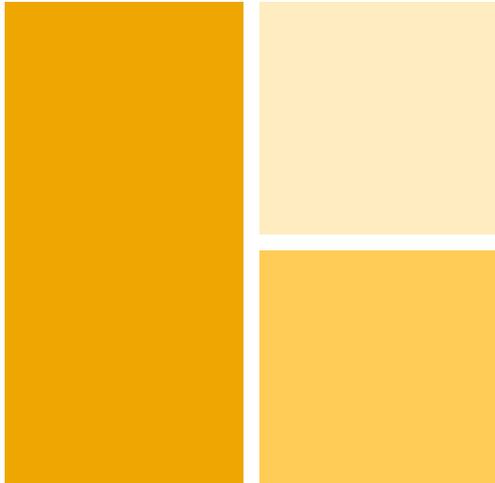


ALGEBRA
I



DESIGN TO ALIGN

STANDARDS LITERACY GUIDE



MATHEMATICS



Virginia A. Alonso

MATHEMATICAL PRACTICES

Illustrative Mathematics. (2014, May 6). *Standards for Mathematical Practice: Commentary and Elaborations for K-5*. Tucson, AZ

The Standards for Mathematical Practice describe eight “processes and proficiencies” that mathematics educators develop in students. These standards originate from the NCTM process standards and National Research Council’s mathematical proficiencies report “Adding It Up.” The Mathematical Practices are the vehicle for engaging mathematical content and are an integral part of curriculum development, classroom instruction, and quality assessments.

MP.1: MAKE SENSE OF PROBLEMS AND PERSEVERE IN SOLVING THEM

Mathematically proficient students analyze and plan a solution pathway. They monitor and evaluate their progress. Students check their answers and continually ask themselves, “Does this make sense?”

THE TEACHER WILL...

- provide adequate time to discuss problem pathways and solutions.
- create opportunities for students to have dialogue with teachers and among peers.
- offer formative feedback during discussions.

STUDENT WILL BE ABLE TO...	QUESTIONS TO ELICIT EVIDENCE
...understand the problem and what is being asked.	How would you describe the problem in your own words? What is this problem asking? What information is given in the problem?
...make a plan for solving the problem.	How could you start this problem? How could you make this problem easier to solve? How are you going to work through this problem? Do you see any formulas you may need to use? Does your plan make sense?
...monitor the progress and make adjustments if needed.	Describe what you have already tried. What steps in the process are you most confident about? What are some other strategies you might try?
...relate current situations to concepts or skills previously learned.	What are some other problems that are similar to this one? How might you use one of your previous problems to help you begin?
...reflect on solution and analyze other approaches.	Does this make sense? How is ___’s way of solving the problem like/different from yours? What is the most efficient way to solve the problem?

JUSTIFICATION AND EXPLANATION SKILLS

ACT (2014). *Exemplary Mathematics Test Questions*. Retrieved from ACT Aspire online:
http://www.discoveractasprie.org/pdf/2014_exemplar_actasprie_math.pdf

Students obtain a strong understanding of mathematics content when they become engaged in routinely constructing and presenting clear, logical, and convincing arguments. These Depth of Knowledge (DOK) 3 Strategic Thinking skills are embedded in the standards progressions and Mathematical Practice 3 (MP3): “Create viable arguments and critique the reasoning of others.” The responsibility of the teacher then becomes to ensure the students are actively engaging in these rich DOK 3 tasks on a regular basis as expected in the grade-level standards’ expectations.

When building DOK 3 tasks for showing evidence of their knowledge, the structure of task must focus attention on grade-level-appropriate mathematical arguments and justifications. These justification skills include stating relevant properties and definitions that support the justification, conducting error analysis, and demonstrating a command of examples and counterexamples to make a claim.

To address the different levels of student learning, a set of scaffold justification skills is presented below. Level 1 skills are beginning grade-level or previous grade-level justification skills. Level 2 justification skills are aligned with on grade-level focus. Level 3 justification skills are advanced, showing skills at the ceiling level of the grade and beyond.

