Mississippi Academic Assessment Program

Item Writing Training Grades 7-12

June 2018

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Desoto County School District

Mississippi Department of Education

VISION
To create a world-class educational system that gives students the knowledge and skills to be successful in college and the workforce, and to flourish as parents and citizens

MISSION
To provide leadership through the development of policy and accountability systems so that all students are prepared to compete in the global community
State Board of Education Goals FIVE-YEAR STRATEGIC PLAN FOR 2016-2020

1. All Students Proficient and Showing Growth in All Assessed Areas
2. Every Student Graduates from High School and is Ready for College and Career
3. Every Child Has Access to a High-Quality Early Childhood Program
4. Every School Has Effective Teachers and Leaders
5. Every Community Effectively Uses a World-Class Data System to Improve Student Outcomes
6. Every School and District is Rated “C” or Higher

Ice Breaker

Math Stars
Math Stars

What do you have in common with your team members?

1. Fold the paper on the vertical/horizontal dotted lines and then cut along the solid lines of the star.
2. Unfold and glue onto a piece of paper. Write each person’s name on a star.

Math Stars Cont.

- Find ways that each person in the team is unique from the others (things that are about that person only), and write those things on each person’s star.
- List your team’s common attributes in the center of the 4 stars.
- If extra time, find something in common with those that the points of your star are connected.
Item Writing Training Goals

- Understand grade level math standards and expectations
- Collaborate with math educators from across the state
- Develop an understanding of best practices in item writing

Unpacking for Item Writing

What is important?
Unpacking the Standard

What does this standard mean?

Represent proportional relationships by equations. For example, if total cost $t$ is proportional to the number $n$ of items purchased at a constant price $p$, the relationship between the total cost and the number of items can be expressed as $t=pn$.

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**7.RP.2c**

<table>
<thead>
<tr>
<th>Knowledge/Concept</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What do students need to know/understand?</strong></td>
<td><strong>What do students need to be able to do?</strong></td>
</tr>
<tr>
<td>Underline the Nouns</td>
<td>Circle the Verbs</td>
</tr>
<tr>
<td>List Nouns:</td>
<td>List Verbs:</td>
</tr>
<tr>
<td>proportional relationships</td>
<td>represent</td>
</tr>
<tr>
<td>equations</td>
<td></td>
</tr>
</tbody>
</table>

Think KEY TERMS!

Think ACTIONS!
7.RP.2c

• What standards should students have mastery of from the prior grade, (6th)?
• Where is this leading to in the next grade level, (8th)?

Prior grade:
6.EE.9 - Write an equation to express one quantity, in terms of another quantity.
6.RP.2 – Understand the concept of unit rate
6.RP.3b – Solve unit rate problems

Next grade:
8.F.2 - Compare two functions given in different forms.
8.EE.5 – Graph proportional relationships.
Now it’s your turn…

- As a team, “unpack” standard 8.EE.7b.
- What standards should students have mastery of from the prior grade, (7th)?
- Where is this leading to in the next grade level, (Algebra I)?

### 8.EE.7b

<table>
<thead>
<tr>
<th>Knowledge/Concept</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>What do students need to understand?</td>
<td>What do students need to be able to do?</td>
</tr>
<tr>
<td>List Nouns:</td>
<td>List Verbs:</td>
</tr>
<tr>
<td>linear equations</td>
<td>solve</td>
</tr>
<tr>
<td>inequalities</td>
<td>including* (this is important info)</td>
</tr>
<tr>
<td>rational number coefficients</td>
<td>expanding</td>
</tr>
<tr>
<td>expressions</td>
<td>using</td>
</tr>
<tr>
<td>distributive property</td>
<td>collecting</td>
</tr>
<tr>
<td>like terms</td>
<td></td>
</tr>
</tbody>
</table>

Think KEY TERMS!

Think ACTIONS!
8.EE.7b

Prior grade:
7.EE.4a - Solve word problems leading to \( px+qr \) and \( p(x+q) = r \), where \( p, q, \) and \( r \) are rational numbers.
7.NS.2a – distributive property with negatives
7.EE.1 – Properties of operations to add, subtract, factor, expand, linear expressions.

Next grade:
A-REI.3 - Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
A-CED.1 – Create equations and inequalities in one variable and use them to solve problems.
Content Alignment

- Literal interpretation of the standard
- On grade level
- Skill specific
- Item should be written to one standard, not overlapping standards
- Items may not cover the entire standard
- Specific to sub standards (e.g., a, b, c...)
- Appropriate DOK level

Sample Items

1. Which statement is a true comparison of the two functions?

A. The $y$-intercept of Function 1 is the same as the $y$-intercept of Function 2.

B. The $y$-intercept of Function 1 is the opposite of the $y$-intercept of Function 2.

C. The rate of change of Function 1 is the same as the rate of change of Function 2.

D. The rate of change of Function 1 is the opposite of the rate of change of Function 2.

2. Of the four linear functions represented below, which has the greatest $y$-intercept?

A. A number ($y$) is two less than twice a number, $x$.

B. $y = 4x + 3$

C. $y = -3x + 3$

D. $y = 12x - 2$

8.F.2 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
Sample Items

1. Sandy made a scale drawing for a rectangular flower bed. If the actual flower bed is 15 feet long, what is the scale factor?

