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!!!

Strengthening Student Achievement and Motivation in Your Math Classes, David R. Johnson, BER, p.10

Overview of the Day

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

The Essential Questions

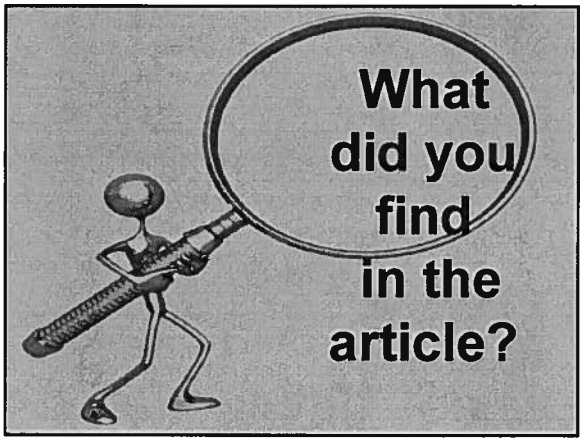
- How are we really using assessment?
- What are the overarching topics in Mathematics I?
- How do the tasks in the frameworks address these ideas?
- How is the EOCT constructed and scored?

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)



Mathematics I: Algebra /Geometry/Statistics

Performance Standards

- 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

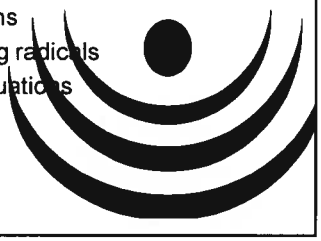
5, 7, 9, 11, …

- In Mathematics I, students are introduced to the closed (explicit) formula:

$$f(n) = 2n + 3$$

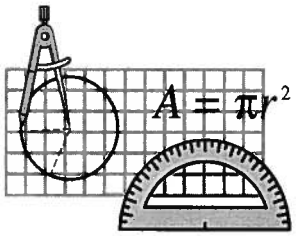
Mathematics I: Algebra/Geometry/Statistics

- 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

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!

- 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 (-7,2) to (3,-5) is:
   a. 5
   b. $\sqrt{145}$
   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. 6
   d. -10

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

Sample Assessment Items – Set 2

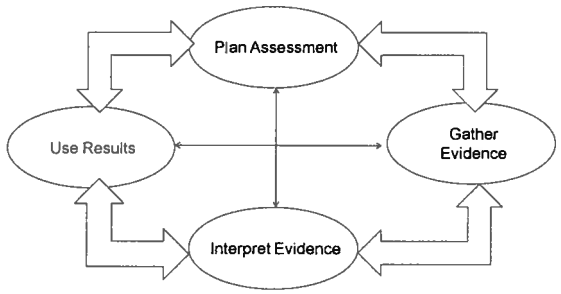
1. Given the center of a circle (2, –3) and a point on the circle (–1, –2), what is the length of the radius of the circle?
a. 10
b. 2
c. 5.10
d. 3.16

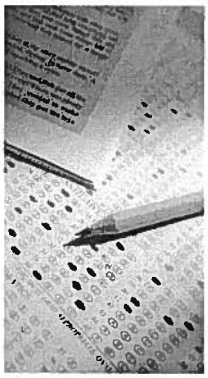
2. Find all points $(4, y)$ that are 10 units from the point (–2, –1).
a. (4, –11) and (4, 9)
b. (4, –9) and (4, 7)
c. (4, 8) and (4, –8)
d. (4, 3) and (4, –3)

3. The coordinates of rectangle ABCD are A(0,2), B(4,8), C(7,5) and D(3,0).
Which method would you use to show that the diagonals are equal in length?
a. Find the midpoint of $\overline{AC}$ and $\overline{BD}$.
b. Find the slope of $\overline{AC}$ and $\overline{BD}$.
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 $\overline{AB}$.

Informed Instruction





EOCT

for

Mathematics I

Algebra/Geometry/Statistics

How is the test constructed?

