

Common Core and Students With Special Needs: Mathematics - Now What?

Angelique Burzynski, M.A. Educational Therapy
Laura Tilem, M.A., Special Education; M.S. School Psychology

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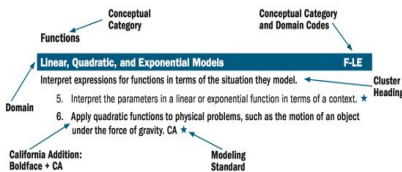
Background

- Beginning school year 2013-2014, California adopting the "Common Core" curriculum for all California schools
- It introduced a new way of thinking (literally) as to what students need to learn and how.
- Emphases is now on: conceptual understanding, reasoning, explaining, modeling, and generalizing.
- What does all of this mean for students with special needs in mathematics?

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A Sample Math Standard

- What it entails¹:



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Driving the Standards

- “Overarching **Habits of Mind** of a **Productive Mathematical Thinker**”²

Structuring the Standards for Mathematical Practice¹

| | | |
|---|---|-----------------------------------|
| 1. Make sense of problems and persevere in solving them. 6. Attend to precision. | 2. Reason abstractly and quantitatively. | Reasoning and explaining |
| | 3. Construct viable arguments and critique the reasoning of others. | Reasoning and explaining |
| | 4. Model with mathematics. | Modeling and using tools |
| | 5. Use appropriate tools strategically. | Modeling and using tools |
| | 7. Look for and make use of structure. | Seeing structure and generalizing |
| | 8. Look for and express regularity in repeated reasoning. | Seeing structure and generalizing |

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The New Expectations

- **Make sense** of problems and **persevere** in solving them: - **Grade 3**

Jaleen has a lemonade stand. The bar graph below shows the number of lemonade cups sold in each of four weeks in July.

Jaleen also sold lemonade for 4 weeks in August. She compares her weekly sales in July to her weekly sales in August.

- For week 1, she sold 22 fewer cups in August than in July.
- For week 2, she sold 18 more cups in August than in July.
- For week 3, she sold 26 more cups in August than in July.
- For week 4, she sold 35 fewer cups in August than in July.

Complete the table to show how many cups Jaleen sold each week in August.

| August Lemonade Sales | |
|-----------------------|-----------|
| Week | Cups Sold |
| 1 | |
| 2 | |
| 3 | |
| 4 | |

Use the **July Lemonade Sales** bar graph to complete this task.

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The New Expectations (cont)

- **Reason abstractly** and **quantitatively** [reasoning and explaining] - **Grade 7**

Tim makes 80 gallons of paint by mixing 48 gallons of gray paint with 32 gallons of white paint.

What part of every gallon is gray paint?

The model represents 1 gallon of mixed paint.

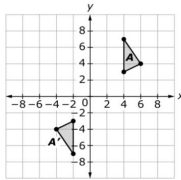
Select the bars to show how much of the gallon is gray paint.

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The New Expectations (cont)

- Construct **viable arguments** and **critique the reasoning of others** [reasoning and explaining] - **HS Math 1**

José and Tina are studying geometric transformations.



José is able to move triangle A to triangle A' using the following sequence of basic transformations:

- Reflection across the x-axis
- Reflection across the y-axis
- Translation two units to the right

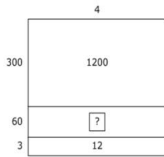
Tina claims that the same three transformations, done in any order, will always produce the same result. Explain why Tina's claim is incorrect.

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The New Expectations (cont)

- Model** with mathematics [modeling and using tools] - **Grade 5**

Jasmine solves the equation $\square \div 4 = 363$ using this area model.



Which statement explains how Jasmine should solve for the missing number in the model?

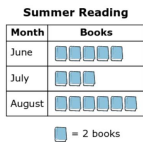
- A. Jasmine should divide 60 by 4.
- B. Jasmine should divide 1200 by 12.
- C. Jasmine should multiply 3 times 60.
- D. Jasmine should multiply 4 times 60.

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The New Expectations (cont)

- Use appropriate **tools strategically** [modeling and using tools] - **Grade 4**

Marcia read books over the summer. She created the picture graph shown.



Create another picture graph that shows these data with a different key. You may use whole books and half books in your graph.

A. Select the key you will use.

= 3 books = 4 books = 5 books = 6 books

B. New picture graph

| Month | Books |
|--------|-------|
| June | |
| July | |
| August | |

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The New Expectations (cont)

- Attend to **precision** - **HS Math 2**

Simplify. Use absolute value signs when necessary

$$10\sqrt[3]{300x^2y^5z^2}$$

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The New Expectations (cont)

- Look for and make use of structure** [Seeing structure and generalizing] - **Grade 5**

The rectangular prism shown has 4 layers with 6 cubes in each layer.



