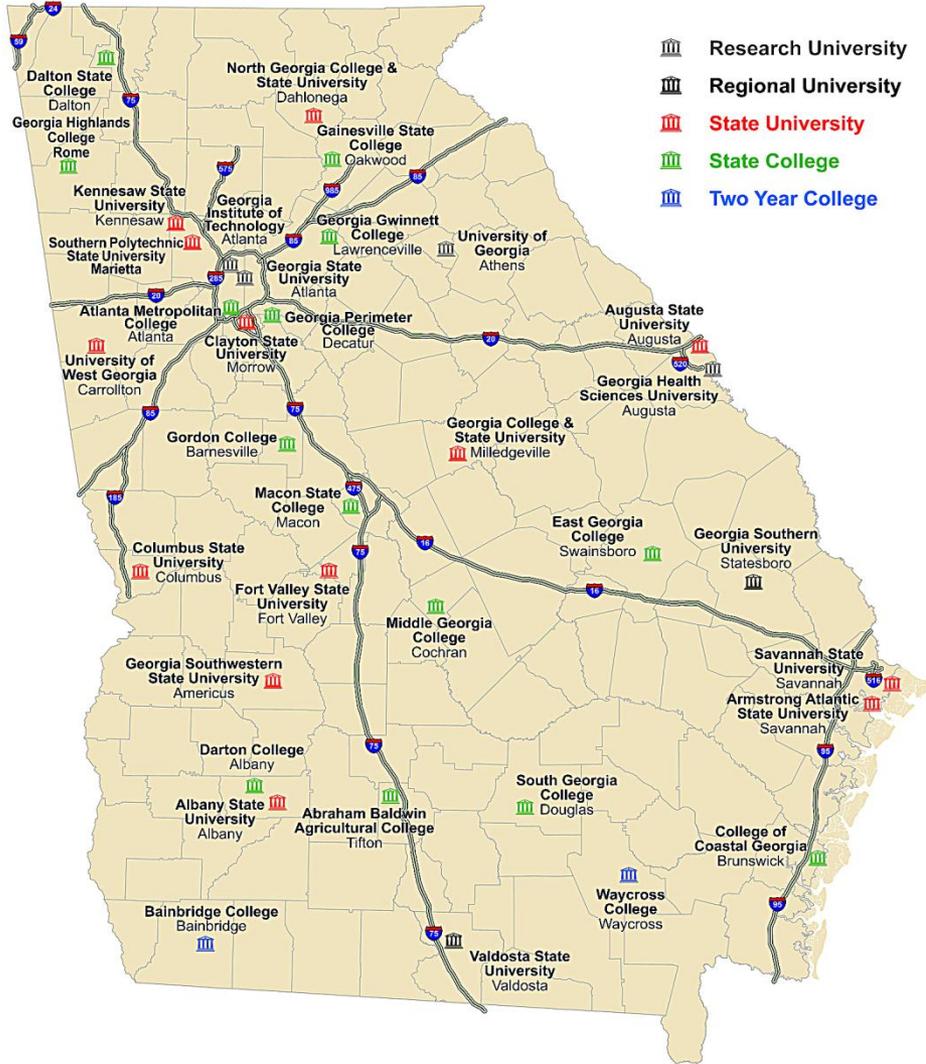


A Two-Year College's Opportunities for Teaching Teachers in the Era of the Common Core

Dr. Carla Moldavan
Dean, Division of Mathematics
Georgia Highlands College

University System Institutions



35 institutions:

4 research universities

2 regional universities

13 state universities

14 state colleges

2 two-year colleges

- Area A1 Communication Skills—writing in English at least 6 semester hours
- Area A2 Quantitative Outcomes—at least 3 semester hours
- Area B Institutional Options—at least 3 semester hours
- Area C Humanities, Fine Arts, and Ethics—at least 6 semester hours
- Area D Natural Sciences, Mathematics, and Technology—at least 7 semester hours
- Area E Social Sciences—at least 6 semester hours
- Area F Lower Division Major Requirements—18 semester hours

Core Curriculum

42 semester hours

U. S. Perspectives
Overlay

Global Perspectives
Overlay

Critical Thinking
Overlay

- College Algebra
 - Pre-calculus
 - Quantitative Skills and Reasoning
 - Mathematical Modeling
-
- At Georgia Highlands College, early childhood education majors are recommended to take Quantitative Skills and Reasoning. However, many take College Algebra.