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

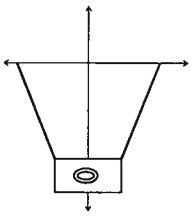
- Based on the rigor of our Georgia Performance Standards Mathematics Curriculum,
- 55% of the questions on the test must be at DOK 2 or above.

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 site 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

So, how are we doing so far?

GPS Implementation and Testing

Subject (Grade 3)	QCC ⇨ GPS	GPS ⇨ GPS
Reading	92 ⇨ 83 = -9	83 ⇨ 85 ⇨ 87 = +4
English/Lang. Arts	87 ⇨ 82 = -5	82 ⇨ 86 ⇨ 87 = +5
Math	90 ⇨ 71 = -19	NA
Science	85 ⇨ 70 = -15	70 ⇨ 75 = +5

Subject (Grade 4)	QCC ⇨ GPS	GPS ⇨ GPS
Reading	87 ⇨ 81 = -6	81 ⇨ 85 ⇨ 87 = +6
English/Lang. Arts	84 ⇨ 79 = -5	79 ⇨ 84 ⇨ 86 = +7
Math	78 ⇨ 70 = -8	NA
Science	88 ⇨ 72 = -16	72 ⇨ 74 = +2

WE WILL LEAD THE NATION IN IMPROVING STUDENT ACHIEVEMENT

GPS Implementation and Testing

Subject (Grade 5)	QCC ⇨ GPS	GPS ⇨ GPS
Reading	89 ⇨ 81 = -8	81 ⇨ 85 ⇨ 87 = +6
English/Lang. Arts	88 ⇨ 85 = -3	85 ⇨ 88 ⇨ 90 = +5
Math	88 ⇨ 72 = -16	NA
Science	89 ⇨ 67 = -22	67 ⇨ 71 = +4

Subject (Grade 6)	QCC ⇨ GPS	GPS ⇨ GPS
Reading	84 ⇨ 87 = +3	87 ⇨ 89 ⇨ 91 = +4
English/Lang. Arts	76 ⇨ 84 = +8	84 ⇨ 86 ⇨ 87 = +3
Math	74 ⇨ 62 = -12	62 ⇨ 65 ⇨ 70 = +8
Science	83 ⇨ 61 = -22	61 ⇨ 60 ⇨ 66 = +5
Social Studies	***83 ⇨ 29 = -54***	NA

WE WILL LEAD THE NATION IN IMPROVING STUDENT ACHIEVEMENT

GPS Implementation and Testing

Subject (Grade 7)	QCC ⇨ GPS	GPS ⇨ GPS
Reading	87 ⇨ 80 = -7	80 ⇨ 85 ⇨ 88 = +8
English/Lang. Arts	84 ⇨ 83 = -1	83 ⇨ 88 ⇨ 89 = +6
Math	81 ⇨ 74 = -7	74 ⇨ 80 = +6
Science	84 ⇨ 63 = -21	63 ⇨ 70 ⇨ 75 = +12
Social Studies	***86 ⇨ 24 = -62***	NA

Subject (Grade 8)	QCC ⇨ GPS	GPS ⇨ GPS
Reading	83 ⇨ 90 = +7	90 ⇨ 89 ⇨ 91 = +1
English/Lang. Arts	80 ⇨ 87 = +7	87 ⇨ 88 ⇨ 89 = +2
Math	81 ⇨ 62 = -19	NA
Science	74 ⇨ 60 = -14	NA
Social Studies	85 ⇨ 59 = -26	NA

WE WILL LEAD THE NATION IN IMPROVING STUDENT ACHIEVEMENT

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!

