Standards For Mathematical Practice

11/01/11

Our session will start momentarily. While you are waiting, please do the following:

Enter/edit your profile information by going to:

•Tools - Preferences - My Profile…

•Fill out the info on the "identity" tab and click "OK"

•To view the profile of another use, hover your mouse over his or her name in the participants window

Configure your microphone and speakers by going to:

•Tools – audio – audio setup wizard

Confirm your connection speed by going to:

•Tools – preferences – connection speed

Clearing up confusion:

- This webinar is not about CCGPS content, it is about using the CCGPS Mathematical Practices this year with GPS content.
- For information about how and why CCSS were developed and adopted, watch: common core- teaching channel and this: common core- math- teaching channel
- GPS is taught and tested 2011-12. CCGPS is taught and tested 2012-13.
- I will provide a list of resources at the end of this webinar.

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Take-away

- Something that you can use tomorrow
- Something to ponder
- Resources

What is learning?

What defines an effective classroom?

How do students become proficient in mathematics?

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Dr. Lewin video can be found at:

http://www.youtube.com/watch?v=7Zc9Nuoe2Ow

Is this learning?

Is this an effective classroom?

Are Dr. Lewin's students becoming proficient in mathematics?

- Attendance in Professor Lewin's classes fell by 40% by the end of the term.
- 10% of Professor Lewin's students failed his Mechanics class.
- 14% of Professor Lewin's students failed his Electricity & Magnetism class.

Where do we begin in creating a classroom environment which encourages students to take responsibility for their learning and allows them to become proficient in mathematics?

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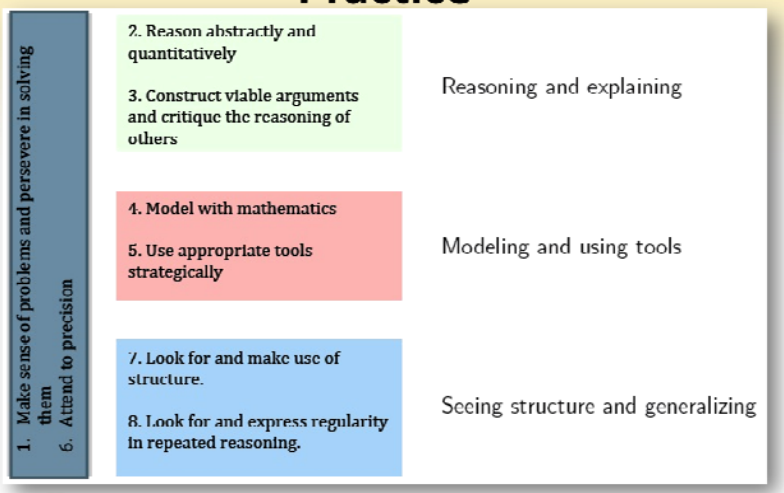
CCGPS Standards for Mathematical Practice



- "The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important 'processes and proficiencies' with longstanding importance in mathematics education."

(CCSS, 2010)

- The mathematical practices require a "re-negotiation" of the classroom contract.
- 3 Major Shifts:
  - Teachers cannot create learning-only learners can do that.
  - Increased student responsibility- from receptive to active learner
  - Teacher/student relationship shift- from adversarial to collaborative

Black and Wiliam, 2006

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What Not to Do

- Problem solving Friday
- Enrichment for the few
- Just give the answer
- Isolate content from process

Who Wants to be a Millionaire video can be found at:

http://www.youtube.com/watch?v=BbX44YSsQ2I

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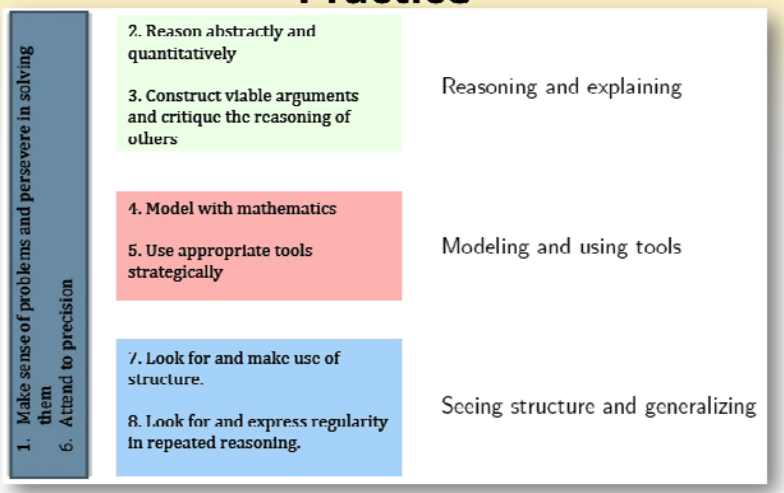

1. Make sense of problems and persevere in solving them.
   - Mathematically proficient students:
     - start by explaining to themselves the meaning of a problem and looking for entry points to its solution.
     - can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends.
     - check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?"