Area A2

- This course places quantitative skills and reasoning in the context of experiences that students will be likely to encounter. It emphasizes processing information in context from a variety of representations, understanding of both the information and the processing, and understanding which conclusions can be reasonably determined.

MATH 1001 Quantitative Skills and Reasoning

- 1. Sets and Set Operations
- 2. Logic
 - Negations, Quantifiers,
 - Conditional Statements,
 - Converses
 - Inductive and Deductive Reasoning,
 - Valid Arguments
- 3. Basic Probability
- 4. Data Analysis
 - Basic Descriptive Statistics
 - Mean, Median, Mode
 - Standard Deviation
 - Correlation, Causality, and Inferences
 - Interpreting Graphical Displays
 - Sampling and Randomness
- 5. Modeling from Data
 - Scatter Plots, Regression Lines
 - Linear Models
 - Quadratic Models
 - Exponential Models
 - Logarithmic Models

Common Topics for Quantitative Skills and Reasoning

- At Georgia Highlands, students take a two-course science sequence and one mathematics course.

- Mathematics courses options:
 - Precalculus (Trigonometry)
 - Elementary Statistics
 - Calculus I or Applied Calculus

- Early childhood education majors are encouraged to take Elementary Statistics for their Area D mathematics course.

Area D

- Early childhood education majors take three education courses:
 - Investigating Critical and Contemporary Issues in Education
 - Exploring Socio-Cultural Perspectives on Diversity in Educational Contexts
 - Exploring Learning and Teaching

- Early childhood education majors take two science classes (life science/earth science and physical science)

- Early childhood education majors take MATH 2008 Foundations of Numbers and Operations

Area F

- Topics

- Problem-Solving
- Standards
- Whole Numbers
- Numeration Systems
- Mental Arithmetic/Estimation
- Divisibility, GCF, LCM
- Integers
- Rational Numbers
- Proportional Reasoning
- Percent

MATH 2008

Foundations of Numbers and Operations

- Early childhood education recommendations
 - A2 Mathematical Modeling
 - D Elementary Statistics
- Area F
 - Same as Georgia Highlands

Upper Division Courses

Math 3316 Ratios and Proportions for Elementary Teachers

Math 3317 Geometry and Measurement for Elementary Teachers

Math 3318 Algebra for Elementary Teachers

Teaching of Specialty Subjects

ECE 4401 Mathematics in Elementary and Early Childhood Education

Kennesaw State
University

- Conceptual development of the rational numbers and extension to the real numbers, operations and problem solving with real numbers, patterns and relationships, and proportional reasoning. Experience and exploration with appropriate technology and physical models will be an integral part of the study of these ideas.

MATH 3316
Rational Numbers
and Proportional
Reasoning for
Elementary
Teachers

- Critical content and conceptual development of measurement; transformational geometry; symmetry in the plane; and constructions. Geometric concepts will be explored and developed using physical models, visual models and educational software.

MATH 3317
Geometry and
Measurement for
Elementary
Teachers

- Understanding and use of the major concepts and techniques of algebra for grades P-5, including expressing, transforming, and generalizing patterns and quantitative relationships through a variety of representations, including tables, graphs, algebraic symbols, verbal descriptions, manipulatives, and geometric figures. Solving problems using multiple strategies, manipulatives, and technological tools will also be a focus.