Mathematics	2008 Percent Meeting or Exceeding	2006-2008 Gains
Grade 6	69%	+7
		2007-2008 Gains
Grade 1	86%	+3
Grade 2	85%	+4
Grade 7	80%	+6

WE WILL LEAD THE NATION IN IMPROVING STUDENT ACHIEVEMENT

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

African-American	2006	2007	2008	Decrease since GPS
Grade 1	-	16	12	4
Grade 2	-	18	15	3
Grade 6	27	27	23	4
Grade 7	-	22	17	5

Hispanic	2006	2007	2008	Decrease since GPS
Grade 1	-	17	11	6
Grade 2	-	16	10	6
Grade 6	20	20	14	6
Grade 7	-	15	10	5

WE WILL LEAD THE NATION IN IMPROVING STUDENT ACHIEVEMENT

Mathematics Achievement Gap

Change in Percent Meeting and Exceeding Standards

Mathematics *(2006-2008 Change)*	All Students	English Language Learner	Students with Disabilities
Grade 6	+7	+11	+6
Mathematics *(2007-2008 Change)*	**All Students**	**English Language Learner**	**Students with Disabilities**
Grade 1	+4	+10	+4
Grade 2	+4	+14	+3
Grade 3	NA	NA	NA
Grade 4	NA	NA	NA
Grade 5	NA	NA	NA
Grade 7	+6	+9	+7
Grade 8	NA	NA	NA

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

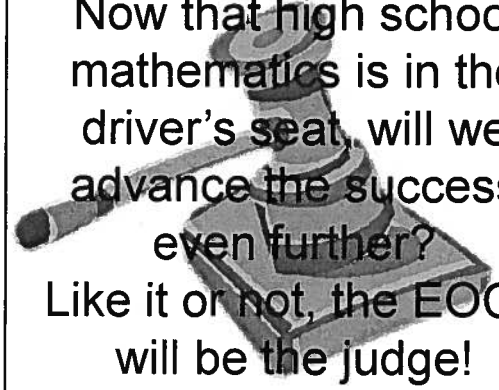
We Raised the Bar

And
the scores prove
our students

CAN

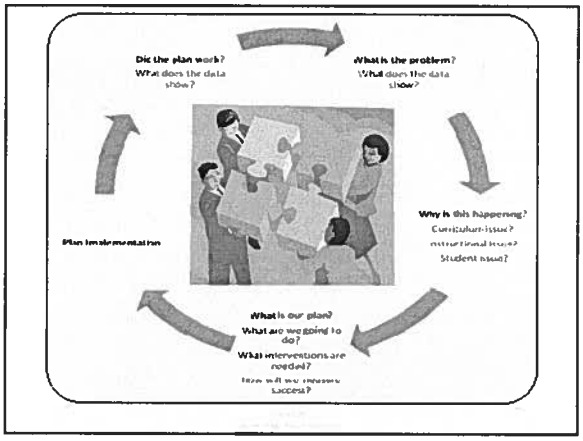
meet the
challenge!

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?

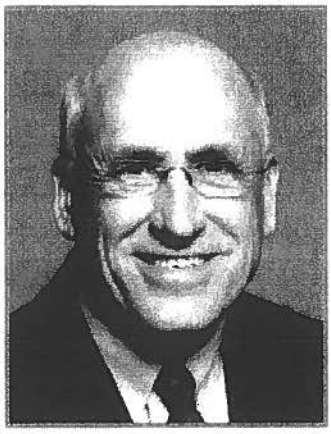
- ❑ The Learning Village
- ❑ Frameworks – Teacher Editions
- ❑ Monthly Elluminates
- ❑ Coach Books
- ❑ Parent Letters
- ❑ EOCT Study Guides
- ❑ Communication with GaDOE Mathematics Team

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.

Originally published in the *NCTM News Bulletin* (December 2006).

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.