6. Attend to precision.
   - Mathematically proficient students:
     - try to communicate precisely
     - state the meaning of symbols they choose, including using the equal sign consistently and appropriately.
     - are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem.
     - calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context.

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- Teachers who are developing students' capacity to "make sense of problems and persevere in solving them" develop ways of framing mathematical challenges that are clear and explicit, and then check in repeatedly with students to help them clarify their thinking and their process. A teacher of adolescents and young adults might frame the task as a real-world design conundrum, inviting students to engage in a "tinkering" process of working toward mathematical proof, changing course as necessary as they develop their thinking.

(Inside Mathematics)

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Problem #1

What is the slope and y-intercept of y = .5x + 5?

(Does this question require students to engage in mathematical practices?)

Problem #1

What is the slope and y-intercept of y = .5x + 5?

Determine the cost of each ticket and the entry fee by using the table.

Number of Tickets	Cost
8	$9.00
12	$11.00
	$12.50
23	

Reasoning and explaining

2. Reason abstractly and quantitatively.
- Mathematically proficient students:
  - make sense of the quantities and their relationships in problem situations.
  - have the ability to decontextualize - to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents.
  - have the ability to contextualize - to pause as needed during the manipulation process in order to probe into the referents for the symbols involved.

3. Construct viable arguments and critique the reasoning of others.
- Mathematically proficient students:
  - understand and use stated assumptions, definitions, and previously established results in constructing arguments.
  - make conjectures and build a logical progression of statements to explore the truth of their conjectures.
  - are able to analyze situations by breaking them into cases, and can recognize and use counterexamples.
  - justify their conclusions, communicate them to others, and respond to the argument of others.
  - reason inductively about data, making plausible arguments that take into account the context from which the data arose.

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Reasoning and explaining

2. Reason abstractly and quantitatively.

- Teachers who are developing students' capacity to "reason abstractly and quantitatively" help their learners understand the relationships between problem scenarios and mathematical representation, as well as how the symbols represent strategies for solution.

(Inside Mathematics)

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3. Construct viable arguments and critique the reasoning of others.

- Teachers who are developing students' capacity to "construct viable arguments and critique the reasoning of others" require their students to engage in active mathematical discourse. This might involve having students explain and discuss their thinking processes aloud, or signaling agreement/disagreement with a hand signal. A teacher of adolescents and young adults might actively engage her students in extended conjecture about conditions for proof in the construction of quadrilaterals, testing their assumptions and questioning their approaches.

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Problem #2

If, $h(t) = -16t^2 + 30t + 200$ what is the value of the function when $t = 2$?

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Problem #2

If, $h(t) = -16t^2 + 30t + 200$ what is the value of the function when $t = 2$?

Myth Busters' crew is testing the theory of throwing a penny off a building. At the top of a 200 ft building a penny is thrown into the air at 30 ft/sec, how high off the ground is the penny after 2 seconds? When will it start to fall to the ground? When will it hit the ground? Justify your answers.

Modeling and using tools

4. Model with mathematics.

- Mathematically proficient students:
  - can apply the mathematics they know to solve problems arising in everyday life, society and the workplace.
  - can apply what they know and are comfortable making assumptions to simplify a complicated situation, and realize when these assumptions must be revised.
  - are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas.
  - can analyze those relationships mathematically to draw conclusions.
  - routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

5. Use appropriate tools strategically.

- Mathematically proficient students:
  - consider the available tools when solving a mathematical problem.
  - are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations.
  - are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems.
  - are able to use technological tools to explore and deepen their understandings of concepts.