Key
represents 1 cubic cm

Enter the volume, in cubic centimeters, of the rectangular prism.

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The New Expectations (cont)

- Look for and express regularity in repeated reasoning** [Seeing structure and generalizing] - **HS Math 1**³

A **recursive rule** for a sequence defines the n th term by relating it to one or more previous terms.
The following is an example of a recursive rule:

$$f(1) = 4, f(n) = f(n - 1) + 10 \text{ for each whole number } n \text{ greater than } 1$$

This rule means that after the first term of the sequence, every term $f(n)$ is the sum of the previous term $f(n - 1)$ and 10.

Example 2 Write the first 4 terms of the sequence defined by the recursive rule.

Ⓐ $f(1) = 2, f(n) = f(n - 1) + 3$ for each whole number n greater than 1

For the first 4 terms, the domain of the function is 1, 2, 3, and 4.

The first term of the sequence is 2.

| n | $f(n) = f(n - 1) + 3$ | $f(n)$ |
|-----|--------------------------------|--------|
| 1 | $f(1) = 2$ | 2 |
| 2 | $f(2) = f(1) + 3 = 2 + 3 = 5$ | 5 |
| 3 | $f(3) = f(2) + 3 = 5 + 3 = 8$ | 8 |
| 4 | $f(4) = f(3) + 3 = 8 + 3 = 11$ | 11 |

The first 4 terms are 2, 5, 8, and 11.

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Considering Special Needs -
Weaknesses In:

- **Auditory Processing**
- **Visual Processing**
- **Sensory-Motor Integration**
- **Language Impairment**
- **Dyslexia/dysgraphia/dyscalculia**
- **Processing Speed**
- **Conceptualization/Cognitive Cohesion**
- **And don't forget . . .**

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Considering Special Needs
Weaknesses In (cont):

- **Executive Functioning**
 - Attention/Focus
 - Organization
 - Planning
 - Problem solving
 - Decision making
 - Working and long-term memory
 - And don't forget . . .

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Considering Special Needs
Weaknesses In (cont):

Executive Functioning (cont)

- **Emotional Regulation:**
 - Effort and hard work
 - Perseverance when challenged
 - “Effective procrastination”⁴
 - Daniel Franklin, PhD, Educational Psychologist
 - Deferred gratification
 - Goal setting
 - Resilience
 - “Slowly is fast enough!”⁵
 - Sam Goldstein, PhD

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Now What?

Possible Accommodations

- **Make sense** of problems and **persevere** in solving them:
 - **Grade 3**

Jaleen has a lemonade stand. The bar graph below shows the number of lemonade cups sold in each of four weeks in July.

Jaleen also sold lemonade for 4 weeks in August. She compares her weekly sales in July to her weekly sales in August.

- For **week 1**, she sold **32 fewer** cups in August than in July.
- For **week 2**, she sold **18 more** cups in August than in July.
- For **week 3**, she sold **26 more** cups in August than in July.
- For **week 4**, she sold **25 fewer** cups in August than in July.

Complete the table to show how many cups Jaleen sold each week in August.

| August Lemonade Sales | |
|-----------------------|-----------|
| Week | Cups Sold |
| 1 | |
| 2 | |
| 3 | |
| 4 | |

Use the **July Lemonade Sales** bar graph to complete this task.

Now What?

Possible Accommodations(cont)

- **Reason abstractly** and **quantitatively** [reasoning and explaining] - **Grade 7**

Tim makes **80 gallons** of paint by mixing **48 gallons** of gray paint with 32 gallons of white paint.

What part of every gallon is **gray** paint?

The model represents 1 gallon of mixed paint.

Select the bars to show how much of the gallon is **gray** paint.

Now What?

Possible Accommodations(cont)

- Construct **viable arguments** and **critique the reasoning of others** [reasoning and explaining] - **HS Math 1**

José and Tina are studying geometric transformations.

José is able to move triangle A to triangle A' using the following sequence of basic transformations:

1. Reflection across the x-axis
2. Reflection across the y-axis
3. Translation two units to the right

Tina claims that the same three transformations, done in any order, will always produce the same result. Explain why Tina's claim is incorrect.

| My Viable Argument | | Regroup Argument | |
|--------------------|---|------------------|---|
| Step 1 | _____ works/ doesn't work because _____ | Step 3 | _____ works/ doesn't work because _____ |
| Step 2 | _____ works/ doesn't work because _____ | Step 1 | _____ works/ doesn't work because _____ |
| Step 3 | _____ works/ doesn't work because _____ | Step 2 | _____ works/ doesn't work because _____ |

Now What? Possible Accommodations(cont)

- **Model** with mathematics [modeling and using tools] - **Grade 5**

Jasmine solves the equation $\square \div 4 = 363$ using this area model.

