The Georgia Performance Standards for K-12 Mathematics

Kathy Cox

State Superintendent of Schools

Assessing for Mathematics Success

Grade 8 Mathematics CRCT

1

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

2

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

3

Overview of the Day

- **BIG ideas in Grade 8 Mathematics**
- **The CRCT**
- **Instruction that puts it all together**

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The Essential Questions

- What are the overarching topics in Grade 8 Mathematics?
- How do the tasks in the frameworks address these ideas?
- How is the CRCT constructed and scored?
- How are we really using assessment?

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Let's take a look at NCTM former President Skip Fennell's view in his message:

Go Ahead, Teach to the Test!

NCTM *News Bulletin* (December 2006).

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What does this mean in OUR classrooms?

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Grade 8 Mathematics

- Numbers and Operations
  - Square roots
  - Integer exponents
  - Scientific notation

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Grade 8 Mathematics

- Algebra of Linear Functions
  - Relations and functions
  - Linear equations and inequalities
  - Systems of linear equations and inequalities

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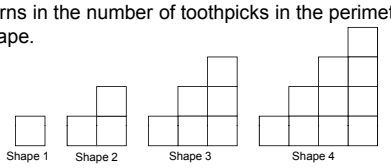
Building Toothpicks

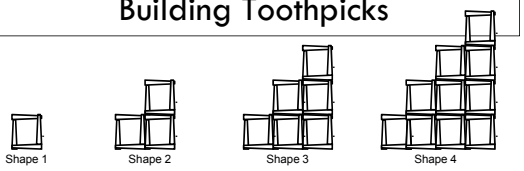
The shapes shown below are made with toothpicks. Look for patterns in the number of toothpicks in the perimeter of each shape.



1.Use a pattern from the shapes above to determine the perimeter of the fifth shape in the sequence. Show or explain how you arrived at your answer.

2.Write a formula that you could use to find the perimeter of any shape *n*. Explain how you found your formula.

Building Toothpicks

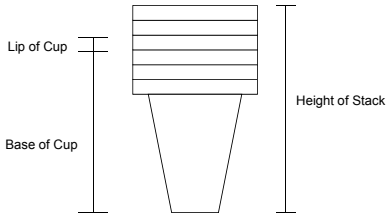


Shape #	1	2	3	4	5	*n*
Perimeter	4	8	12	16	20	4*n*

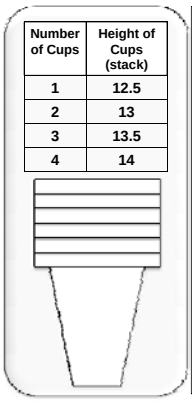
Paper Cups

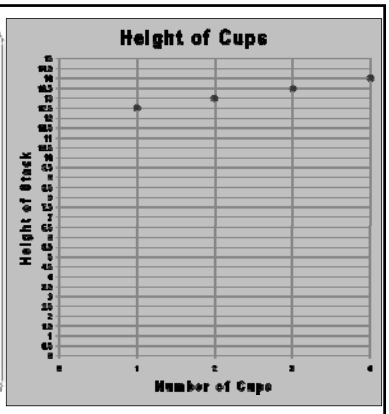
You will be given a stack of identical paper cups similar to those shown in the picture below. The paper cups shown here are identical. By making appropriate measurements, you are to represent the relationship between the number of cups in a stack and the height of the stack using a table, a coordinate graph, a formula and a written description.

In the case of each representation, discuss the advantage of that representation over the other three



Number of Cups	Height of Cups (stack)
1	12.5
2	13
3	13.5
4	14





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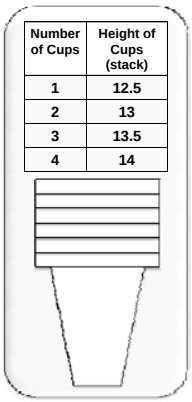


height = 12 + 0.5 (number of cups)

$h = 12 + 0.5n$

The number of cups that fit on an 60" shelf:

$60 = 12 + 0.5n$

$60 - 12 = 0.5n$

$48 = 0.5n$

$96 = n$

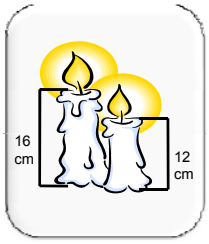
The height of 18 cups:

$h = 12 + 0.5(18)$

$h = 12 + 9$

$h = 21$

Cara's Candles



Time (hr)	Height (16 cm candle)	Height (12 cm candle)
0	16	12
1	13.5	10.5
2	11	9
3	8.5	7.5
4	6	6
5	3.5	4.5

16 cm Candle

$h = 16 - 2.5t$ or $h = -2.5t + 16$

12 cm Candle

$h = 12 - 1.5t$ or $h = -1.5t + 12$

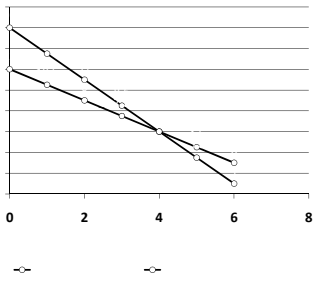
16 cm Candle

$h = 16 - 2.5t$ or $h = -2.5t + 16$

12 cm Candle

$h = 12 - 1.5t$ or $h = -1.5t + 12$

Time (hr)	Height (16 cm candle)	Height (12 cm candle)
0	16	12
1	13.5	10.5
2	11	9
3	8.5	7.5
4	6	6
5	3.5	4.5



Substitution method:

