students and should be used to guide and enhance their learning. There are several forms of assessment. Formative assessment involves using classroom-based assessments to collect feedback that can be used to improve teaching and learning. Summative assessment measures what students have learned at the end of a set of learning experiences. Summative assessments include state and local school district assessments.

Formative assessment is an essential part of teaching and learning. It takes place in the classroom and is among the daily responsibilities of the classroom teacher. According to NCTM’s *Principles and Standards for School Mathematics*, assessments—particularly formative assessments—must be a routine part of classroom activity, not an interruption. Students’ learning is enhanced when teachers regularly use formative assessments to make judgments about teaching and learning (Black and William, *Phi Delta Kappan*, October 1998). As teachers become comfortable with a myriad of formative assessment techniques, they tend to develop special expertise in knowing when a lesson is going well, when to stop a lesson in its tracks, when to stretch a lesson into the next day, when to review, when to ask deeper questions, and so on. This “on your feet” ability to use assessment to modify a lesson is an important trait of “highly qualified” teachers, as I define such teachers.

Formative assessment “opportunities” include observations that teachers make when watching students engage in the mathematics they are learning. While observing, teachers should ask themselves, “How are students involved in the lesson activity? How successful are they? What on-the-spot interventions would make the lesson more successful for students?”

As *Principles and Standards* notes, communication deepens understanding. Classroom discussions are an integral component of formative assessment. Students need opportunities to discuss their thinking. This may be through explaining and justifying their reasoning as they solve a problem like the following:

Busch Stadium, home of the world-champion St. Louis Cardinals baseball team, seats about 44,000 people. Ben is in charge of all the hot dog vendors. He expects about 1/5 of the crowd to buy a hot dog. Hot dogs are priced at $4.75. Do you think Ben’s sales would exceed $10,000 for the game?

To promote discussions of this problem, try using questions such as, “How did you solve the problem? Why did you solve it that way? Could we solve the problem another way?”

The student interview is another formative assessment technique that teachers can use; it is particularly valuable for assessing the progress of individual students. The interview protocol might engage a student in solving a few problems or exercises. The accompanying questions might require the interviewee to describe the steps that he or she used to complete the example problems. The assessment would then determine the student’s level of understanding and would examine the student’s thinking. The interview is especially useful for the early identification of misconceptions.

Writing is another powerful formative assessment tool. Students can be asked to create and write down their own problems, provide reflective comments on their daily work, or suggest more efficient solutions to problems. Exit questions, or what I refer to as “quizlets,” offer another quick way to assess informally. Exit questions at the conclusion of a lesson consist of a few problems or examples designed to measure students’ understanding. An analysis of students’ responses to the exit questions or quizlets can then be used in planning the next day’s lesson. Of course, formative assessments may also take the form of a classroom quiz, worksheets, homework, and other projects.

When planning formative assessment, consider how you’ll link the formative assessment opportunity to what you are teaching. Perhaps that will mean having students use a hundreds chart to represent common multiples of 5 and 6. It could mean using place-value manipulatives to show different representations of a particular whole number. Timing is very important, and planning how to monitor students’ responses and how to use those responses to alter teaching are important as well.

In short, assess as you teach: observe, ask questions, look for representations and responses that demonstrate understanding. Along the way, determine if the formative assessment strategy is actually working or not. Frankly, some students don’t like to discuss much with anyone. Observation may work best with these students. Other students may be slow in responding, but with time and experience students’ representations of problem solutions can improve. The point is, whatever formative assessment tactics you use should provide accurate information about students’ progress—they should reveal students’ misconceptions, help you pace the lesson, change topics, and offer remediation or enrichment when it’s needed.

Formative assessments are essential components of classroom instruction and should be used to make students’ thinking visible. So, teach to this test. No, let me get that right—use formative assessments to guide and monitor teaching and learning mathematics—every day.