2. Sandy made a scale drawing for a rectangular flower bed. If the scale used is 1 inch:6 feet, what is the area of the actual flower bed?

Sample Items

1. Which expression is equivalent to $\frac{4}{3}x + 4\frac{2}{3}$?
   
   A $\frac{1}{3}(4x + 6)$
   
   B $\frac{2}{3}(2x + 7)$
   
   C $\frac{2}{3}(2x + 4)$
   
   D $\frac{4}{3}(4x + 2)$

2. Which expressions are equivalent to $4(x + 7)$?
   Select two choices.
   
   A $2(x + 3.5)$
   
   B $2(2x + 14)$
   
   C $4x + 7$
   
   D $4x + 11$
   
   E $4x + 28$

7.G.1 Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

7.EE.1 Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.
Depth of Knowledge (DOK)

Level 1 Recall/Reproduction
Level 2 Skill/Concept
Level 3 Strategic Thinking
Level 4 Extended Thinking

Understanding DOK—Big Ideas

- Verbs do not dictate DOK level
- Level increases if it is not common knowledge, (difficulty)
- DOK level
  - Does not equal rigor
  - Should equal the “thought process”
- Writers
  - Aim for DOK 2 and DOK 3
  - No DOK 4 items on this assessment
DOK Activity

• Take out the cards from the envelope so that every member can see/read the question.

• As a team, sort each item according to the DOK level you think it best aligns.

To what DOK level does this item align?

• Solve for the missing value.

\[3x + 6 = 18\]

• Write the answer in the box.

\[x = \_\_\_\_\_\_\_\_\_\_\_\]  

7.EE.4a
To what DOK level does this item align?

• Michael earns an allowance of $10 per week. He can earn another $2 for each extra chore he completes. He wants to earn $40 in the next two weeks. How many extra chores must be completed to earn Michael’s desired amount?

• Write the answer in the box.

extra chores

7.EE.4a

To what DOK level does this item align?

Sherry likes to rent movies. She has two options from which to choose. Adventureland Video charges $3.50 per movie. Videos on Demand (VOD) charges a one-time $10 membership fee, then $2 per video.

What is the least number of movies, \( m \), Sherry must rent to make VOD the better deal? Fill in the blanks with the appropriate value.

For VOD to be the better deal,
Sherry must rent at least \( \underline{\text{}} \) videos.

7.EE.4b
To what DOK level does this item align?

What is the value of $x$?

\[
\frac{1}{2}(x - 12) + \frac{3}{2}x = \frac{2}{3}(15 + 6)
\]

Write the answer in the box.

$x =$

8.EE.7.b

To what DOK level does this item align?

Compare the two functions. Which statement is true?

<table>
<thead>
<tr>
<th></th>
<th>Function 1</th>
<th>Function 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>$x$</td>
<td>2 4 5 7</td>
<td>2x + y = 5</td>
</tr>
<tr>
<td>$y$</td>
<td>6 4 3 1</td>
<td></td>
</tr>
</tbody>
</table>

A. The rate of change of Function 2 is twice the rate of change of Function 1.
B. The rate of change of Function 2 is half the rate of change of Function 1.
C. The rate of change of Function 2 is the same as the rate of change of Function 1.
D. The rate of change of Function 2 is the opposite of the rate of change of Function 1.

8.F.2
To what DOK level does this item align?

Which are functions? Select **all** that apply.

- \{(-1, 6), (0,5), (1, 4), (-1,-6)\}
- \{(2, 8), (-3, 8), (0,-4), (3, 4)\}
- \(xy = 36\)
- \(3y = 2x - 12\)

**DOK 1**

HS-F-IF.1

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To what DOK level does this item align?

A test has sixteen questions worth 100 points. The test consists of open-ended questions worth 8 points each and multiple choice questions worth 4 points each.

How many multiple choice questions are on the test?

Write your answer in the box.

**DOK 2**

\[\square\] multiple choice questions

HS-A-REI.6
Understanding DOK—Big Ideas Revisited

• Verbs do not dictate DOK level
• Level increases if it is not common knowledge, (difficulty)
• DOK level
  − Does not equal rigor
  − Should equal the “process”
• Writers
  − Aim for DOK 2 and DOK 3
  − No DOK 4 items on this assessment

7.RP.2c
Represent proportional relationships by equations. For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as t=pn.
8.EE.7b Solve linear equations and inequalities with rational number coefficients, including those whose solutions require expanding expressions using the distributive property and collecting like terms.