16 cm Candle

$h = 16 - 2.5t$ or $h = -2.5t + 16$

12 cm Candle

$h = 12 - 1.5t$ or $h = -1.5t + 12$

$$h = 16 - 2.5t$$
$$h = 12 - 1.5t$$

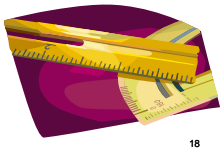
$$\begin{array}{rcl} 12 - 1.5t & = & 16 - 2.5t \\ -12 & & = -12 \end{array}$$

$$\begin{array}{rcl} -1.5t & = & 4 - 2.5t \\ +2.5t & = & +2.5t \end{array}$$

$$t = 4$$

Grade 8 Mathematics

- Geometry
  - Parallel and perpendicular lines
  - Congruence
  - Pythagorean Theorem



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Grade 8 Mathematics

- Data Analysis and Probability
  - Set theory
  - Simple counting techniques
  - Simple and compound independent events
  - Line of best fit

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A Thought

- Develop ideas and concepts with skills embedded
- Work to maintain the balance between skills, concepts, and problem solving while developing students' understanding of how and why
- Not doing the same old mathematics rearranged
- Instead, changing the way we think about mathematics as we transition students to algebraic thinking
- These are ***NON-NEGOTIABLES***

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Performance Standards

- Content and process standards
- Tasks
- Student work
- Commentary

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A Task, Of Course!

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- What skills and concepts are the students building in this task?
- What would an assessment question be that addressed the skills?
- What would an assessment question be that addressed the concepts?
- Could you do both at once, in context?

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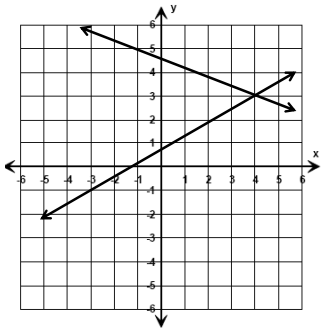
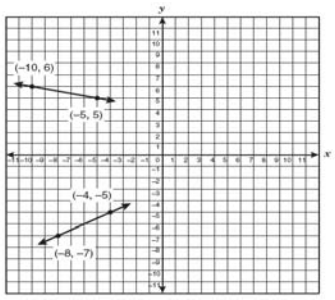
The graph of a system of equations is shown below.



What is the solution to this system of linear equations?

24

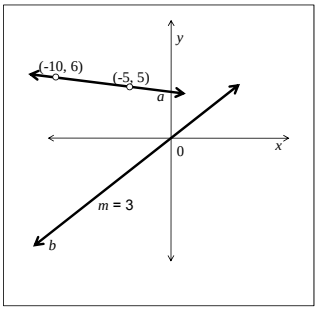
The graph of a system of equations is shown below.



What is the solution to this system of linear equations?

25

The graph of a system of equations is shown below.



Write an equation for the line that is perpendicular to line ***a*** and contains the solution to the system of equations shown on the graph.

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Which item requires a greater understanding of linear functions?

1. Given a slope of 5 and a *y*-intercept of 3, write the equation of the line.

OR

2. A company that produces pens has *n* pens in stock at the beginning of a certain day. It produces these pens at a constant rate *r* for the entire day. If that day, pens have been produced at a greater constant rate, write an equation that can be used to determine the number of pens the company has in stock at the end of that day.

Using Assessment to Plan Instruction

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CRCT

for

8th Grade Mathematics

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How is the test constructed?

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How many questions?

QCC CRCT	60	
	field test	12
	active	72
GPS CRCT	60	
	field test	12
	active	72

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How are the three strands weighted?

- Numbers and Operations 22%
- Algebra 50%
- Geometry 12%
- Data Analysis and Probability 17%

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So, let's do some MATH

How many in each strand?

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Curriculum Map

Georgia Performance Standards: Grade 8 Curriculum Map							
1st 9 weeks		2nd 9 weeks		3rd 9 weeks		4th 9 weeks	
Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8
5 weeks	4 weeks	4 weeks	5 weeks	5 weeks	4 weeks	4 weeks	5 weeks
Outcomes and Likelihoods	The Powers That Be	Equal or Not	Functional Relationships	Slippery Slope	Traversing Congruency	Systems	Show What We Know
D2, D3	N1, G2	A1, A2	A3, D1	A3, A4, D4	G1	A5	
All units will include skills to maintain and the Process Standards.							

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How are the questions categorized?

Questions are coded by DOK
Depth
Of
Knowledge

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- 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.

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MS CRCT Formula Sheet

Area

Rectangle and Parallelogram $A = bh$

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

Circle $A = \pi r^2$

Volume

Rectangular Prism/Cylinder $V = Bh$

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

Circumference

$C = \pi d$ $\pi \approx 3.14$

Surface Area

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

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

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So, how are we doing so far?

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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 39

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 40

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

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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!

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 42

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.

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

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

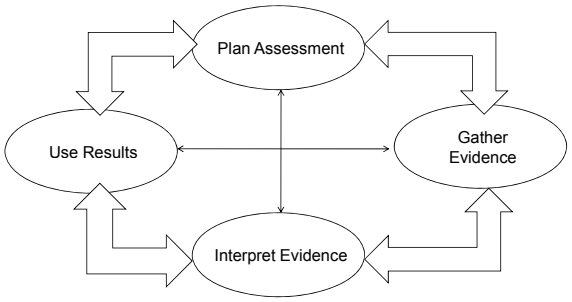
Eighth Grade CRCT Results

- 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!

Informed Instruction



Response to Intervention

…is defined as the

process of aligning appropriate assessment with purposeful instruction for all students.