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Notes on Video Game Learning Task

This task provides a guided discovery of the formula for the distance between two points. Using a game format the activity leads students to discover the relationship between the Pythagorean Theorem and the distance formula. Standards addressed in this task include, but are not limited to:

- MM1G1. Students will investigate properties of geometric figures in the coordinate plane.
  a. Determine the distance between two points.
  d. Understand the distance formula as an application of the Pythagorean Theorem.

Students will need to use the following concepts from 8th grade math:
- M8A5. Students will understand systems of linear equations and inequalities and use them to solve problems.
  a. Given a problem context, write an appropriate system of linear equations or inequalities.
  b. Solve systems of equations graphically and algebraically, using technology as appropriate.
  c. Graph the solution set of a system of linear inequalities in two variables.
  d. Interpret solutions in problem contexts.

This task reinforces concepts learned throughout Math I.

Supplies Needed:
- Centimeter graph paper
- Rulers
- Some type of graphing utility.
**Video Game Learning Task**

John and Mary are fond of playing retro style video games on handheld game machines. They are currently playing a game on a device that has a screen that is 2 inches high and four inches wide. At the start, John's token starts ¼ inch from the left edge and half way between the top and bottom of the screen. Mary's token starts out at the extreme top of the screen and exactly at the midpoint of the top edge.

![Game Setup Diagram]

**Starting Position**

As the game starts, John's token moves directly to the right at a speed of 1 inch per second. For example, John's token moves 0.1 inches in 0.1 seconds, 2 inches in 2 seconds, etc. Mary's token moves directly downward at a speed of 0.8 inches per second.

![Game Movement Diagram]
After One Second

Let time be denoted in this manner: $t = 1$ means the positions of the tiles after one second.

1. Draw a picture on graph paper showing the positions of both tokens at times $t = \frac{1}{4}$, $t = \frac{1}{2}$, $t = 1$, and other times of your choice.

2. Discuss the movements possible for John’s token.

3. Discuss the movements possible for Mary’s token.

4. Discuss the movements of both tokens relative to each other.

5. Find the distance between John and Mary’s tokens at times $t = 0$, $t = \frac{1}{4}$, $t = \frac{1}{2}$, $t = 1$. 
If Mary's token gets closer than \( \frac{1}{4} \) inch to John's token, then Mary's token will destroy John's, and Mary will get 10,000 points. However, if John presses button A when the tokens are less than \( \frac{1}{2} \) inch apart and more than \( \frac{1}{4} \) inch apart, then John's token destroys Mary's, and John gets 10,000 points.

6. Find a time at which John can press the button and earn 10,000 points. Draw the configuration at this time.

7. Compare your answers with your group. What did you discover?

8. Estimate the longest amount of time John could wait before pressing the button.

9. Drawing pictures gives an estimate of the critical time, but inside the video game, everything is done with numbers. Describe in words the mathematical concepts needed in order for this video game to work.
Inside the computer game the distance between John and Mary’s token are computed using a mathematical formula based on the coordinates of the tokens. Our goal now is to develop this formula.

To help us think about the distance between the tokens in our video game, it may help us to look first at a one-dimensional situation. Let’s look at how you determine distance between two locations on a number line:

10. What is the distance between 5 and 7? 7 and 5? -1 and 6? 5 and -3?

11. Can you find a formula for the distance between two points, a and b, on a number line?

Now that you can find the distance on a number line, let’s look at finding distance on the coordinate plane:

12. Plot the points A = (0, 0), B = (3, 0) and C = (3, 4) on centimeter graph paper.

13. Find the distance from the point (0, 0) to the point (3, 4) using a ruler.
14. Consider the triangle ABC, what kind of triangle is formed? Find the lengths of the two shorter sides. Use these lengths to calculate the length of the hypotenuse. Is this consistent with your prior measurement? Why or why not?