**Content Standard**

<table>
<thead>
<tr>
<th>8.EE.7b</th>
<th>Depth of Knowledge (DOK) Level</th>
</tr>
</thead>
</table>
| Solve linear equations and inequalities with rational number coefficients, including those whose solutions require expanding expressions using the distributive property and collecting like terms. | 🗑️ Recall
🗑️ Skill/Concept
☐ Strategic Thinking
☐ Extended Thinking |

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**Item Writing Basics**
Item Writing Basics

• No barriers
• Accessible for all students
• Short sentences
• Most important ideas first
• One idea, fact, or process introduced at a time
• Simple, uncluttered graphics and line drawings

Multiple Choice Basics

• Alignment to standard
  − Right down to the verb
• Clearly worded
  − Avoid negatives when possible
• Written as a question
  − Not as a completion statement
• Parallel construction to choices
• Answer choices should follow order, (i.e., least to greatest; shortest to longest, etc.).
Multiple Choice Basics

- To interpret the question
  - Students should not have to read the choices
- Avoid absolutes
  - “None of the Above” and “All of the Above”
- Use of
  - “What” or “Which”
- Eliminate
  - Any unnecessary or nonfunctional words
  - Excessive prepositional phrases

Multiple Choice Basics

- Avoid window dressing
  - Put questions in context
- Avoid cluing or clang associations
- Avoid phrases or topics that
  - Date an item or limit its lifespan
- Avoid misleading graphics
  - Graphics should be clear and labeled
Question #1

Revise this question to match the guidelines.

Anna was wearing her favorite dress while baking a cake on a warm and sunny day. The recipe called for ½ cup of sugar. She wanted to triple the recipe. Which …

Question #2

Revise this question to match the guidelines.

What must be true of a right triangle?

A. The angles must sum to 360 degrees
B. All 3 sides must be equal
C. The height must be half of the base
D. There must be one right angle
Question #3

Revise this question to match the guidelines.

Quadrilaterals all have ___

A. 4 sides  
B. 3 sides  
C. 2 sides  
D. 5 sides

Parts of an Item

Item Types
Parts of an Item

I. Directions (with appropriate directional line)
II. Stem
III. Graphic- sketch/drawing/picture to support your item (if needed)
IV. Answer choices
   a) Distractors (incorrect answers)
   b) Rationales

Distractor/Rationale Item

• In addition to the correct answer, create three distractors and provide your rationales for the question.

A cake recipe calls for ½ cup of sugar. Anna wants to triple the recipe. How much sugar does she need?
MAAP Item Types

<table>
<thead>
<tr>
<th>TAO</th>
<th>Description</th>
<th>Item Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choice</td>
<td>• Regular Multiple Choice</td>
<td>Multiple Choice</td>
</tr>
<tr>
<td></td>
<td>• M of N Multiple Choice (2 of 5 or 3 of 7)</td>
<td></td>
</tr>
<tr>
<td>Inline Choice</td>
<td>Drop Down Options</td>
<td></td>
</tr>
<tr>
<td>Drag and Drop</td>
<td>Drag and Drop</td>
<td>Technology Enhanced</td>
</tr>
<tr>
<td>Match</td>
<td>Multi-Select Table</td>
<td></td>
</tr>
<tr>
<td>Line Match</td>
<td>Matching</td>
<td></td>
</tr>
<tr>
<td>Text Entry</td>
<td>Type-in-Text</td>
<td>Constructed Response</td>
</tr>
<tr>
<td></td>
<td>(currently, MAAP only allows text entry for numbers &amp; symbols only)</td>
<td></td>
</tr>
<tr>
<td>Two-Part</td>
<td>Part A/Part B</td>
<td>Varies</td>
</tr>
</tbody>
</table>

*Questar currently uses TAO as their item development platform.

Parts of an Item

Solve for the missing value.

3x + 6 = 18

Write the answer in the box.

x = 
Choice Items

- Answer choices are A-D
- **Standard Choice items do not have a directional line.**

Which expression is equivalent to $3x^2 + 7x - (x + 4)^2 - 9$?

- $2x^2 + 7x - 25$
- $2x^2 + 7x + 7$
- $2x^2 + 6x + 7$
- $2x^2 - x - 25$

Choice M of N Items

Which groupings represent 36 apples placed equally into baskets?

Select **two** answer choices.