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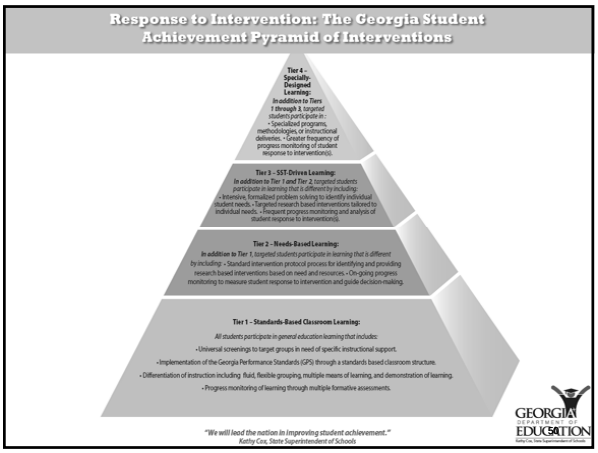

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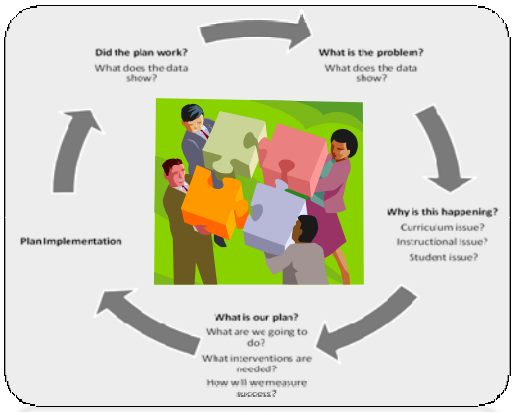

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Tier 1 Non-negotiables

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.

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Can We Really Do This?

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Thank you!

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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. Ω

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

1 New Message

Anthony and Katlyn each requested a new cell phone for their birthday. Now, their parents need to decide between wireless companies. Both companies offer basic plans, which include a limited number of text messages. Eagle Company charges $20 for the first 200 text messages and $0.10 for each additional text message. Rockwell Company charges $5 for the first 150 text messages and $0.20 for each additional text message. Which wireless company should Anthony's and Katlyn's parents choose?

Part 1:

Use the information from Eagle Company to answer the questions in part 1.

1. What is the cost for 130 text messages?

2. What is the cost for 201 text messages?

3. What is the cost for 205 text messages?

4. What is the cost for 210 text messages?

5. What is the cost for 224 text messages?

6. Write an equation that represents the total cost, C, in terms of *x* text messages.

Part 2:

Use the information from Rockwell Company to answer the questions in part 2.

7. What is the cost for 30 text messages?

8. What is the cost for 151 text messages?

9. What is the cost for 155 text messages?

10. What is the cost for 160 text messages?

11. What is the cost for 174 text messages?

12. Write an equation that represents the total cost, C, in terms of *x* text messages.

Part 3:

13. Sketch a graph of both cost equations on the same grid.

14. Using the graph, describe when both wireless companies charge the same amount for text messages.

15. Use the algebraic rules to determine when both wireless companies charge the same amount for text messages.

Part 4:

16. When is Eagle Company's cost for text messages cheaper than Rockwell Company's cost for text messages? Justify your answer using a graph, a table, and the algebraic rules.

17. When is Rockwell Company's cost for text messages cheaper than Eagle Company's cost for text messages? Justify your answer using a graph, a table, and the algebraic rules.

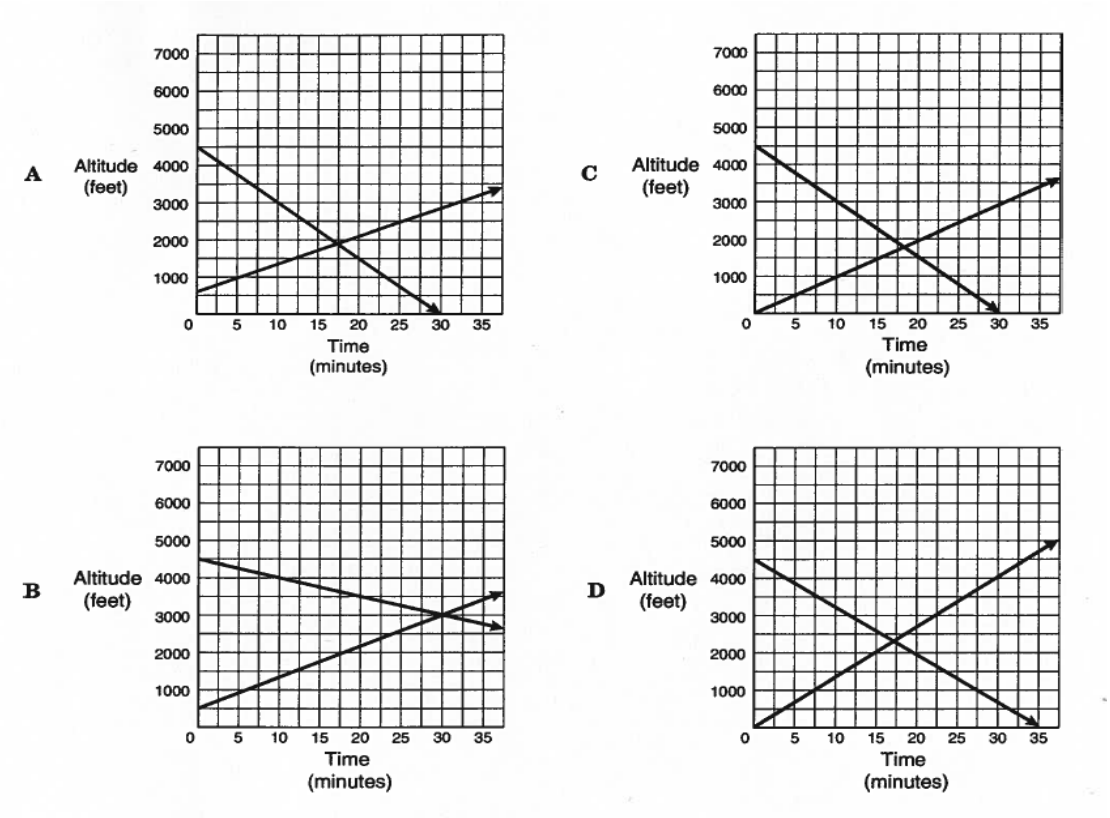
18. Which wireless company should Anthony's and Katlyn's parents choose? Explain your reasoning.

