**Huron Intermediate School District**
# Algebra Probes Administration Manual and Scoring Guide
*Using Algebra Assessment & Instruction: Meeting Standards (AAIMS) Probes for Universal Screening and Progress Monitoring*
**September, 2015**


## INTRODUCTION


Researchers at Iowa State University (Project AAIMS – http://www.ci.hs.iastate.edu/aaims/) have developed four Algebra probes for progress monitoring of students in Algebra I.  Some Huron County schools use three of the four probes for benchmark screening and progress monitoring at junior high and high school as part of a multi-tiered system of supports (MTSS).

When administering the probes, teachers should follow the administration directions provided by AAIMS with the following modification:

- Students should simplify **all answers** as far as possible.
- Calculators are not allowed to be used on the Algebra probes.


The **shaded cells** in the chart below indicate grade levels at which measures are recommended for fall, winter, and spring benchmark screening.

| Benchmark Screening Measure | Grade 6 | | | Grade 7 | | | Grade 8 | | | Algebra 1 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | W | S | F | W | S | F | W | S | F | W | S |
| **Math Computation** (Monitoring Basic Skills Progress – MBSP) | ▓ | ▓ | ▓ | | | | | | | | | |
| **Algebra Basic Skills** | ▓ | ▓ | ▓ | ▓ | ▓ | ▓ | | | | | | |
| **Algebra Foundations** | | | | ▓ | ▓ | ▓ | ▓ | ▓ | ▓ | ▓ | ▓ | ▓ |
| **Content Analysis** | | | | | | | ▓ | ▓ | ▓ | ▓ | ▓ | ▓ |

The three Algebra probes used in Huron County are described on the following pages.  Scoring guidelines and example problems are included, along with recommended targets.  Administration directions for each probe are at the end of this document.

# GENERAL ADMINISTRATION INFORMATION

## Progress Monitoring v. Benchmark Screening

- In an MTSS model, students are assessed three times a year for benchmark screening (see chart on Page 1).  This information is used to 1) identify students at risk, 2) measure student improvement, and 3) assess the effectiveness of core instruction provided to all students.  Benchmark screenings are brief, robust indicators that are predictive of future success, not comprehensive diagnostic assessments.
- Students who are identified as at risk (Tier 2 = Strategic or Tier 3 = Intensive) may be progress monitored every 2-4 weeks between benchmark screenings.  A chart on the back of the progress monitoring booklet allows teachers to track student progress in reference to an end-of-year goal.
- Based on research regarding goal-setting and feedback, it is "best practice" to engage students with charting their progress.  This is effective for all students, as it allows them to see growth in their own learning.  For those who struggle, this is more encouraging than to constantly see a score that is lower than their classmates.

## Universal Screening Materials

- Districts may order benchmark screening materials from Huron ISD prior to each benchmark screening window.  The materials will be delivered to your building.
- Progress Monitoring and answer booklets are also available from HISD.  Each student being progress monitored should have his or her own booklet.

## Data Management

Huron ISD supports districts in collecting and analyzing universal screening data.  Currently, AAIMS screening measure scores are entered into Excel spreadsheets that are sent to the district's coordinator each fall.  A summary of these scores is also entered into a district-wide Excel dashboard.

## Progress Monitoring Websites

- National Center on Response to Intervention  http://www.rti4success.org/
- National Center on Student Progress Monitoring  http://www.studentprogress.org/
- Research Institute on Progress Monitoring (RIPM)  http://www.progressmonitoring.org/

**ALGEBRA BASIC SKILLS MEASURE**

Algebra Basic Skills is recommended for Grades 6 and 7. Grade 6 students may also be assessed on the *Monitoring Basic Skills Progress* (MBSP) *Basic Math* measures for Computation or Concepts and Applications.

### Algebra Basic Skills Measure – General Description
- "Robust Indicator" focusing on skills for which some level of automaticity is desirable:
  - Solving basic fact equations
  - Applying the distributive property
  - Working with integers
  - Combining like terms
  - Applying proportional reasoning
- 60 items in 5 minutes

### Algebra Basic Skills Measure – Scoring
- Each correct problem is worth 1 point.
- Skipped problems and incorrect answers are worth 0 points.
- Count mathematically equivalent responses as correct.
- All answers must be completely simplified.
- Calculators should not be used.
- TOTAL SCORE = number of problems correct (60 points possible)

### Simplifying
**Q:** Do students need to simplify on all problems, or only on the ones that say "simplify?"
**A:** The administration directions will be changed to read, "Simplify all answers as far as you can."