- 6 apples in 4 baskets
- 6 apples in 6 baskets
- 7 apples in 4 baskets
- 8 apples in 3 baskets
- 9 apples in 4 baskets

**Choice M of N:**
Select 2 of 5;
Select 3 of 7
Inline Choice (Drop Down)

A nanometer can be expressed as $1 \times 10^{-9}$ meters, and a millimeter can be expressed as $1 \times 10^{-3}$ meters.

Select the options that correctly complete the sentence.

A [ ] is [ ] larger than a [ ].

- millimeter
- nanometer
- 10,000
- 100,000
- 1,000,000
- 10,000,000

Matching/Line Match

Draw a line from each equation in Column A to an equation in Column B that is equal.

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>$485 - 255 = ?$</td>
<td></td>
</tr>
<tr>
<td>$296 + 504 = ?$</td>
<td></td>
</tr>
<tr>
<td>$800 - 420 = ?$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$375 - 145 = ?$</td>
</tr>
<tr>
<td></td>
<td>$600 - 220 = ?$</td>
</tr>
<tr>
<td></td>
<td>$640 + 160 = ?$</td>
</tr>
</tbody>
</table>
### Match (Multi-Select Table)

Select the box or boxes that represent the transformation of each function from the parent function \( f(x) = x^2 \).

<table>
<thead>
<tr>
<th>Function</th>
<th>Vertical Reflection</th>
<th>Vertical Translation</th>
<th>Horizontal Translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>( f(x) = x^2 - \frac{9}{7} )</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>( f(x) = -x^2 )</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>( f(x) = (x + 3)^2 )</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>( f(x) = (x + 1)^2 + 13 )</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

### Drag and Drop

Drag each expression on the left to its equivalent value.

\[ 2^7 \]
\[ 3^5 = 12 \]
\[ 3^5 = 14 \]
\[ 3^5 = 15 \]
\[ 2^6 = 64 \]
\[ 3^7 = 128 \]
\[ 4^3 = 243 \]
Text Entry (Type-in-Text)

The basket attached to each model balloon is a rectangular box. The box is 10 inches long and 8 inches wide. The volume of the box is 400 cubic inches. What is the height of the box (in inches)?

Write the answer in the box.

inches

Include appropriate units

Text Entry (Type-in-Text)

A soccer game started at 2:15 p.m. and ended at 3:35 p.m. How long did the game last?

minutes

What is missing?
LUNCH BREAK
Who’s hungry?

Group Task
Item Writing
Practice time
Team Practice

• As a team, write a test item of your choice on the chart paper from one of the given standards.
• Be sure to write the standard and include all the parts of an item.

Carousel Activity – As a team:

2. Item Type reference sheet – check for all parts of the item.
3. Post-its and pen – write groups feedback.

Use a post-it to give the team feedback that can be used to improve their item.
Individual Task

Item Writing

Show What You Know

Individual Exit Activity

Using the Standards, write 1 multiple choice question and 1 technology enhanced question.

Be sure to include:
• Directions (with directional line)
• Stem
• Graphic/Sketch (if needed)
• Answer Choices
  • Distractors (incorrect answers)
  • Rationales (plausible reason a student would choose)
Choose a Standard from a Domain below:

<table>
<thead>
<tr>
<th>7th Grade</th>
<th>8th Grade</th>
<th>Algebra I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geometry</td>
<td>Functions</td>
<td>A-SSE</td>
</tr>
<tr>
<td>Statistics</td>
<td>Statistics and Probability</td>
<td>A-APR</td>
</tr>
<tr>
<td></td>
<td>Functions</td>
<td>Functions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Statistics</td>
</tr>
</tbody>
</table>

Wrap-Up

- All participants are required to complete the survey, evaluation, and the exit task sheet.
- Please turn in all paperwork on your way out and pick up your CEU certificate.
- Thanks for coming and have a great afternoon!
## Contact Information

<table>
<thead>
<tr>
<th>Contact</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vinnie Segalini</td>
<td><a href="mailto:vsegalini@mdek12.org">vsegalini@mdek12.org</a></td>
</tr>
<tr>
<td>State Assessment Director</td>
<td></td>
</tr>
<tr>
<td>Libby Cook</td>
<td><a href="mailto:ecook@mdek12.org">ecook@mdek12.org</a></td>
</tr>
<tr>
<td>OSA Mathematics Content Specialist</td>
<td></td>
</tr>
<tr>
<td>Marsha Hillhouse</td>
<td><a href="mailto:mhillhouse@pontotoc.k12.ms.us">mhillhouse@pontotoc.k12.ms.us</a></td>
</tr>
<tr>
<td>Pontotoc City Schools</td>
<td></td>
</tr>
<tr>
<td>Michelle Corbin</td>
<td><a href="mailto:Michelle.corbin@dcsms.org">Michelle.corbin@dcsms.org</a></td>
</tr>
<tr>
<td>Desoto County Schools</td>
<td></td>
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