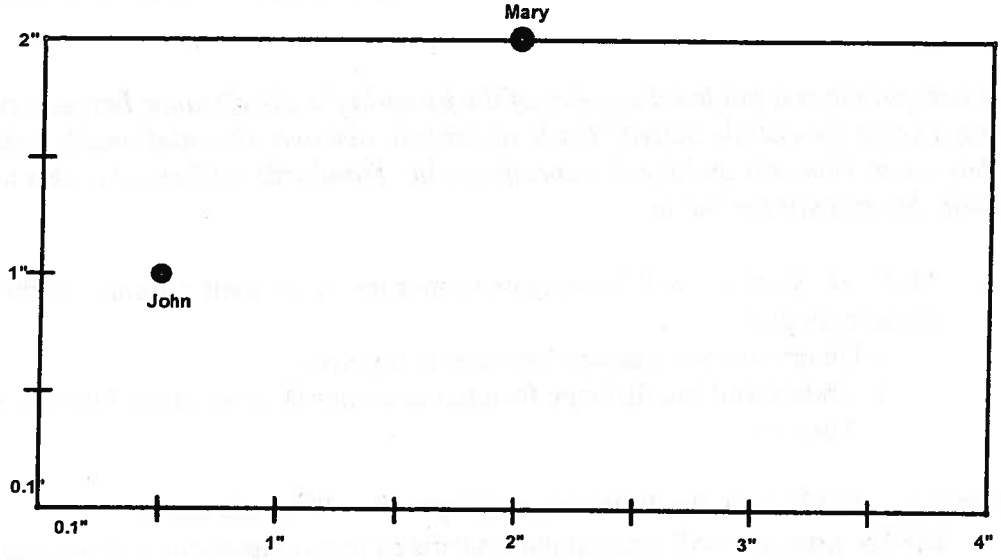
This task reinforces concepts learned throughout Math I.

Supplies Needed:

- *Centimeter graph paper*
- *Rulers*
- *Some type of graphing utility.*

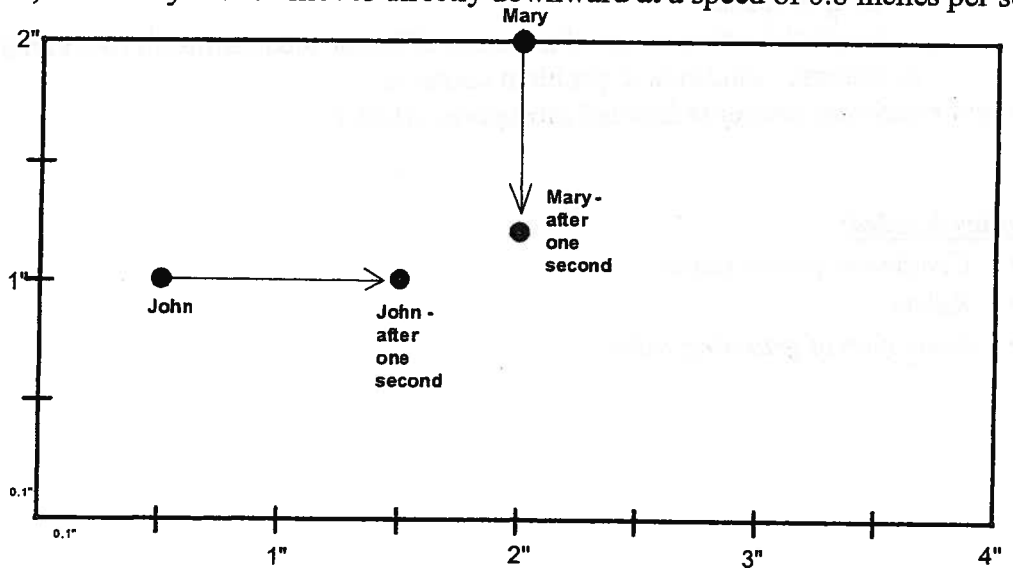
Video Game Learning Task

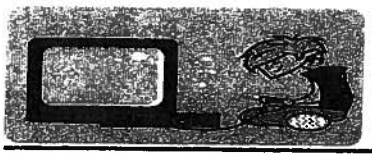
John and Mary are fond of playing retro style video games on hand held game machines. They are currently playing a game on a device that has a screen that is 2 inches high and four inches wide. At the start, John's token starts ½ inch from the left edge and half way between the top and bottom of the screen. Mary's token starts out at the extreme top of the screen and exactly at the midpoint of the top edge.



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 0.1inches 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.