"Simplify" means
- Perform the order of operations.
- Combine all like terms (in any order).
- Opposite operations are allowed. For example, a ● ¼ is the same as a ÷ 4, and b – 4 is the same as b + -4.

Examples:

| | |
|---|---|
| Problem: | **Evaluate: 5 – (-3) – 4** |
| Student response: | **8 - 4** |
| Points: | **0 points** |
| Acceptable responses: | **4, +4** |

| | |
|---|---|
| Problem: | **Simplify: 8(b – 7) + 1 + 2b** |
| Student response: | **10b + -55** |
| Points: | **1 point** (10b – 55 and 10b + -55 are both correct answers) |

**ALGEBRA FOUNDATIONS MEASURE**

Algebra Foundations is recommended for Grades 7, 8, and Algebra 1. Grade 7 students may also be assessed using the Algebra Basic Skills measure. Students in Grade 8 and Algebra 1 may also be assessed using the Content Analysis measure.

## Algebra Foundations Measure – General Description
- "Robust Indicator" with problems representing five core concepts/skills essential to conceptual understanding in algebra:
  - Writing and evaluating variables and expressions
  - Computing expressions (integers, exponents, and order of operations)
  - Graphing expressions and linear equations
  - Solving 1-step equations and simplifying expressions
  - Identifying and extending patterns in data tables
- 42 items (50 points) in 5 minutes
- Score number of problems correct

## Algebra Foundations Measure – Scoring
- Each correct response is worth 1 point. **Some boxes have spaces for two answers – each answer is worth 1 point, for a total of 2 points for the box.**
- Each ordered pair is counted as 1 point (the box with two ordered pairs is worth TWO points, not four). Ordered pairs must be assigned to the <u>correct</u> label.
- Skipped problems and incorrect answers are worth 0 points.
- Count mathematically equivalent responses as correct.
- Answers must be completely simplified.
- TOTAL SCORE = total number of points earned (50 points possible)

### Simplifying
**Q:** Do students need to simplify on all problems, or only on the ones that say "simplify?"
**A:** The administration directions will be changed to read, "Simplify all answers as far as you can."

*See description and examples on previous page.*

### Slopes
**Q:** Do slopes need to be reduced?
**A:** No. However, the numerator and denominator must each be simplified.

<u>Example:</u>
Problem:              The graph shows a line with a slope of 2.

Correct responses:    $2, +2, \dfrac{4}{2}, \dfrac{2}{1}, \dfrac{+4}{+2}$, etc.

Incorrect response:    $\dfrac{4-2}{2-1}$

**Key points about word phrase problems on the Algebra Foundations Measure**:

- Numbers do not need to be spelled out. It is acceptable to write "2" or "two" in a word phrase problem.
- Operations must be spelled out in words; symbols such as **+**, **-**, **\***, **÷**, are not acceptable when a word phrase is required.
- Operations must be explicit.

  ○ Example: Given the fraction $\dfrac{k}{2}$, "a number over 2" is <u>not</u> an acceptable response.

  Answers such as "a number divided by 2" or "1/2 of a number" are acceptable.

- It is acceptable to use letters to represent variables. For example, "4b" could be translated as "4 times b" or "4 times a number."
- Order of operations should always be assumed. For example, "4 divided by b minus 8" is the same as $\dfrac{4}{b}-8$, but is NOT the same as $\dfrac{4}{b-8}$.

Word Phrase Example 1: Write a word phrase for this expression: $\dfrac{k}{2}$

|  | Answer given | Score As |
|---|---|---|
| **Answer Key** | a number divided by 2 | Correct |
| **Student 1** | k over 2 | Incorrect, because the operation is not explicit |
| **Student 2** | a number over 2 | Incorrect, because the operation is not explicit |
| **Student 3** | k divided by 2 | Correct |
| **Student 4** | 2 divided into a number | Correct |
| **Student 5** | 2 divided by k | Incorrect, because the statement is not mathematically equivalent |
| **Student 6** | One-half of a number | Correct |
| **Student 7** | k times ½ | Correct |
| **Student 8** | A number multiplied by 1/2 | Correct |

Word Phrase Example 2: Write a word phrase for this expression: d – 15

|  | Answer given | Score As |
|---|---|---|
| **Answer Key** | 15 subtracted from a number | Correct |
| **Student 1** | a number minus 15 | Correct |
| **Student 2** | d subtracted by 15 | Incorrect, because the meaning of "by" is unclear |
| **Student 3** | 15 less than a number | Correct |
| **Student 4** | 15 subtracted from d | Correct |
| **Student 5** | A number subtracted from 15 | Incorrect, because the statement is not mathematically equivalent |
| **Student 6** | d minus 15 | Correct |

# CONTENT ANALYSIS MEASURE

Content Analysis is recommended for students in Grade 8 and Algebra 1.  Students may also be assessed on the Algebra Foundations measure at these grade levels.