MATH 3318 Algebra for Elementary Teachers

- Early childhood education majors

- Area A—encouraged to take College Algebra

- Area D—required to take Introduction to Computer Concepts

- Area F—same requirements as Georgia Highlands

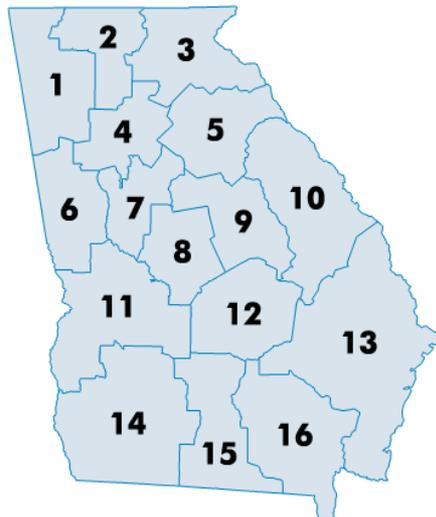
- Upper Division Courses
 - MATH 3803 Algebra for Teachers
 - MATH 3703 Geometry for Teachers
 - MATH 4713 Probability and Statistics for Teachers
 - ECED 4263 Teaching Content and Processes: Mathematics Education

State University
of West Georgia

- What is needed?

Opportunities for Four-Year Programs in Education

- Northwest Georgia Educational Services Agency
- Serves 16 school districts
- One of 16 RESAs



- 1 - Northwest Georgia
- 2 - North Georgia
- 3 - Pioneer
- 4 - Metro
- 5 - Northeast Georgia
- 6 - West Georgia
- 7 - Griffin
- 8 - Middle Georgia
- 9 - Oconee
- 10 - Central Savannah
- 11 - Chattahoochee-Flint
- 12 - Heart of Georgia
- 13 - First District
- 14 - Southwest Georgia
- 15 - Coastal Plains
- 16 - Okfenokee

Opportunities
with
Mathematics-
Science
Partnerships

- Led 7th/8th-grade groups at three sites
- Two-week summer workshops for two summers
- Five meetings throughout the school year
- Focus on algebra and geometry in year 1