15. Using the same graph paper, find the distance between:

   a. (1,1) and (4,4)
   b. (-1,1) and (11,6)
   c. (-1,2) and (2,-6)

16. Find the distance between points (a, b) and (c, d) shown below.

   ![](diagram)

17. Using your solutions from 16, find the distance between the point \((x_1, y_1)\) and the point \((x_2, y_2)\). Solutions written in this generic form are often called formulas.

18. Do you think your formula would work for any pair of points? Why or why not?
Let's revisit the video game. Draw a diagram of the game on a coordinate grid placing the bottom left corner at the origin.

19. Place John and Mary's tokens at the starting positions.

20. Write an ordered pair for John's token and an ordered pair for Mary's token when \( t = 0 \), when \( t = \frac{1}{2} \), when \( t = 1 \frac{1}{2} \), and when \( t = 2 \). (Hint: Charts can be used to organize your information.)

21. Find the distance between their tokens when \( t = 0 \), when \( t = \frac{1}{2} \), when \( t = 1 \frac{1}{2} \), and when \( t = 2 \).

22. Write an ordered pair for John and Mary's tokens at any time \( t \).
23. Write an equation for the distance between John and Mary's tokens at any time $t$.

24. Using a graphing utility, graph the equation you derived for the distance between the two tokens.

25. What does the graph look like? What are the characteristics of this graph?

26. What do the variables represent?

27. Recall that when John and Mary are between $\frac{1}{4}$ and $\frac{1}{2}$ inches apart, John may press the button to earn 10,000 points. What interval of time represents John's window of opportunity to score points?
1. The distance from point (-7, 2) to (3, -5) is:
   a. 5
   b. $\sqrt{149}$
   c. $\sqrt{109}$
   d. $\sqrt{145}$

2. What is the distance between (-3, 4) and (2, 7)?
   a. $\sqrt{34}$
   b. $\sqrt{74}$
   c. $2\sqrt{30}$
   d. $\sqrt{10}$

3. The distance between $(n, 4)$ and (-2, 7) is the $\sqrt{73}$. What is one possible value for $n$.
   a. -6
   b. 10
   c. 8
   d. -10

4. What is the distance between the origin and (-6, 8)?
   a. 10
   b. 2
   c. 14
   d. $\sqrt{28}$

\[ A = \pi r^2 \]
Mathematics I: Algebra/Geometry/Statistics
Assessing for Mathematics Success Training
Assessment Sample Items – Set 2

1. Given the center of a circle (2, –3) and a point on the circle (–1, –2), what is the length of the radius of the circle?
   a. 10
   b. 2
   c. 5.10
   d. 3.16

2. Find all points (4, y) that are 10 units from the point (–2, −1).
   a. (4, -11) and (4, 9)
   b. (4, -9) and (4, 7)
   c. (4, 8) and (4, -8)
   d. (4, 3) and (4, -3)

3. The coordinates of rectangle ABCD are A(0,2), B(4,8), C(7,6) and D(3,0).
   Which method would you use to show that the diagonals are equal in length?
   a. Find the midpoint of AC and BD.
   b. Find the slope of AC and BD.
   c. Find the distance from A to C and B to D.
   d. Find the distance from A to B and C to D.

4. Let A = (1, 5) and B = (3, -1). Point P(8, 4) is equidistant from A and B. Describe all such points.
   a. A line through P parallel to \( \overline{AB} \).
   b. Any line parallel to \( \overline{AB} \).
   c. A line through P that is the perpendicular bisector of \( \overline{AB} \).
   d. Any line perpendicular to \( \overline{AB} \).
Figure 1 Georgia Test Development Cycle

Stage 1

(1) Georgia school content specialists identify standards to be assessed on the assessment.

Stage 2

(2) Developers and Georgia educators create domains and test standards, and test blueprints.

Stage 3

(3) Develop item and test specifications.

(4) Develop test items for content areas

Stage 4

(5) Content specialists review test items internally, and Georgia educators review items.