## Content Analysis Measure – General Description
- "Curriculum Sampling" rather than "Robust Indicators"
- Problems are sampled from the initial 2/3 of a traditional Algebra 1 course (McDougal-Littel – through systems of linear equations and inequalities)
- 16 items (48 points) in 7 minutes
- Items are multiple choice, but students are encouraged to show work to obtain partial credit (see "Content Analysis Measure – Scoring")

## Content Analysis Measure - Scoring
- Each multiple-choice item is worth up to 3 points (48 possible points)
- To discourage random guessing, students lose one point (-1) for each wrong answer for which no work is shown
- Students are encouraged to show work to earn partial credit:
  - **+3** points for **correct answer** with or without work
  - **-1** point for **wrong answer** with no work shown (penalty for guessing)
  - For a **wrong answer** or **no answer** with work shown, assign **partial credit**:
    - **+0** if the student's work **DOES NOT ALIGN** with anything on the scoring key
    - **+1** if the student's answer has features that match what is **ABOVE** the line on the scoring key
    - **+2** if the student's answer has features that match what is **BELOW** the line on the scoring key
  - **Ignore blank problems** (no answer and no work = 0 points)

## Common Partial Credit Issues
The purpose of the Content Analysis Measure is to track growth on conceptual understanding.  Therefore, errors that reflect misconceptions related to order of operations, exponents, and other algebraic ideas generally earn fewer points of partial credit than do "simple" computational errors, including errors in integer manipulation.   For borderline responses, err on the generous side:

- If the student's work includes both correct and incorrect work, award partial credit for the correct work.
- If work has been erased or crossed out but is still legible, partial credit may also be awarded, in accordance with the scoring key.
- "Marks", such as marking points on a graph, using slashes to reduce a fraction, or crossing out incorrect answers, count as work shown.  That means that a wrong answer would receive 0 points instead of -1, even if there is no work shown that matches the answer key.
- If the student writes the correct answer but does not circle the answer, award 2 points.
- On the answer key, sometimes more than one possible response is shown, but this is sometimes misinterpreted by teachers as a sequence of essential steps.  When awarding partial credit, it is important to be aware that the answer keys show **random examples** for illustration purposes only.

**Partial Credit Question1:** What if the only work shown is a copy of the wrong answer chosen? Would the student receive 0 points, or -1 for guessing?

Example A (Probe E-6, Page 2, Row 2, Problem 2):

Question:     **Write the equation in slope-intercept form if m = 6 and b = 4.**

Student writes: **y = 4x + 6** and circles **answer D** (y = 4x + 6).  (Correct answer is y = 6x + 4)

Scoring:      **0 points.**  No penalty for guessing, because this could reflect a reasonable attempt.


Example B (Probe E-5, Page 2, Row 2, Problem 1):

Question:     **Find the slope of a line through (2, 3), (8, -9)**.

Student writes:  **2** and circles **answer B** ("2").

Scoring:      **-1 point.**  Without work, there is no evidence that the student did anything other than guess.

Clarification
For one-step problems, writing the wrong answer can be counted as work.  For example, a student who uses the slope-intercept formula incorrectly (Example A) still shows some knowledge about the form of the equation.  However, for problems that require multiple steps (such as finding and simplifying the slope of a line), additional work would be needed to know that the student had not guessed randomly.


**Partial Credit Question 2:** What if one of the distractors is the same as the work shown above the line on the answer key?

Example A (Probe E-5, Page 2, Row 2, Problem 2):

Question:     **Simplify the expression** $\dfrac{f^3 g}{g^2} \bullet \dfrac{g^2}{fg}$

Answer key:   Student can earn one point for "Multiplies across to combine terms" (i.e., $\dfrac{f^3 g^3}{g^3 f}$ )

Answer choices:     **Answer A** is incorrect but matches the work shows for partial credit: $\dfrac{f^3 g^3}{g^3 f}$

Example B (Probe E-5, Page 1, Row 1, Problem 2):

Question:                 **Evaluate the expression** $(-9)^2$

Answer key:               Student can earn one point for "Applies the exponent:  -81"

Answer choices:          **Answer A** is incorrect but matches the work shown for partial credit:  -81

In Example B above, one student wrote **-81** and circled **answer A** ("-81") and received +1.  A different student wrote nothing but also circled answer A and received -1 for guessing.