Years 1 and 2
MSP

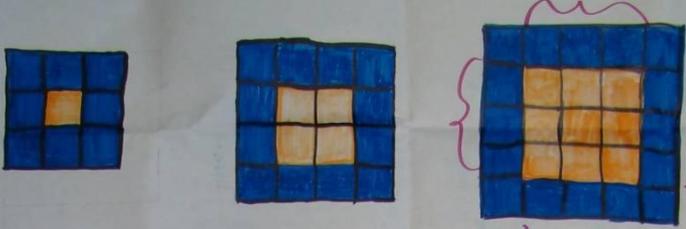
The Painted Cube Problem



**Perseverance in
Problem-Solving**



Seeing Growing Patterns in Different Ways



second set of differences is constant \rightarrow quadratic

T-chart	X	Y
	0	4
	1	9
	2	16
	3	25
	n	$(n+2)^2$

$y = (x+2)^2$
or
 $y = x^2 + 4x + 4$

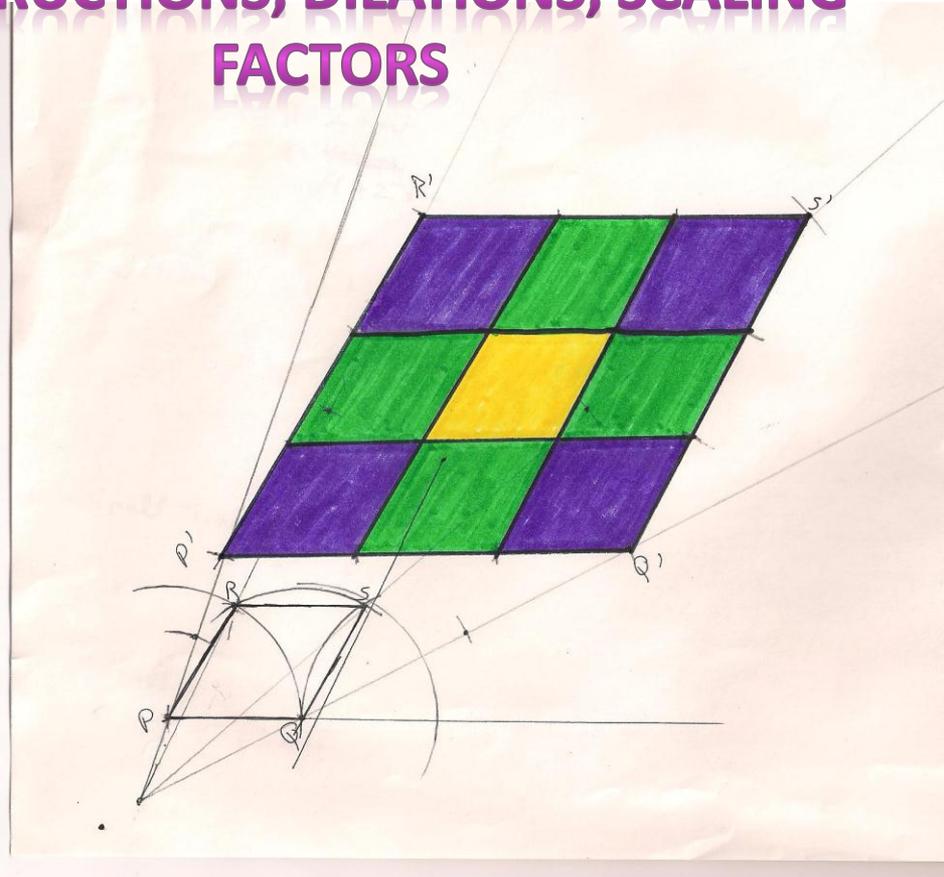
no. of inner light squares \rightarrow corner square

- I saw ~~growth~~ growth by looking at the squares in the middle and developed a formula based on position.

- Saw the 1st one as a 3x3 and 2nd one as a 4x4 area and developed an equation based on position.

Table	X	1	2	3	N
Y	9	16	25	$(n+2)^2$	

CONSTRUCTIONS, DILATIONS, SCALING FACTORS



Seeing the same principle in different representations— building similar pentominoes