Stage 4

(6) Content and psychometric specialists construct tests for approval by GaDOE and Georgia educators. ALIGNMENT

Stage 4

(7) GaDOE and Georgia educators review operational test forms and set standards

Stage 4

(8) Tests are administered, scored, reported, and developers perform post-test administration tasks.

Stage 4

(9) Psychometricians conduct data analysis. Georgia educators review data, statistics, DIF, and alignment.

Stage 4

(10) Items that meet requirements are added to operational bank to build new forms.
# MATHEMATICS

## Formulas
Below are formulas you may find useful as you work the problems. However, some of the formulas may not be used. You may refer to this page as you take the test.

<table>
<thead>
<tr>
<th><strong>Area</strong></th>
<th><strong>Volume</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rectangle/Parallelogram</td>
<td>Rectangular Prism/Cylinder</td>
</tr>
<tr>
<td>$A=bh$</td>
<td>$V=Bh$</td>
</tr>
<tr>
<td>Triangle $A= \frac{1}{2}bh$</td>
<td>Pyramid/Cone $V=\frac{1}{3}Bh$</td>
</tr>
<tr>
<td>Circle $A=\pi r^2$</td>
<td><strong>Surface Area</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Rectangular Prism</strong></td>
</tr>
<tr>
<td></td>
<td>$SA=2lw+2wh+2lh$</td>
</tr>
<tr>
<td></td>
<td><strong>Cylinder</strong></td>
</tr>
<tr>
<td></td>
<td>$SA=2\pi r^2 + 2\pi rh$</td>
</tr>
</tbody>
</table>

**Circumference** $C=\pi d$

**Mean Absolute Deviation**

$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$

$\Sigma_{i=1}^{n} |x_i - \bar{x}|$
Depth of Knowledge Levels

**Level 1** (Recall of Information) asks students to recall facts, terms, concepts, and trends or to recognize or identify specific information contained in graphics. This level generally requires students to identify, list, or define. The items at this level usually ask the student to recall who, what, when, and where. Items that require students to “describe” and/or “explain” could be classified at Level 1 or Level 2, depending on what is to be described and/or explained. A Level 1 “describe and/or explain” would require students to recall, recite, or reproduce information. Items that require students to recognize or identify specific information contained in documents, excerpts, quotations, maps, charts, tables, graphs, or illustrations are generally Level 1.

**Level 2** (Basic Reasoning) includes the engagement of some mental processing beyond recalling or reproducing a response. This Level generally requires students to: contrast or compare people, places, events, and concepts; convert information from one form to another; give an example; classify or sort items into meaningful categories; draw simple conclusions; or describe, interpret, or explain issues and problems, patterns, reasons, cause and effect, significance or impact, relationships, points of view, or processes. A Level 2 “describe and/or explain” would require students to go beyond a description or explanation of recalled information to describe and/or explain a result or “how” or “why.”

**Level 3** (Complex Reasoning) requires reasoning, using evidence, and a higher level of thinking than Level 1 and Level 2. Students will go beyond explaining or describing “how and why” to justifying the “how and why” through application and evidence. The cognitive demands at Level 3 are more complex and more abstract than Level 1 or Level 2. Items at Level 3 can include: drawing conclusions from multiple or complex stimuli; citing evidence; applying concepts to new situations; using concepts to solve problems; analyzing similarities and differences in issues and problems; proposing and evaluating solutions to problems; recognizing and explaining misconceptions; or making connections across time and place to explain a concept or “big idea.”