Correct Scoring
For consistency in scoring, students who circle a wrong answer <u>without showing work</u> lose one point (-1), even in problems like those shown above.


**Evaluating Expressions with Order of Operations**
Some problems ask students to evaluate an expression for given values.  A student who "substitutes values for variables" can earn 1 point.  A student who "further reduces elements in the expression" would earn 2 points, even if calculation errors are made.  However, the reducing of terms <u>must follow the order of operations</u>.  For example, consider the problem

   **Evaluate $a^2 - b \div 2$ when a = 4 and b = 6**

| **Student 1** | **Student 2** |
|---|---|
| $4^2 - 6 \div 2$ | $4^2 - 6 \div 2$ |
| $8 - 6 \div 2$ | $8 - 6 \div 2$ |
| $8 - 3$ | $2 \div 2$ |
| 5 | 1 |
| **Earns +2** | **Earns +1** |

Both students substituted values for variables, as shown above the line on the scoring key.  Both students attempted to further reduce elements in the expression, and both students made the same calculation error ($4^2 \neq 8$).

However, Student 1 followed the order of operations when reducing the expression $8 - 6 \div 2$; Student 2 did not.  Therefore, Student 1 earns 2 points partial credit, while Student 2 only earns 1 point.  (The correct answer for this problem is 13.)

# Recommended Cut Scores for AAIMS Algebra Probes

## Based on Student Performance within Huron County, Michigan prior to August, 2012

When using AAIMS Algebra probes as part of a Multi-Tiered System of Supports (MTSS), it is useful to set cut scores based on a correlation of student performance on the AAIMS probes to later performance on the mathematics portions of the Michigan Educational Assessment Program (MEAP) or Michigan Merit Exam (MME). In order to interpret the tables below, the following definitions will be useful:

**sensitivity** – the percentage of students correctly identified as at risk
**specificity** – the percentage of students correctly identified as not at risk
**accuracy** – the overall percentage of students who are correctly identified as at risk or not at risk

The **sensitivity** and **specificity** of a measure can be changed by raising or lowering the target (the Tier 1 cut score). Raising the target will result in increased sensitivity and decreased specificity. A measure with high sensitivity will "catch" most students who are at risk but may over-identify some students. By contrast, lowering the target will increase the specificity of the measure at the expense of sensitivity. When a student performs below target on a measure with high specificity, one can be certain that the student is at risk, but the measure may "miss" some at-risk students.

The Tier 1 cut scores (targets) in the following tables were determined by seeking the cut score that would yield the greatest specificity and accuracy possible while not allowing the sensitivity to drop below 0.70. The Tier 3 range is based on a high specificity (>0.95) along with correlation to a MEAP or MME performance level of 4. Students performing above Tier 3 but below target are considered to be Tier 2.

### Table 1: Algebra Basic Skills

|  | Fall | Winter | Spring |
|---|---|---|---|
| Grade 6 |  |  |  |
| **Tier 1** | 11+ | 12+ | 16+ |
| *sensitivity* | 0.79 | 0.78 | 0.67 |
| *specificity* | 0.64 | 0.61 | 0.68 |
| *accuracy* | 0.72 | 0.70 | 0.68 |
| **Tier 2** | 5-10 | 6-11 | 7-15 |
| **Tier 3** | 0-4 | 0-5 | 0-6 |
| Grade 7 |  |  |  |
| **Tier 1** | 15+ | 16+ | 17+ |
| *sensitivity* | 0.73 | 0.87 | 0.74 |
| *specificity* | 0.71 | 0.63 | 0.70 |
| *accuracy* | 0.72 | 0.80 | 0.73 |
| **Tier 2** | 7-14 | 8-15 | 10-16 |
| **Tier 3** | 0-6 | 0-7 | 0-9 |

**Table 2:  Algebra Foundations**

|  | Fall | Winter | Spring |
|---|---|---|---|
| Grade 7 |  |  |  |
| **Tier 1** | 11+ | 14+ | 17+ |
| *sensitivity* | 0.83 | 0.76 | 0.78 |
| *specificity* | 0.71 | 0.74 | 0.63 |
| *accuracy* | 0.80 | 0.75 | 0.74 |
| **Tier 2** | 4-10 | 7-13 | 11-16 |
| **Tier 3** | 0-3 | 0-6 | 0-10 |
| Grade 8 |  |  |  |
| **Tier 1** | 19+ | 21+ | 23+ |
| *sensitivity* | 0.76 | ------- | 0.76 |
| *specificity* | 0.79 | ------- | 0.62 |
| *accuracy* | 0.77 | ------- | 0.74 |
| **Tier 2** | 12-18 | 12-20 | 12-22 |
| **Tier 3** | 0-11 | 0-11 | 0-11 |
| Grade 9+ |  |  |  |
| **Tier 1** | 23+ | 25+ | 28+ |
| *sensitivity* | 0.73* | 0.85* | 0.76* |
| *specificity* | 0.69* | 0.62* | 0.69* |
| *accuracy* | 0.73* | 0.81* | 0.75* |
| **Tier 2** | 12-22 | 12-24 | 12-27 |
| **Tier 3** | 0-11 | 0-11 | 0-11 |