No. of Text Messages	No. of Text Messages over 200	Cost
130		
201		
205		
210		
224		
x		

No. of Text Messages	No. of Text Messages over 150	Cost
30		
151		
155		
160		
174		
x		

Eighth Grade Assessment Sample Items
Assessing for Success Training
Fall 2008

1. At the Dallas-Fort Worth International Airport, a DC-10, at 4500 feet, is descending toward the east runway at a rate of 150 feet per minute, and a 727, at 600 feet, is climbing at a rate of 75 feet per minute. Which graph shows when the two planes will be at the same altitude?



2. At a restaurant the cost of a breakfast taco and a small glass of milk is \$2.10. The cost for 2 tacos and 3 small glasses of milk is \$5.15. Which pair of equations can be used to determine t, the cost of a taco, and m, the cost of a small glass of milk?

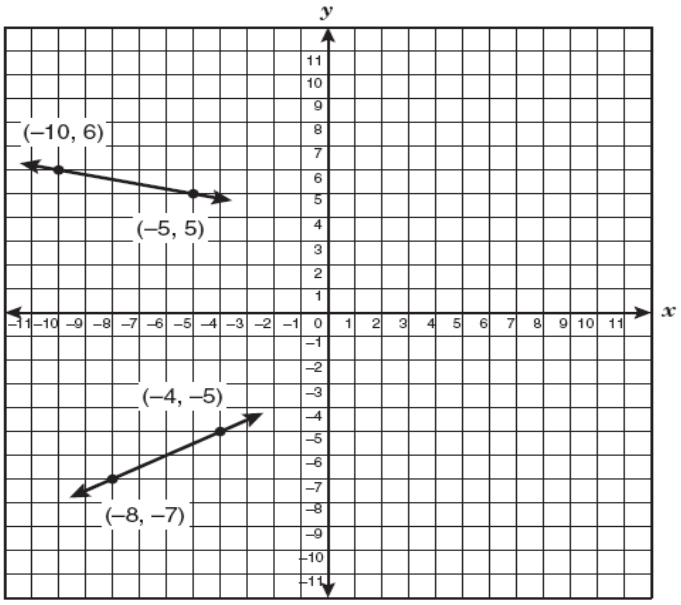
A. $t + m = 2.10$
$2t + 2m = 5.15$

B. $t + m = 2.10$
$3t + 3m = 5.15$

C. $t + m = 2.10$
$3t + 2m = 5.15$

D. $t + m = 2.10$
$2t + 3m = 5.15$

3. The graph of a system of equations is shown below.



Which of the following is the solution to this system of linear equations?

A. (0, 4) B. (8, 1) C. (0, -3) D. (10, 2)

4. The price, *e*, of an entertainment system at Extreme Electronics is $220 less than twice the price, *u*, of the same system at Ultra Electronics. The difference in price between the system at Extreme Electronics and Ultra Electronics is $175. Which system of linear equations can be used to determine the price of the system at each store?

A. $2e - u = 220$
$e - u = -175$

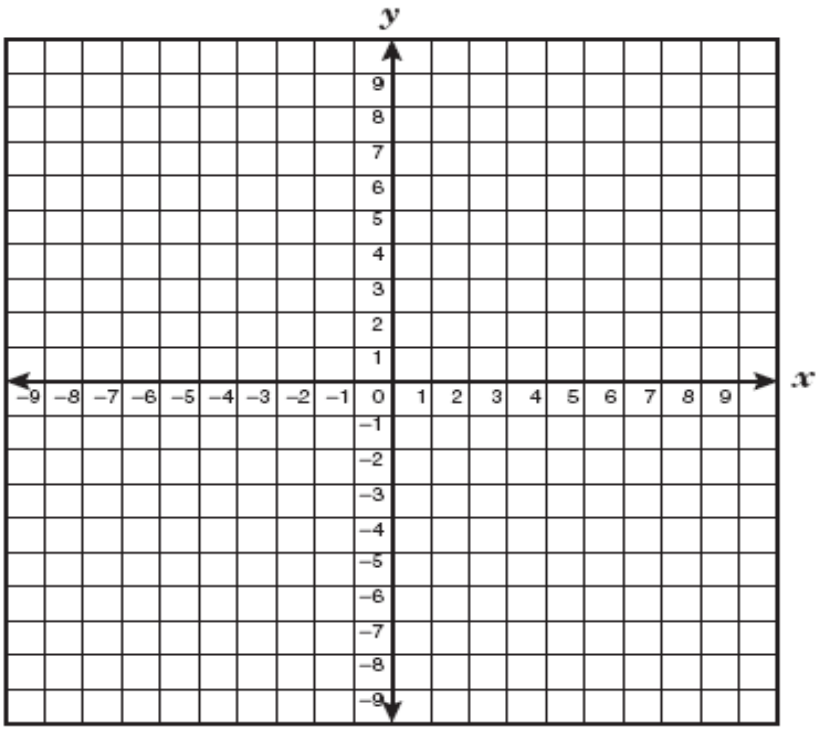
B. $2e - u = 220$
$e + u = 175$

C. $2e - 2u = 440$
$e - u = -175$

D. $e - 2u = -220$
$e - u = 175$

5.