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 $t = ¼$, $t = 1/2$, $t = 1$, 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 $t = 0$, $t = ¼$, $t = 1/2$, $t = 1$.

If Mary's token gets closer than ¼ 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 1/2 inch apart and more than ¼ 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.

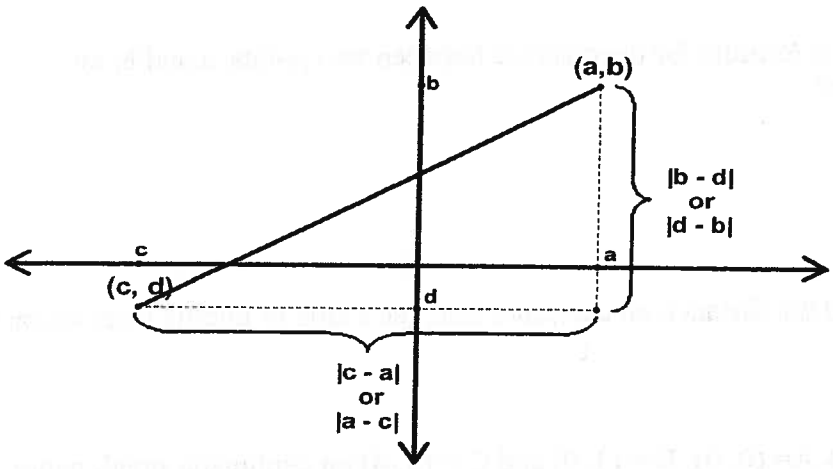
13. Find the distance from the point (0, 0) to the point (3, 4) using a ruler.

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.



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 = ½, when t = 1 ½, 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 = ½, when t = 1 ½, 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 ¼ and ½ 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?

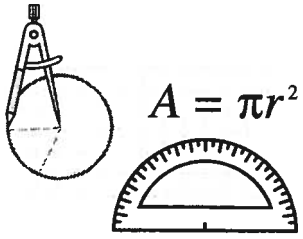
Mathematics I: Algebra/Geometry/Statistics
Assessing for Mathematics Success Training
Sample Assessment Items – Set 1

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. $\sqrt{28}$



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 $\overline{AC}$ and $\overline{BD}$.
   b. Find the slope of $\overline{AC}$ and $\overline{BD}$.
   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 $\overline{AB}$.