This information allows for classroom design of tasks around DOK 3 and MP 3, while addressing the learning levels of the students. A task can be centered a particular content/graph/model, while asking three different justifications expectations. Another option is to design a rubric of leveled justification evidence around one task with the same justification expectation.

ERROR ANALYSIS SCAFFOLDING SAMPLE

The owner of a company must buy 29 phones for the office. Each phone costs \$52.25. The owner calculates the total cost using the thought process below:

30 phones at \$50 would cost \$1500

So 29 phones at \$50 each would cost \$1500- \$50

Because the price of 1 phone is \$52.25 and NOT \$50, I must add \$2.25.

So the total cost is \$1500 - \$50 + \$2.25

<i>Low Level</i>	<i>On Level</i>	<i>Above Level</i>
Identify any mistakes in the student’s thought process.	Identify any mistakes in the student’s thought process. Write an expression that represents the total cost of the 29 phones and explain why it is correct.	Identify any mistakes in the student’s thought process. Use mathematical formulas and/or definitions to support your claim. Write an expression that represents the total cost of the 29 phones and explain why it is correct.

ALGEBRA: CREATING EQUATIONS

A.CED.1

Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

Depth of Knowledge

RECALL

1

Requires a one-step task of recalling information, performing a simple algorithm, or applying a formula.

- Recall a fact or definition
- Perform a clearly defined series of steps
- Apply a well-defined, straight algorithmic procedure
- Recognize a basic pattern
- Retrieve information from a graph

SKILLS & CONCEPTS

2

Requires approaching a multi-step problem using the engagement of some mental processing beyond a habitual response.

- Apply basic application of a skill or concept
- Make some decisions to solve the problem
- Notice and describe non-trivial patterns
- Make observations
- Collect, display, and compare non-complex data

Mathematical Practices

1

Make sense of problems and persevere in solving them

- How would you describe the problem in your own words?
- How could you start this problem?
- Does your plan make sense?
- What is the most efficient way to solve the problem?
- What are some other problems that are similar to this one?

2

Reason abstractly and quantitatively

- What is the relationship of the quantities?
- How can you create a representation of the problem?
- Explain how you determined the meaning of the quantities.
- Could you have used another operation or property to solve this task?
- How did you decide in this task that you needed to use...?

4

Model with mathematics

- What assumptions can you make to simplify the situation?
- What are some ways to visually represent...?
- What model did you use to represent the problem?
- Could you have improved the model?
- How did you analyze your model mathematically to draw conclusions?

CLUSTER

Create equations that describe numbers or relationships

EMPHASIS

MAJOR

Major clusters are areas of intensive focus, where students need fluent understanding and application of the core concepts (approximately 70%).

ALGEBRA: CREATING EQUATIONS

Learning Targets

I can create linear equations in one variable, by identifying the quantity in a mathematical or real world situation that should be represented by a distinct variable and describe what the quantity the variable represents, in order to solve the problem.

I can create linear inequalities in one variable, by identifying the quantity in a mathematical or real world situation that should be represented by a distinct variable and describe what the quantity the variable represents, in order to solve the problem.

I can create quadratic equations in one variable, by identifying the quantity in a mathematical or real world situation that should be represented by a distinct variable and describe what the quantity the variable represents, in order to solve the problem.

I can create quadratic inequalities in one variable, by identifying the quantity in a mathematical or real world situation that should be represented by a distinct variable and describe what the quantity the variable represents, in order to solve the problem.

I can create simple exponential equations in one variable, by identifying the quantity in a mathematical or real world situation that should be represented by a distinct variable and describe what the quantity the variable represents, in order to solve the problem.

I can create simple exponential inequalities in one variable, by identifying the quantity in a mathematical or real world situation that should be represented by a distinct variable and describe what the quantity the variable represents, in order to solve the problem.

Academic Vocabulary

equations, equalities, variable, linear functions, quadratic functions, simple, rational functions, exponential functions

PARCC Assessment Limits

i) Tasks are limited to linear or exponential equations with integer exponents. ii) Tasks have a real-world context. iii) In the linear case, tasks have more of the hallmarks of modeling as a mathematical practice (less defined tasks, more of the modeling cycle, etc.).