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Modeling and using tools

4. Model with mathematics.

- Teachers who are developing students' capacity to "model with mathematics" move explicitly between real-world scenarios and mathematical representations of those scenarios. A teacher of adolescents and young adults might pose a "kite factory" scenario, in which advanced students are asked to determine the conditions for always creating a particular shape of kite given the dimensions of the diagonals and the angle of intersection.

(Inside Mathematics)

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(Inside Mathematics)

5. Use appropriate tools strategically.

- Teachers who are developing students' capacity to "use appropriate tools strategically" make clear to students why the use of manipulatives, rulers, compasses, protractors, and other tools will aid their problem solving processes. A teacher of adolescents and young adults might have established norms for accessing tools during the students' group "tinkering processes," allowing students to use paper strips, brass fasteners, and protractors to create and test quadrilateral "kite" models.

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Problem #3

What are the roots of $y = x^5 + 3x^2 - 2$?

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Graph the function: $y = x^5 + 3x^2 - 2$ to determine the values of the roots.

Seeing structure and generalizing

7. Look for and make sense of structure.

8. Look for and express regularity in repeated reasoning.

Seeing structure and generalizing

7. Look for and make sense of structure.
- Mathematically proficient students:
  - look closely to discern a pattern or structure.
  - can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects.
  - recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems.
  - can step back for an overview and shift perspective.

8. Look for and express regularity in repeated reasoning.
- Mathematically proficient students:
  - notice if calculations are repeated, and look both for general methods and for shortcuts.
  - maintain oversight of the process, while attending to the details.
  - continually evaluate the reasonableness of their immediate results.

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- Mathematically proficient students:
  - notice if calculations are repeated, and look both for general methods and for shortcuts.
  - maintain oversight of the process as they work to solve a problem, while attending to the details.
  - continually evaluate the reasonableness of their immediate results.

Seeing structure and generalizing

7. Look for and make sense of structure.

- Teachers who are developing students' capacity to "look for and make use of structure" help learners identify and evaluate efficient strategies for solution. A teacher of adolescents and young adults might focus on exploring geometric processes through patterns and proof.

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(Inside Mathematics)

8. Look for and express regularity in repeated reasoning.

- Engaging in repeated reasoning may emerge over many weeks so that students learning to divide fractions may gradually attain insight into the underlying concepts over many days or weeks. In the end, students arrive at the algorithm or formula through discovery, but in a longitudinal discovery process, and so sharing the "eureka" moment from a single lesson will not reveal the process that led to the insight.

(Inside Mathematics)

Problem #4

What is the next term in the sequence:

9, 25, 49, . . .

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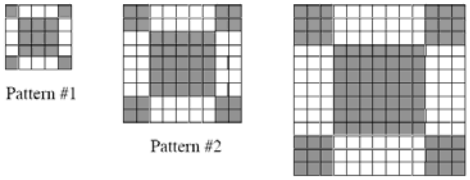
Problem #4

What is the next term in the sequence:

9, 25, 49, . . .

How many blocks of each kind will Pattern #*n* need?



Pattern #1 Pattern #2 Pattern #3

Where can we start?

- GaDOE Teaching Guides
- http://public.doe.k12.ga.us/ci_services.aspx?PageReq=CIServMath
- Learning Village
- https://portal.doe.k12.ga.us/LearningVillageLogin.aspx
- List Serve
- join-mathematics-k-5@list.doe.k12.ga.us
- join-mathematics-6-8@list.doe.k12.ga.us
- join-mathematics-9-12@list.doe.k12.ga.us
- join-mathematics-districtsupport@list.doe.k12.ga.us
- join-mathematics-administrators@list.doe.k12.ga.us
- join-mathematics-resa@list.doe.k12.ga.us

- Inside Mathematics
- http://www.insidemathematics.org/
- Teaching Channel
- http://www.teachingchannel.org/videos?categories=topics_common-core

- Arizona
- http://www.ade.az.gov/standards/math/2010MathStandards/
- New York City
- http://schools.nyc.gov/Academics/CommonCoreLibrary/SeeStudentWork/default.htm
- North Carolina
- http://www.ncpublicschools.org/acre/standards/extended/
- Ohio
- http://www.ode.state.oh.us/GD/Templates/Pages/ODE/ODEPrimary.aspx?page=2&TopicRelationID=1704

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Dancing Guy video can be found at:

http://www.youtube.com/watch?v=fW8amMCVAJQ

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http://prezi.com/as3zivtdozh5/ccgps-standards-for-mathematical-practice/

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