If the system of linear equations $2x + y = 1$ and $y = -\frac{1}{2}x + 1$ are graphed on the same coordinate grid, which of the following is the solution to this system of linear equations?



A (2, 0)

B (0, 2)

C (0.5, 0)

D Not here

Eighth Grade Assessment Sample Items
Assessing for Success Training
Group 2
Fall 2008

1. In the equations below, *a* is the price, in dollars, of an adult ticket to a school play, and *s* is the price of a student ticket.

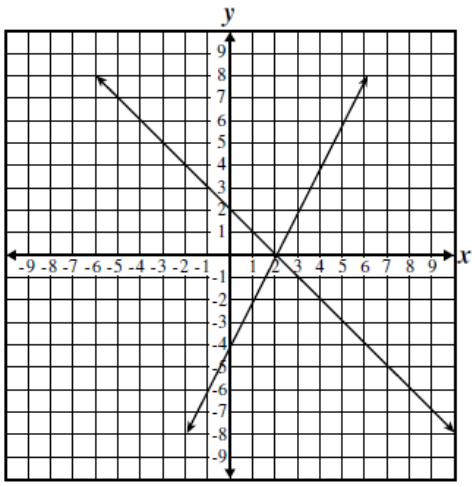
$$5a + 3s = 42$$
$$3a + s = 22$$

What is the price of an adult ticket to the play?

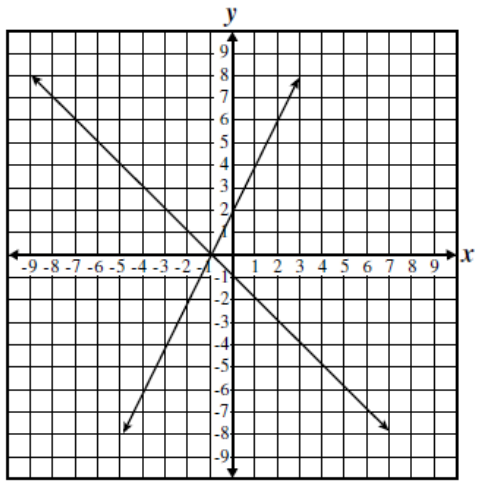
A. $4
B. $5
C. $6
D. $10

2. Which of these graphs represents the solution to the system of equations $y = 2 - x$ and $y = 2x + 2$?

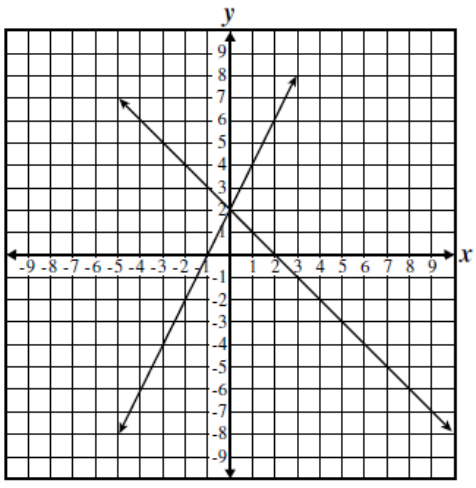
A



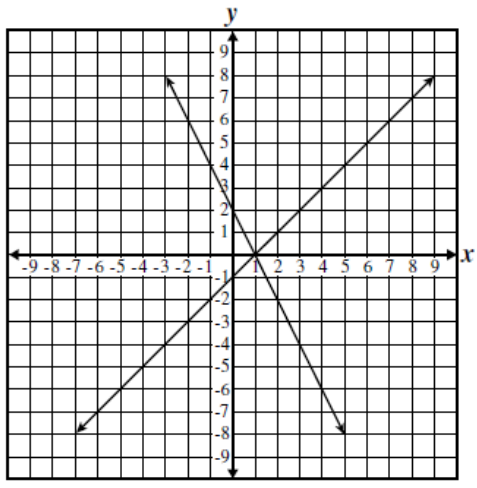
C



B



D



3. In the following equations, the value of x represents the price per pound of gravel and the value of y represents the price per pound of sand.