Misconceptions

Students may believe that equations of linear, quadratic and other functions are abstract and exist only "in a math book," without seeing the usefulness of these functions as modeling real-world phenomena. Additionally, they believe that the labels and scales on a graph are not important and can be assumed by a reader, and that it is always necessary to use the entire graph of a function when solving a problem that uses that function as its model.

Connections

Working with expressions and equations, including formulas, is an integral part of the curriculum in Grades 7 and 8. In high school, students explore in more depth the use of equations and inequalities to model real-world problems, including restricting domains and ranges to fit the problem's context, as well as rewriting formulas for a variable of interest.

PARCC Types

TYPE I	TYPE II	TYPE III	INTEGRATED

Essential Question

DEPTH OF KNOWLEDGE:

1 2

EMPHASIS:
MAJOR

MATHEMATICAL PRACTICES:

1 2 4

Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

A.CED.1

ALGEBRA: SEEING STRUCTURE IN EXPRESSIONS

A.SSE.2

Use the structure of an expression to identify ways to rewrite it.

Depth of Knowledge

1

RECALL

Requires a one-step task of recalling information, performing a simple algorithm, or applying a formula.

- Recall a fact or definition
- Perform a clearly defined series of steps
- Apply a well-defined, straight algorithmic procedure
- Recognize a basic pattern
- Retrieve information from a graph

2

SKILLS & CONCEPTS

Requires approaching a multi-step problem using the engagement of some mental processing beyond a habitual response.

- Apply basic application of a skill or concept
- Make some decisions to solve the problem
- Notice and describe non-trivial patterns
- Make observations
- Collect, display, and compare non-complex data

Mathematical Practices

2

Reason abstractly and quantitatively

- What is the relationship of the quantities?
- How can you create a representation of the problem?
- Explain how you determined the meaning of the quantities.
- Could you have used another operation or property to solve this task?
- How did you decide in this task that you needed to use...?

4

Model with mathematics

- What assumptions can you make to simplify the situation?
- What are some ways to visually represent...?
- What model did you use to represent the problem?
- Could you have improved the model?
- How did you analyze your model mathematically to draw conclusions?

7

Look for and make use of structure

- How can you use what you know to explain why this works?
- How do you know if something is a pattern?
- Did you shift perspectives as you looked for the pattern?
- What parts of the problem might you eliminate or simplify?
- What patterns did you find in...?

CLUSTER

Interpret the structure of expressions

EMPHASIS

MAJOR

Major clusters are areas of intensive focus, where students need fluent understanding and application of the core concepts (approximately 70%).

ALGEBRA: SEEING STRUCTURE IN EXPRESSIONS

Learning Targets

I can rewrite a polynomial expression, by identifying the structure of the expression, in order to create an expression in a different form

I can rewrite the rational expression, by identifying the structure of the expression, in order to create an expression in a different form

I can rewrite an exponential expression, by identifying the structure of the expression, in order to create an expression in a different form

I can develop strategies, by examining the different structures of expressions, in order to classify expressions

Misconceptions

Students may believe that the use of algebraic expressions is merely the abstract manipulation of symbols. Use of realworld context examples to demonstrate the meaning of the parts of algebraic expressions is needed to counter this misconception. Students may also believe that graphing linear and other functions is an isolated skill, not realizing that multiple graphs can be drawn to solve equations involving those functions.

Students may also believe that an expression cannot be factored because it does not fit into a form they recognize. They need help with reorganizing the terms until structures become evident.

Connections

An introduction to the use of variable expressions and their meaning, as well as the use of variables and expressions in real-life situations is included in the Expressions and Equations Domain of Grade 7

Academic Vocabulary

structure

PARCC Assessment Limits

N/A

PARCC Types

TYPE I	TYPE II	TYPE III	INTEGRATED

Essential Question

DEPTH OF KNOWLEDGE:

1

2

EMPHASIS:
MAJOR

MATHEMATICAL PRACTICES:

2

4

7

Use the structure of an expression to identify ways to rewrite it.

A.SSE.2