Which statement explains how Jasmine should solve for the missing number in the model?

- Ⓐ Jasmine should divide 60 by 4.
- Ⓑ Jasmine should divide 1200 by 12.
- Ⓒ Jasmine should multiply 3 times 60.
- Ⓓ Jasmine should multiply 4 times 60.

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Now What? Possible Accommodations(cont)

- **Use appropriate tools strategically** [modeling and using tools] - **Grade 4**

Marla read books over the summer. She created the picture graph shown.

Summer Reading

| Month | Books |
|--------|-------|
| June | = 10 |
| July | = 6 |
| August | = 12 |

Summer Reading

| Month | Books |
|--------|-------|
| June | |
| July | |
| August | |

Summer Reading

| Total | 2 Books | 4 Books |
|----------|---------|---------|
| Jun = 10 | | |
| July = 6 | | |
| Aug = 12 | | |

Key: = 2 books

Create another picture graph that shows these data with a different key. You may use whole books and half books in your graph.

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Now What? Possible Accommodations(cont)

- **Attend to precision - HS Math 2**
Simplify. Use absolute value signs when necessary

$$10\sqrt{300}x^2y^5z^2$$

| | Steps | Done |
|---|--|------|
| 1 | Pull out square roots | X |
| 2 | Place Absolute Value signs on singular variables | |
| 3 | | |
| 4 | | |

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Now What?

Possible Accommodations(cont)

- Look for and make use of structure [Seeing structure and generalizing] - **Grade 5**

The rectangular prism shown has 4 layers with 6 cubes in each layer.

Key
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Enter the volume, in cubic centimeters, of the rectangular prism.

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Now What?

Possible Accommodations(cont)

- Look for and express regularity in repeated reasoning [Seeing structure and generalizing] - **HS Math 1**³

A recursive rule for a sequence defines the n th term by relating it to one or more previous terms.

The following is an example of a recursive rule:

$$f(1) = 4, f(n) = f(n - 1) + 10 \text{ for each whole number } n \text{ greater than } 1$$

This rule means that after the first term of the sequence, every term $f(n)$ is the sum of the previous term $f(n - 1)$ and 10.

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Selected Accommodations

- Categorize** the concepts involved in the entire problem
- Identify** each concept **separately**: circle, highlight, underline – (Identify what is not needed to solve the problem)
- Group like concepts** across steps: circle = circle, yellow = yellow, underlined = underlined, and so forth
- Use pre-established **scripts**
- Add symbols** to represent operations
- Convert** information to usable **charts**
- Create **step by step directions**, check off as each step is completed
- Deconstruct figures** into separate pieces; show flow of separation
- Simplify** language

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What Can Parents Do?

- **Work with your child’s Case Carrier** to understand your child’s disabilities and how they affect learning
- **Frequent contact** with your child’s teachers
- **Learn** as much about your **child’s curriculum** as possible
- **Utilize school resources:** tutoring, teacher conference hours, teacher websites, on-line support
- **Collaborate** with other parents

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The Future

- Looking forward to:
 - Research-based, effective Common Core Math instructional strategies for both students with and without special needs
 - Consideration of disabilities in the design of the common core textbooks and student handbooks
 - Teacher training that includes processing and executive functioning weaknesses
 - Ongoing collaboration between general and special educators regarding the relationship between processing and accommodations

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End-note References

- ¹ California State Board of Education. (2013). *Common Core State Standards for Mathematics for California Public Schools Kindergarten through Grade Twelve* (p. 5). California: CDE.
- ² California State Board of Education. (2013) *Common Core State Standards for Mathematics for California Public Schools Kindergarten through Grade Twelve* (p.3). California: CDE.
- ³ Kanold, T. D., Burger, E. B., Dixon, J. K., Larson, M. R., Leinwand, S. J. (2015). *Integrated Mathematics (Vol. 1)*. Orlando, FL: Houghton Mifflin Harcourt.
- ⁴ Franklin, D. PhD. (2014). From Learning & the Brain 37th Conference: *Social Neuroscience of Executive Functioning*. San Francisco, CA: Public Information Resources, Inc.
- ⁵ Goldstein, S. J. PhD. (2015). From Learning & the Brain 37th Conference: *Brain Dance: How Self-Perception, Emotion and Cognitive Drive Development and Achievement*. San Francisco, CA: Public Information Resources, Inc.
- ⁶ Kriegler, S., Gamelin, T., Goldstein, M., & Chan, H. H. (2007). *Introduction to Algebra: Student Handbook*. Los Angeles, CA: UCLA Department of Mathematics.

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