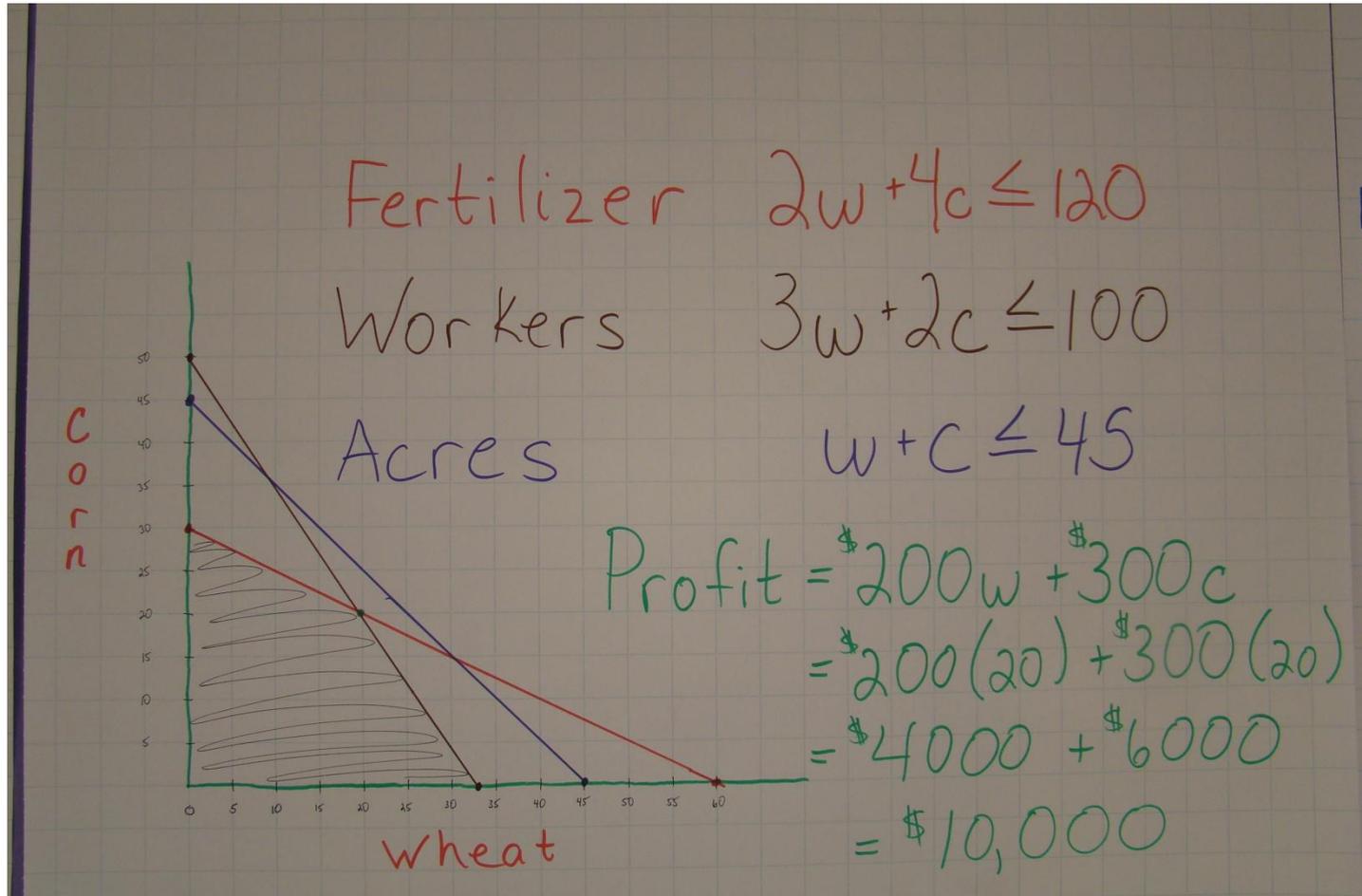
Tangrams—Find the perimeter and area of each piece



Making dodecahedral ornaments



Teaching for transfer—understanding where the mathematics taught now leads in two years—from inequalities to linear programming



Determining whether alternate algorithms work

1. Subtract "1" from the whole-number part of the first mixed number.
2. Subtract the first numerator from the second numerator and store the number mentally or on paper.
3. Subtract the "stored" number from the denominator, which gives the numerator of the answer. Write this number over the denominator.
4. Subtract the whole-number part of the mixed numbers.
5. Write the answer in lowest terms.

Example 1:

$$\begin{array}{r} 7 - 2 = \boxed{5} \quad 9 - 5 = \boxed{4} \\ 3 \cancel{4} \frac{2}{9} - 1 \frac{7}{9} = 2 \frac{4}{9} \end{array}$$

Example 2:

$$\begin{array}{r} 10 - 1 = \boxed{9} \quad 15 - 9 = \boxed{6} \\ 10 \cancel{1} \frac{1}{15} - 3 \frac{10}{15} = 7 \frac{6}{15} \end{array}$$

Has anyone else worked problems using this method? I am interested in other quick tricks.

Terri L. Curtis

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Jackson, MS 39206

*Mathematics Teaching
in the Middle School April, 1994*

Determining whether alternate algorithms work

Does $a/b \div c/d = (a/c) \div (b/d)$?

Does $15/28 \div 5/7 =$
 $(15 \div 5) / (28 \div 7) = 3/4$?

Does $62 - 47 = -5 + 20 = 15$?

An 11-year-old conjectures that

if $\frac{12}{32} = \frac{3}{8}$ $\frac{123}{328} = \frac{3}{8}$

Analysis

and if $\frac{80}{120} = \frac{2}{3}$ *then* $\frac{802}{1203} = \frac{2}{3}$

Does this really work?