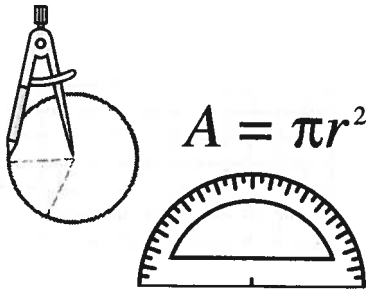
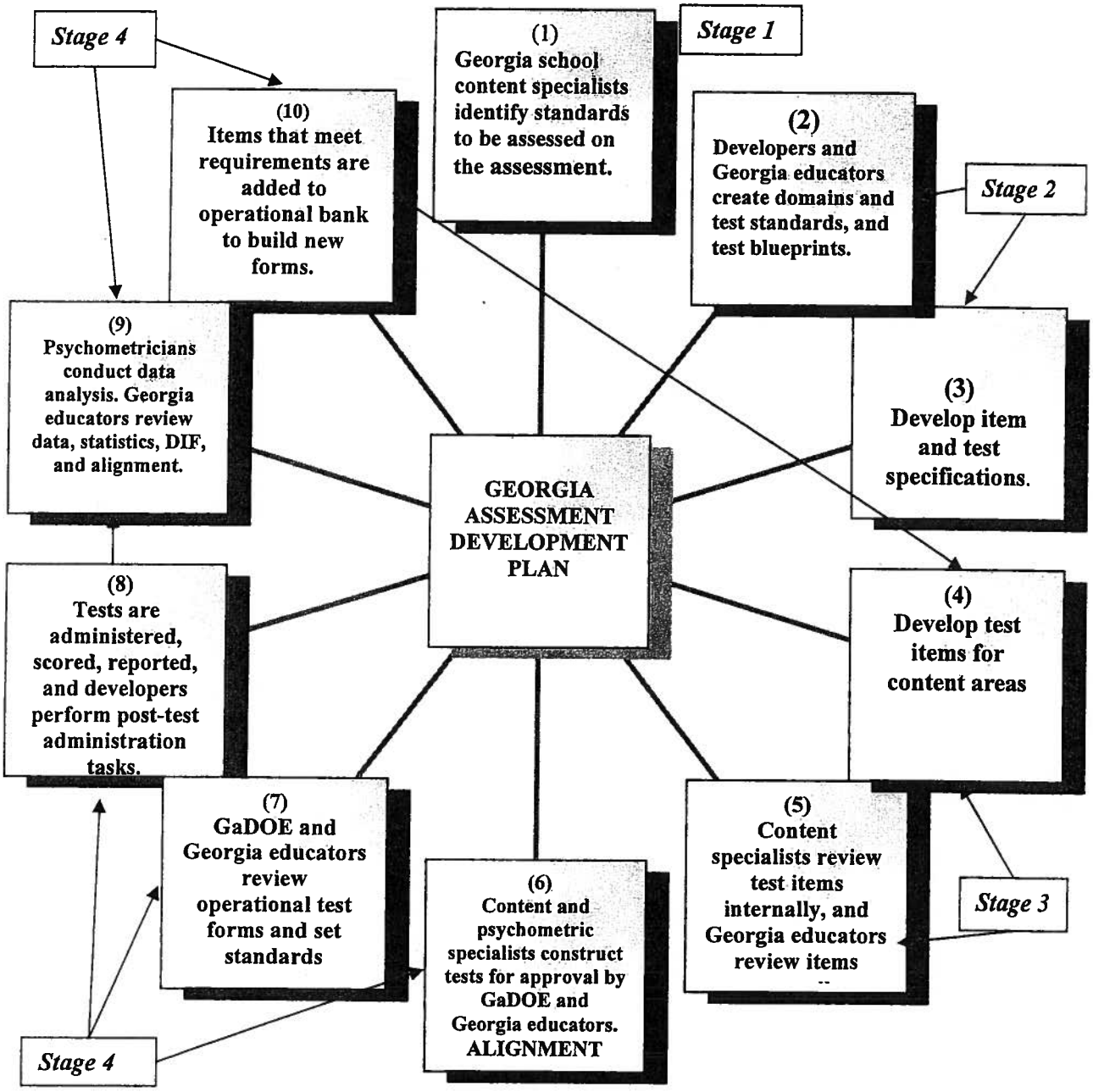


Figure 1 Georgia Test Development Cycle



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.

Area

Rectangle/Parallelogram
$A=bh$

Triangle $A= \frac{1}{2}bh$

Circle $A=\pi r^2$

Circumference

$C=\pi d$

$\Pi=3.14$

Volume

Rectangular Prism/Cylinder
$V=Bh$

Pyramid/Cone $V=\frac{1}{3}Bh$

Surface Area

Rectangular Prism
$SA=2lw+2wh+2lh$

Cylinder $SA=2\pi r^2 + 2\pi rh$

Mean Absolute Deviation

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

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

Level	Skills Demonstrated	Question Cues
Recall of Information **Level 1**	• 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
Basic Reasoning **Level 2**	• 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
Complex Reasoning **Level 3**	• 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

High Impact Practice Implementation Rubric: Standards-Based Classrooms

This rubric for standards-based classrooms is an implementation rubric and each column builds on the previous column. When a school is fully operational, they will continue to implement criteria addressed in the emergent and operational columns of the rubric. Implementation of standards-based classrooms is a process. Each stage on the rubric is a part of the process of growth and progress over time and should be celebrated.