**Level 4** (Extended Reasoning) requires the complex reasoning of Level 3 with the addition of planning, investigating, or developing that will most likely require an extended period of time. The extended time period is not a distinguishing factor if the required work is only repetitive and does not require applying significant conceptual understanding and higher-order thinking. At this level the cognitive demands should be high and the work should be very complex. Students should be required to connect and relate ideas and concepts within the content area or among content areas in order to be at this highest level. The distinguishing factor for Level 4 would be evidence through a task or product that the cognitive demands have been met. A Level 4 performance will require students to analyze and synthesize information from multiple sources, examine and explain alternative perspectives across a variety of sources and/or describe and illustrate how common themes and concepts are found across time and place. In some Level 4 performance students will make predictions with evidence as support, develop a logical argument, or plan and develop solutions to problems.

Many on-demand assessment instruments will not include assessment activities that could be classified as Level 4. However, standards, goals, and objectives can be stated so as to expect students to perform thinking at this level. On-demand assessments that do include tasks, products, or extended responses would be classified as Level 4 when the task or response requires evidence that the cognitive requirements have been met.

Source: http://facstaff.wcer.wisc.edu/normw
<table>
<thead>
<tr>
<th>Level</th>
<th>Skills Demonstrated</th>
<th>Question Cues</th>
</tr>
</thead>
</table>
| Recall of Information | • Make observations  
  • Recall information  
  • Recognize formulas, properties, patterns, processes  
  • Know vocabulary, definitions  
  • Know basic concepts  
  • Perform one-step processes  
  • Translate from one representation to another  
  • Identify relationships | • Tell what, when, or where  
  • Find  
  • List  
  • Define  
  • Identify; label; name  
  • Choose; select  
  • Compute; estimate  
  • Express as  
  • Read from data displays  
  • Order |
| **Level 1**          | • Apply learned information to abstract and real life situations  
  • Use methods, concepts, theories in abstract and real life situations  
  • Perform multi-step processes  
  • Solve problems using required skills or knowledge (requires more than habitual response)  
  • Make a decision about how to proceed  
  • Identify and organize components of a whole  
  • Extend patterns  
  • Identify/describe cause and effect  
  • Recognize unstated assumptions, make inferences  
  • Interpret facts  
  • Compare or contrast simple concepts/ideas | • Apply  
  • Calculate; solve  
  • Complete  
  • Describe  
  • Explain how; demonstrate  
  • Construct data displays  
  • Construct; draw  
  • Analyze  
  • Extend  
  • Connect  
  • Classify  
  • Arrange  
  • Compare; contrast |
| **Level 2**          | • Solve an open-ended problem with more than one correct answer  
  • Create a pattern  
  • Generalize from given facts  
  • Relate knowledge from several sources  
  • Draw conclusions  
  • Make predictions  
  • Translate knowledge into new context  
  • Compare and discriminate between ideas  
  • Assess value of methods, concepts, theories, processes, formulas  
  • Make choices based on reasoned argument  
  • Verify the value of evidence, information, numbers, data | • Plan; prepare  
  • Predict  
  • Create; design  
  • Ask "what if?" questions  
  • Generalize  
  • Justify; explain why; support; convince  
  • Assess  
  • Rank; grade  
  • Test; judge  
  • Recommend  
  • Select  
  • Conclude |
| **Level 3**          |                                                                                     |                                                                               |
### Standards-Based Classrooms

**Concept:** Standards-Based Classrooms

<table>
<thead>
<tr>
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### High-Impact Practice Implementation Rubric: Standards-Based Classrooms

1. **Teaching:**
   - GPs are integrated into the lesson plan.
   - Evidence of learning is provided.
   - Feedback is given to students.
   - Students are engaged in the lesson.

2. **Lesson:**
   - Evidence of integration of GPs is provided.
   - Evidence of learning is provided.
   - Students are engaged in the lesson.
   - Feedback is given to students.

3. **Teacher:**
   - Evidence of integration of GPs is provided.
   - Evidence of learning is provided.
   - Students are engaged in the lesson.
   - Feedback is given to students.

---

A part of the process of growth and progress over time and should be evaluated.