- Learning Mathematics for Teaching (LMT)
 - 9 out of 12 increased in Number and Operations
 - 7 out of 12 increased in Geometry
 - 10 out of 12 showed significant gains in Algebra
 - 4 had significant gains in all three areas
 - 6 had significant gains in two of the three areas

Evaluation after
first year
(Midpoint of MSP
grant project)

- Higher education faculty split time in workshops throughout the year among groups for teachers of grades three and four, grades five and six, and grades seven and eight
- Higher education faculty team-taught with RESA staff courses for teachers to get an elementary mathematics endorsement

MSP Year 2

- Two panels (one of each of the two years of MSP)
 - Writing items
 - Analyzing distracters
 - Editing
 - Trying with students
 - Considering item difficulty and discrimination values

Assessment Item Development

- 3rd Grade Bank—50 items
- 4th Grade Bank—100 items
- 5th Grade Bank—75 items
- 6th Grade Bank—90 items
- 7th Grade Bank—67 items
- 8th Grade Bank—106 items

Assessment Item Bank

- Estimation
- Algebraic Thinking

Examples of
Difficulties for
Elementary
Teachers

Sample Third-Grade Item

M3N2b Use mental math and estimation strategies

32. Sara wanted a hamburger that cost \$3.89, fries for \$2.62, and a lemonade for \$0.89. She has \$10.00. Estimate how much change she will receive.

1. \$1.00

2. \$2.00

3. \$4.00

4. \$7.00

Sample Third-Grade Item

M3A1c Use a symbol to represent an unknown

34. Melanie had 7 more Tootsie Rolls than peanut butter cups on Monday. If \square stands for the number of peanut butter cups, which expression below would describe the total number of Tootsie Rolls and peanut butter cups Melanie has?

- a. $\square + 7$
- b. $7 - \square$
- c. $\square + \square$
- d. $\square + \square + 7$

- Thinking through an estimation question
- Giving advice to teachers

Meet Third-
Grader
Barton Sopata

Sample Sixth-Grade Item

M6N1g Solve problems involving fractions, decimals, and percents.

Eric was asked to explain how he knew that $\frac{4}{9}$ was “close” to $\frac{1}{2}$. Which of the following explanations contains an error?

- Since half of the denominator is 4.5 and the numerator of the given fraction is 4, I know that $\frac{4}{9}$ is close to $\frac{1}{2}$ but less than $\frac{1}{2}$.
- The fraction $\frac{4}{9}$ can be thought of as 49%. The fraction $\frac{1}{2}$ is equivalent to 50%. Since 49% is close to 50%, $\frac{4}{9}$ is close to $\frac{1}{2}$ but less than $\frac{1}{2}$.
- I know that $9 \div 4 = 2 \frac{1}{4}$ and $2 \div 1 = 2$. Since $2 \frac{1}{4}$ is close to 2, then $\frac{4}{9}$ is close to $\frac{1}{2}$ but less than $\frac{1}{2}$.
- Since $\frac{4}{8}$ is equivalent to $\frac{1}{2}$ but $\frac{4}{8}$ is more than $\frac{4}{9}$, $\frac{4}{9}$ is close to $\frac{1}{2}$ but smaller.

- Delivery of science courses for elementary science endorsement
- On-site (at schools) support for teachers participating in grant
- Summer workshops for 7th/8th and High School Teachers

2011-2012
Year One of
Second MSP
Grant

- Mathematics-science connections

- Density
- Light intensity
- Hooke's Law
- Radioactive decay

- Use of technology

Summer
Workshop,
2011

- Requests for resources on particular topics
 - Voice-over PowerPoints
 - Webinars

- Email questions/answers and website links, etc.

- Hire qualified high school teachers to teach part-time at GHC

Continuing
Contact

- Math Contests
- Math Trails
- Fabulous Fridays

Other
Opportunities

- Acquainting GHC faculty with NCTM process standards
- Providing rubric for class observations
- See Draft MET II Recommendation 5
 - Recognize that there are opportunities for professional growth for university faculty in mathematics and mathematics education.

Other Opportunities

Problems, Issues, Questions, Comments, Conclusions

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