Standards-Based Classrooms				
Concept	**Not Addressed**	**Emergent**	**Operational**	**Fully Operational**
1. The Georgia Performance Standards are utilized as the curriculum in the school (based on the phase-in plan), and there is a shared understanding of the standards.	Teaching is often driven solely by the textbook (or other resources) or is performance activities-based but unaligned with the GPS.	Curriculum documents are developed to support implementation of the GPS, using textbooks as a resource.	Teachers work together to build consensus on what students are expected to know, understand, and be able to do and plan instruction based on the GPS.	Teachers utilize the GPS to collaboratively plan for instruction and assessment. Teachers and students articulate a common understanding of what they are expected to know, understand, and be able to do based on the Georgia Performance Standards.
2. Standards are accessible to all students.	Teachers do not explain the purpose of the lesson or articulate the expectations for student work. Visual cues and other strategies to make the standards accessible are not evident.	Teachers use a variety of strategies to make the standards accessible to students such as paraphrasing, repetition, visual cues, essential questions, etc. Teachers do not explicitly state the standard(s) being addressed during a lesson.	Teachers use the language of the standards during instruction as well as when they provide feedback to students. Teachers provide students with models and provide specific examples of how the work meets standards. Students explain the standards in their own words. Students can articulate the standards and elements they are currently working on and show evidence of the standards in their work.	Teachers expect students to use the language of the standards to describe their work. Students use the language of the standards to support their work and their answers. Students use the language of the standards when they provide feedback to other students.
3. Teachers sequence the lesson or their instruction in a logical, predictable manner referencing standards throughout.	There is not an agreed upon school-wide instructional framework or sequence for instruction.	Teachers implement a common instructional framework or sequence of lessons. (e.g., opening, work session, closing)	Teachers implement a sequence of instruction or instructional framework that provides opportunities for students to receive explicit instruction connected to the standards, apply learning independently and collaboratively, share and explain their work as it relates to the standards, and receive feedback based on the standards.	Teachers expect students to explain the standards and/or elements they are applying during the sequence of instruction or instructional framework. Students can explain the sequence of instruction and how they apply the standards and elements to the resulting work.

Concept	Not Addressed	Emergent	Operational	Fully Operational
4. A variety of delivery modes are incorporated into instruction to ensure that all students have access to and meet standards.	Teachers use lecture as the predominant mode of instruction assuming the responsibility of "imparting" knowledge and "covering" the curriculum.	Teachers use a variety of delivery modes including modeling, demonstration, small-group instruction, whole group instruction, one-on-one instruction, etc. but still assume the responsibility of "imparting" knowledge and "covering" the curriculum.	Teachers use a variety of delivery modes to ensure mastery of the standards (e.g., extended time, additional support, etc.) rather than impart knowledge. Students can explain different grouping options typically used in the class. Students transition smoothly from one activity to another.	Teachers can explain the specific purposes of how students are divided into work groups and can articulate the data that led to the flexible groups. The delivery modes observed support the learning goals of the lesson and students' needs. All students make progress toward meeting standards and apply new knowledge to real-world tasks.
5. Students are expected to meet the same standards and instruction is differentiated by content, process, and/or product.	Content is present in the same way to all students regardless of readiness levels, learning styles, and/or student interests. Teachers make a single plan for all learners.	Teachers use summative assessments to determine students in need of support. Teachers assign students to interventions outside of the regular classroom instructional time.	Teachers use summative and formative assessments to systematically and purposefully plan for student differences. Classroom instruction is tailored to student readiness levels, learning styles, and interests to ensure that students meet the same standards. Students show mastery of standards in a variety of ways.	Teachers monitor student progress to revise content (how students are given access to the standards), process (how students learn and apply the standards) and product (how students demonstrate their understanding of the standards). Teachers revise content, process, and product as necessary. Although the content, process, and product may differ for students they can explain how their work meets standard(s).
6. Assessments are aligned to the GPS and used frequently to adjust instruction and provide students with feedback.	Assessment is typically summative in nature and used to assign grades.	Teachers use summative assessments aligned to the standards. These assessments are analyzed to identify students in need of additional instruction.	Teachers utilize formative assessments frequently which are directly aligned to the standards and lead to revision of instruction as well as specific feedback to students. Examples include: rubrics; conferencing; questioning; observations; written reflections (e.g. 3-2-1, KWL, ticket out the door, etc.); graphic representations of thinking; etc. Summative assessments are utilized to identify students in need of additional instruction or interventions and to revise classroom instruction.	Teachers collaborate regularly to develop common formative and summative assessments. They use the results from the assessments to revise common assessments and instructional plans. Students utilize summative and formative assessment results to set learning goals toward meeting standards.