This table for standards-based classrooms is an implementation rubric and is used in conjunction with the feedback loop. When a school is fully operational, they will continue to improve their performance addressed in the lesson and perform additional scoring of the impact. Implementation of standards-based classrooms is a process. Each phase of the rubric is

---

**High-Impact Practice Implementation Rubric: Standards-Based Classrooms**
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<th>Concept</th>
<th>Instructional Model</th>
<th>Operation</th>
<th>Evaluation</th>
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<td>Classroom instruction</td>
<td>Indirect feedback and presenta</td>
<td>Monitor the progress and provide feedback to the students and ask for more assessment and feedback</td>
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<tr>
<td>Teacher meets the needs of individual students</td>
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<td>Indirect feedback and presenta</td>
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<tr>
<td>Category</td>
<td>Description</td>
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<td></td>
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<tr>
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<td>-------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>World Situation</td>
<td>Students apply their understanding of the world to real-world scenarios. Teachers explain how the performance tasks make connections to other content areas and real-world situations.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performance</td>
<td>Students show evidence of the standards. They are working on tasks that require them to show performance. Teachers explain how the performance tasks are aligned with the standards.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evidence of Student</td>
<td>Students meet the standards at the next level. They are working on tasks that require them to show evidence of the standards. Teachers explain how the performance tasks are aligned with the standards.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concept</td>
<td>Examples of student work are provided to guide students. Work is provided to guide students in their work. Teachers do not have a checklist of performance standards. Students apply the standards to complete benchmark work.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Operational**

- Students apply their understanding of the world to real-world scenarios.
- Teachers explain how the performance tasks make connections to other content areas and real-world situations.
- Students show evidence of the standards. They are working on tasks that require them to show performance.
- Teachers explain how the performance tasks are aligned with the standards.
- Students meet the standards at the next level. They are working on tasks that require them to show evidence of the standards.
- Teachers explain how the performance tasks are aligned with the standards.
- Examples of student work are provided to guide students. Work is provided to guide students in their work. Teachers do not have a checklist of performance standards. Students apply the standards to complete benchmark work.

**Emergent**

- Students apply their understanding of the world to real-world scenarios.
- Teachers explain how the performance tasks make connections to other content areas and real-world situations.
- Students show evidence of the standards. They are working on tasks that require them to show performance.
- Teachers explain how the performance tasks are aligned with the standards.
- Students meet the standards at the next level. They are working on tasks that require them to show evidence of the standards.
- Teachers explain how the performance tasks are aligned with the standards.
- Examples of student work are provided to guide students. Work is provided to guide students in their work. Teachers do not have a checklist of performance standards. Students apply the standards to complete benchmark work.

**Not Addressed**

- Students apply their understanding of the world to real-world scenarios.
- Teachers explain how the performance tasks make connections to other content areas and real-world situations.
- Students show evidence of the standards. They are working on tasks that require them to show performance.
- Teachers explain how the performance tasks are aligned with the standards.
- Students meet the standards at the next level. They are working on tasks that require them to show evidence of the standards.
- Teachers explain how the performance tasks are aligned with the standards.
- Examples of student work are provided to guide students. Work is provided to guide students in their work. Teachers do not have a checklist of performance standards. Students apply the standards to complete benchmark work.
<table>
<thead>
<tr>
<th>Standard(s)</th>
<th>Understanding of the standards</th>
<th>Assessments and performance standards</th>
<th>Student work reflects student understanding and evidence of learning</th>
<th>Teacher's influence on student understanding of the Georgia Performance Standards</th>
<th>Teacher's influence on student understanding of the Georgia Performance Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Students are responsible for their understanding of the standards.</td>
<td>Students identify their next steps. Teachers identify their next steps.</td>
<td>Teachers assess their performance standards.</td>
<td>Student work reflects understanding of the standards.</td>
<td>Teachers assess their performance standards.</td>
<td>Student work reflects understanding of the standards.</td>
</tr>
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<td>2. Teachers are responsible for their understanding of the standards.</td>
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