$$2y = 3x + 8$$
$$5y - 15x = -30$$

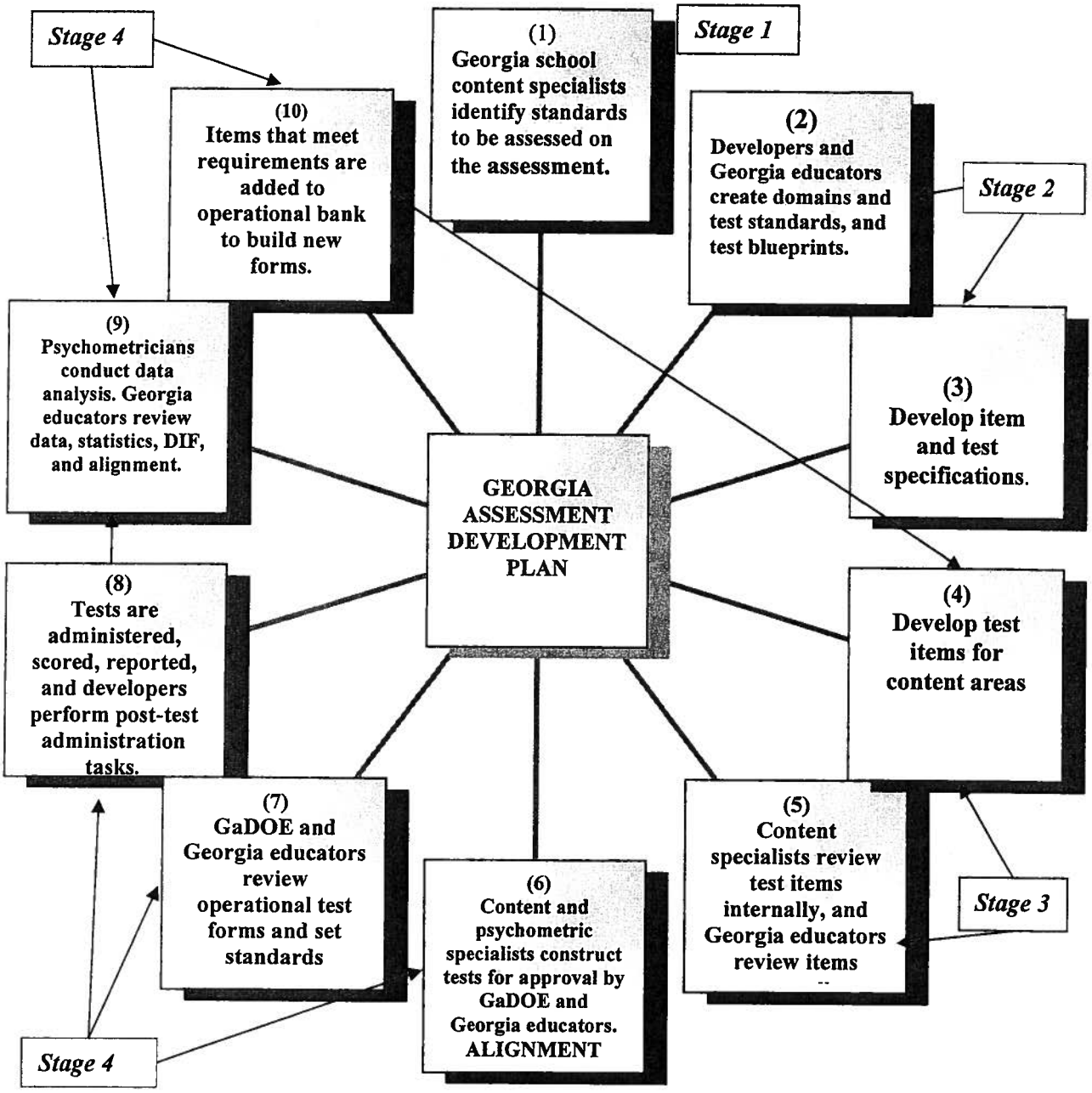
At what price for sand do the two lines intersect?

A. $6.67
B. $10.00
C. $12.33
D. $14.00

4. The sum of two numbers is 48. The difference of the two numbers is 4. Find the numbers.
   A. 20 and 28
   B. 22 and 26
   C. 24 and 24
   D. 20 and 24

5. The sum of Joan's age and her daughter's age is 46. Joan is 2 less than 3 times her daughter's age. How old are Joan and her daughter?
   A. Joan: 36; daughter: 10
   B. Joan: 35; daughter: 11
   C. Joan: 34; daughter: 12
   D. Joan: 32; daughter: 14

Figure 1 Georgia Test Development Cycle



Content Weights for the CRCT
GPS-Based CRCT

The Chart below shows the approximate weights for domains on the CRCT subject assessments. Due to rounding the percents may be not always sum to exactly 100%. The CRCT Content Descriptions provide more details as to the specific skills and knowledge that a student is required to demonstrate on the tests; these documents may be found at www.gadoe.org/ci_testing.aspx

	Approximate Weights for Reporting Domains							
Grade	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Reading								
Vocabulary	20%	20%						
Comprehension	80%	80%						
Literary Comprehension			60%	45%	40%	40%	40%	40%
Reading for Information			20%					
Information & Media Literacy				35%	40%	45%	45%	45%
Reading Skills & Vocabulary Acquisition			20%	20%	20%	15%	15%	15%
ELA								
Grammar/Phonological Awareness/Phonics	72%							
Grammar/ Phonics		60%						
Sentence Construction	16%	25%						
Research	12%	15%						
Grammar and Sentence Construction			60%	60%	60%	60%	56%	70%
Research &Writing Process			40%	40%	40%	40%	44%	30%
Mathematics								
Number and Operations	55%	55%	50%	43%	38%	15%	20%	22%
Measurement	15%	15%	18%	17%	32%	20%		
Geometry	20%	20%	12%	20%	10%	20%	25%	12%
Algebra			10%	10%	10%	30%	40%	50%
Data Analysis & Probability	10%	10%	10%	10%	10%	15%	15%	17%
Science								
Earth Science			34%	40%	30%			
Life Science			33%	30%	40%			
Physical Science			33%	30%	30%			
Geology						40%		
Hydrology &Meteorology						40%		
Astronomy						20%		
Cells and Genetics							35%	
Interdependence of Life							50%	
Evolution							15%	
Structure of Matter								30%
Force and Motion								30%
Energy &Its Transformation								40%
Social Studies								
History			30%	50%	50%	30%	30%	47%
Geography			20%	15%	15%	30%	30%	12%
Civics/Government			30%	20%	20%	20%	20%	25%
Economics			20%	15%	15%	20%	20%	16%

The following is the Curriculum Map for the instructional plan that is part of a GaDOE collection of Unit Frameworks, Performance Tasks, examples of Student Work, and Teacher Commentary. Many more GaDOE approved instructional plans are available by using the Search Standards feature located on GeorgiaStandards.Org.