Concept	Not Addressed	Emergent	Operational	Fully Operational
7. Examples of student work are displayed for student use. Benchmarks are provided to gauge progress over time. Exemplars are provided to exemplify the standards.	Teachers do not have a collection of benchmark (anchor papers) or exemplary student work.	Teachers collect examples of local and national benchmark and exemplary student work. Teachers post examples of student work. The benchmarks demonstrate progress toward meeting the standards. The exemplary work shows expected levels of rigor as defined in the standards.	Teachers explain how the exemplary work meets standards and refer to it frequently during the sequence of instruction or instructional framework. Teachers explain how a set of benchmark work displays progress over time toward the standards. Teachers explicitly teach students how to compare their work to the benchmark work to identify next steps. Students can explain how they use benchmark and exemplary student work to improve their own work.	Teachers collect benchmark work and exemplars from their own class. Students identify where their work falls in relation to the benchmarks. Students identify exemplars from their own collections of work and describe their work based on the standards. Students can identity next steps toward meeting standards and revise accordingly.
8. Student performance tasks require students to show progress toward meeting the standard(s)/element(s).	Students are not demonstrating progress towards standards in performance tasks. Rather, they are passive selectors of correct answers.	Teachers design performance tasks that require students to show evidence of the standards.	Teachers collaboratively analyze common performance tasks to ensure rigor and revise tasks as needed. Students can explain how performance tasks show evidence of the standards they are working on.	Teachers ensure that performance tasks make connections to other content areas and real world situations. Students apply their understanding of the standards to other content areas and real-world situations.

Concept	Not Addressed	Emergent	Operational	Fully Operational
9. Students receive feedback through written or verbal commentary aligned with the standards that results in revision of work, if needed.	Feedback is limited to evaluative judgments such as, "That is right," "That is incorrect," "80%," "Great job," etc.	Teachers provide feedback that extends evaluative judgments but does not connect to the standards. For example, *That is incorrect because you forgot to move the decimal point.*	Teacher feedback is directly aligned to the standards and provides students with specific strengths and next steps. For example, *You develop your character by using literary language when you said, "he had orange hair like wire...Good writers help the reader to feel satisfied when the story ends. They do this by providing a sense of closure. A next step for you as a writer would be to provide closure to your writing.* Students identify how their work meets standards based on teacher feedback.	Teachers encourage students to revise their work as a result of feedback from teachers and peers. Teachers expect students to use the language of the standards when describing their work, providing feedback to peers, and identifying next steps. Students use the language of the standards as they discuss their work and explain teacher feedback. Students identify their next steps based on teacher feedback. Students can show a piece of student work and describe how it was revised to meet standards based on teacher feedback. Students provide feedback to peers that is directly aligned to standards.
10. Student work reflects understanding of the Georgia Performance Standards.	Teachers independently determine what students should know, understand, and be able to do with little or no relation to the Georgia Performance Standards. Student work does not represent student understanding of the standard(s).	Teachers collaboratively identify what students should know, understand and be able to do relative to the Georgia Performance Standards and design instruction and assessments accordingly.	Teachers collaboratively analyze student work based on the Georgia Performance Standards. Based on collaborative analysis of student work, teachers revise instruction. As a result of revised instruction, students revise their work to reflect their understanding of the standards.	Teachers have collaboratively aligned assessments and instruction to the GPS. Students analyze the quality of their own work and articulate why it meets, exceeds, or does not meet standards. Students identify their own next steps towards meeting standards.