Georgia Performance CURRICULUM MAP for MATHEMATICS – GRADE 8

Georgia Performance Standards: Grade 8 Curriculum Map

1st 9 weeks		2nd 9 weeks		3rd 9 weeks		4th 9 weeks	
Unit 1	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**	**Unit 6**	**Unit 7**	**Unit 8**
5 weeks	**4 weeks**	**4 weeks**	**5 weeks**	**5 weeks**	**4 weeks**	**4 weeks**	**5 weeks**
Outcomes and Likelihoods	**The Powers That Be**	**Equal or Not**	**Functional Relationships**	**Slippery Slope**	**Traversing Congruency**	**Systems**	**Show What We Know**
D2, D3	**N1, G2**	**A1, A2**	**A3, D1**	**A3, A4, D4**	**G1**	**A5**	

All units will include skills to maintain and the Process Standards.

NOTE: Mathematical standards are interwoven and should be addressed throughout the year in as many different units and activities as possible in order to stress the natural connections that exist among mathematical topics.

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

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 and Parallelogram $A = bh$

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

Circle $A = \pi r^2$

Volume

Rectangular Prism/Cylinder $V = Bh$

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

Circumference

$C = \pi d$ $\pi \approx 3.14$

Surface Area

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

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

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.

Teaching and Learning in the Mathematics Classroom
(Addendum to the Standards-Based Classroom Rubric)

This rubric is an extension to the Standards-Based Classroom Rubric and details further concepts specific to the mathematics classroom. This rubric for mathematics 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 operational column 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. Note: The concepts included in the addendum may not be implemented during every lesson.

Teaching and Learning in a Mathematics Classroom				
Concept	**Not Addressed**	**Emergent**	**Operational**	**Fully Operational**
1. Teaching and learning reflect a balance of skills, conceptual understanding, and problem solving.	The teacher assigns large numbers of repetitive, skills-based problems. Student work reflects only skills-based knowledge. Students are engaged in tasks that do not represent grade-level expectations.	Instruction is driven by the textbook and worksheets, and includes not only isolated skills, but the application of isolated skills in solving problems. Students learn an isolated skill and then apply that skill to solve mathematical problems as well as word problems.	The teacher models simple tasks, establishes expectations, and identifies important vocabulary before students engage in a task. The teacher provides opportunities for new skills and concepts to be learned within the context of real-world situations. Students are engaged in tasks aligned to the Georgia Performance Standards that incorporate the use of skills, conceptual understanding, and problem solving.	The teacher supports students as they work through challenging tasks without taking over the process of thinking for them. Students are engaged in tasks aligned to the GPS that develop mathematical concepts and skills, require students to make connections, involve problem solving, and encourage mathematical reasoning. Students can explain why a mathematical idea is important and the types of contexts in which it is useful.

Concept	Not Addressed	Emergent	Operational	Fully Operational
2. Students will solve a variety of real-world problems.	The teacher only assigns skill-based problems. Students are not required to reason and/or solve real-world problems. Students solve skill-based problems in isolation.	The teacher limits the method by which students may solve problems. The teacher presents problem solving strategies in isolation. Students solve problems using only a method previously modeled by the teacher.	The teacher models a variety of strategies to solve problems. The teacher presents rigorous and relevant problems in mathematics that require the understanding and application of a variety of problem-solving strategies. Students solve rigorous and relevant problems using a variety of appropriate strategies.	The teacher provides students with opportunities to engage in performance tasks that allow students to discover new mathematical knowledge through problem solving. Students apply their mathematical understanding to interpret and solve real-world problems. Students apply and adapt a variety of appropriate strategies to solve problems. Students monitor and reflect on their process of mathematical problem solving.
3. Students will communicate mathematically.	The teacher does not require students to explain their mathematical thinking orally or in writing. Students provide answers only and do not explain their mathematical thinking.	The teacher accepts explanations that do not include grade level appropriate mathematical vocabulary and/or the language of the standards. Students can explain their thinking and learning, but do not use mathematical vocabulary and/or the language of the standards.	The teacher models and expects students to use appropriate grade-level mathematical vocabulary and/or the language of the standards when communicating mathematical reasoning. Students use mathematical vocabulary and the language of the standards to clearly communicate their mathematical thinking to others when prompted.	The teacher creates an environment where students feel comfortable engaging in conversations, discussions, and debating using mathematical vocabulary and/or the language of the standards when communicating mathematical reasoning. Students use mathematical vocabulary and/or the language of the standards to communicate their mathematical thinking and ideas coherently and precisely to peers, teachers, and others. Students analyze and evaluate the mathematical thinking and strategies of others.

Concept	Not Addressed	Emergent	Operational	Fully Operational
4. Students will justify their reasoning and evaluate mathematical arguments of others.	The teacher does not ask students to justify their answers. Answers are simply right or wrong. Students have limited or no knowledge of how to evaluate mathematical arguments.	The teacher arrives at an answer, explains why, tells how, and details ideas to justify reasoning. Students are able to explain the process used to arrive at an answer, but are unable to explain why.	The teacher uses various types of reasoning appropriate to grade level (e.g., inductive, deductive, counter-examples, etc.) and methods of proofs (e.g., paper folding, miras, etc.) when introducing a concept. Students are able to arrive at an answer, explain why, tell how, and detail their ideas to justify their reasoning.	The teacher provides opportunities for students, who solve the problem differently from others, to share their procedures, thus encouraging diverse thinking. The teacher ensures that reasoning and proof are a consistent part of a student's mathematical experience. Students make and investigate mathematical conjectures (mathematical statements that appear to be true, but not formally proven) about solutions to problems. Students use their mathematical understanding to evaluate and debate their own mathematical arguments as well as those of others. Students offer various methods of proof to support their positions.
5. Students will represent mathematical solutions in multiple ways. *(e.g., tables, charts, graphs, pictures, symbols, and words)*	The teacher models only one way to represent a concept. The teacher does not expect students to represent their mathematical thinking and ideas. Students represent their mathematical thinking in the form of an answer only.	The teacher models the use of multiple representations to teach concepts, but does not expect students to represent their work in multiple ways. Students represent their mathematical thinking symbolically.	The teacher uses multiple representations to teach concepts and expects students to represent their work in multiple ways. Students represent their mathematical thinking in various ways when prompted.	The teacher releases responsibility by providing opportunities for students to independently select and use various representations to organize, record, and communicate mathematical ideas. Students select and apply appropriate mathematical representations to solve problems, and explain and interpret the connections between those representations.

Concept	Not Addressed	Emergent	Operational	Fully Operational
6. Students will make connections among mathematical ideas and to other disciplines.	Mathematical skills and concepts are taught in isolation. Students do not connect new concepts to prior knowledge or other disciplines.	The teacher makes connections between mathematical concepts and other disciplines. Students connect mathematical concepts to prior learning.	The teacher makes connections between mathematical ideas and other content areas and supports students with connecting new concepts to those within previous strands or domains. Students apply mathematical concepts to prior knowledge and other disciplines when prompted.	The teacher expects students to independently make connections without prompting. Students make connections between mathematical ideas and other content areas and connect new concepts to those within previous strands or domains. Students understand how mathematical ideas interconnect and build on one another to produce a coherent whole. Students recognize and apply mathematics in contexts outside of the mathematics classroom.
7. Students will understand and use manipulatives appropriately. *(e.g., tangrams, rods, pattern blocks, compasses, algebra tiles, graphing calculators, etc.)*	Manipulatives may not be visible in the classroom or accessible to teachers or students. The teacher does not model use of manipulatives and students do not use manipulatives. Students use manipulatives inappropriately.	Manipulatives are visible in the classroom, but not readily accessible to students. The teacher models use of manipulatives and directs student use of manipulatives. Students imitate use of manipulatives without reflection, exploration, or connection to symbols, pictures, and explanations.	The teacher models the decision-making process for choosing appropriate manipulatives to give meaning to abstract concepts. The teacher actively engages students in using manipulatives to construct and give meaning to new concepts. Students independently select appropriate manipulatives to make connections from symbols, pictures, and explanations to concepts in order to problem solve and represent their understanding of mathematics.	The teacher scaffolds students' understanding so they become less reliant on manipulatives. Students can demonstrate their knowledge of abstract relationships using symbols, pictures, and explanations, but are no longer dependent on certain manipulatives. Some manipulatives, such as the graphing calculator, are appropriate for consistent use. Students have internalized use of manipulatives and can describe how manipulatives were used to develop an understanding of mathematical concepts.

Georgia Performance Standards

Mathematics Resources

- Mathematics Program Manager
  Janet Davis
  jdavis@doe.k12.ga.us
- Mathematics TOA
  Sharquinta Tuggle
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- Mathematics Curriculum Page | www.gadoe.org
  - Research and Reports
  - What's New
  - What's Coming
  - Information for Administrators
  - Mathematics Information for Educators
  - Support Materials
  - Textbook/Instructional Materials
  - Vertical Alignment Charts
- Georgia Performance Standards-Mathematics | www.georgiamath.org
  - Introductory Video by Kathy Cox
  - Comparison of QCC and GPS Course Content
  - Acceleration and Support for Learners
  - Resources for Parents, Teachers and Administrators
  - General Information
  - CRCT Math Re-Test Support Materials
    - CRCT Study Guides
    - Online Assessment System
    - Georgia Mathematics Frameworks
- Georgia Virtual School | www.gavirtualschool.org
  - 2008-2009 school year
    - Mathematics I
    - Accelerated Mathematics I
    - Mathematics I with Support

- One Stop Shop for Educators | www.georgiastandards.org
  - Georgia Performance Standards
  - Frameworks
  - Curriculum Maps
  - GPS Training Materials
  - Learner Needing Support
  - Mathematics GPS High School Research and Resource Manual
  - Executive Summary
  - Middle School Math Transition

- Learning Space for Georgia K-12 Teachers | www.elearning.gadoe.org
  - Math Teacher TALKS (Talking About Learning and Kids)
  - Math Curriculum Elluminate Live!
  - Recorded Elluminate LIVE!
  - Discussion Forums

- Monthly Conference Call for School Administrators and Math Department Chairs

- National Council of Teachers of Mathematics (NCTM) | illuminations.nctm.org
  - Standards-based resources for mathematics education

- National Library of Virtual Manipulatives | nlvm.usu.edu/en/nav/vlibrary.html
  - Interactive web-based manipulatives for mathematics education

- SciTrain | www.catea.gatech.edu/scitrain/index.php
  - Support resources for students with disabilities

- Thinkfinity | www.thinkfinity.org/EducatorHome.aspx
  - Online resources to enhance and support the GPS frameworks

- National Assessment of Educational Progress (NAEP) | nces.ed.gov/naep3
  - National Achievement Assessment

Georgia Department of Education
Grade 8 Mathematics
Assessing for Mathematics Success
Evaluation

Date	
Time	8:30 AM – 3:30 PM
Location