**Table 3:  Content Analysis**

|  | Fall | Winter | Spring |
|---|---|---|---|
| Grade 8 |  |  |  |
| **Tier 1** | 12+ | 15+ | 20+ |
| *sensitivity* | 0.76 | ------- | ------- |
| *specificity* | 0.61 | ------- | ------- |
| *accuracy* | 0.72 | ------- | ------- |
| **Tier 2** | 3-11 | 7-14 | 11-19 |
| **Tier 3** | 0-2 | 0-6 | 0-10 |
| Grade 9+ |  |  |  |
| **Tier 1** | 20+ | 24+ | 27+ |
| *sensitivity* | 0.71* | 0.80* | 0.80* |
| *specificity* | 0.69* | 0.85* | 0.62* |
| *accuracy* | 0.71* | 0.80* | 0.77* |
| **Tier 2** | 11-19 | 15-23 | 18-26 |
| **Tier 3** | 0-10 | 0-14 | 0-17 |

* Correlations between ninth-grade performance on the AAIMS measures and later performance on the MME are less accurate because the only students who take the AAIMS assessments in Grade 9 are those who did not complete Algebra 1 in Grade 8.

# AAIMS Algebra Basic Skills (A) or Algebra Foundations (B)
## <mark>FALL ADMINISTRATION DIRECTIONS</mark>

**<u>Before</u> distributing tests, read:**

*{<u>Basic Skills</u> or <u>Algebra Foundations</u>} is a short assessment, or probe, to monitor your learning in math.  This probe is different from classroom tests or quizzes and is <u>not</u> meant to be completely finished.  There may be problems that are difficult or unfamiliar.  As you learn more about math in this class, your scores will improve.*

**Distribute probes with Page 2 facing up, and direct students to write their name and teacher on the page.  Continue reading:**

*Please turn your paper over.  The sample page shows examples of the types of problems on the {<u>Basic Skills</u> or <u>Algebra Foundations</u>} probe.  Take 1 minute to practice doing the sample page.  If you finish before I say "Stop," please do NOT turn to the next page.  Any questions?* [pause] *Ready, begin.* [time for 1 minute]  *Stop, pencils down.  Are there any questions?* [answer procedural questions only; DO NOT suggest ways to solve the problems]

*You will have 5 minutes to complete this two-page probe.  Please look at each problem.  If you do not know how to answer it, skip it, and go on to the next problem.  If you have time at the end, go back to the problems you skipped.  Try to complete as many problems correctly as you can in the time allowed, and do your best work.  Remember to simplify all answers.*

*When I say "begin," turn the page and begin on Page 1.  If you finish the first side, turn it over and continue working.  Do you have any questions?  Ready, begin.* [time for 5 minutes]  *Stop.  Please put your pencils down and hold up your papers so that I can collect them.*

*CALCULATORS MAY <u>NOT</u> BE USED ON THE PROBES.*

# AAIMS Algebra Basic Skills (A) or Algebra Foundations (B)
## <mark>WINTER and SPRING ADMINISTRATION DIRECTIONS</mark>

**<u>Before</u> distributing tests, read:**

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**Distribute probes with Page 2 facing up, and direct students to write their name and teacher on the page.   Continue reading:**

> *You will have 5 minutes to complete this two-page probe.  Please look at each problem.  If you do not know how to answer it, skip it, and go on to the next problem.  If you have time at the end, go back to the problems you skipped.  Try to complete as many problems correctly as you can in the time allowed, and do your best work.  Remember to simplify all answers.*

> *When I say "begin," turn your paper over and begin on Page 1.  If you finish the first side, turn it over and continue working.  Do you have any questions?  Ready, begin.  [time for 5 minutes]  Stop.  Please put your pencils down and hold up your papers so that I can collect them.*

**CALCULATORS MAY <u>NOT</u> BE USED ON THE PROBES.**

# AAIMS Content Analysis (E)
## <mark>FALL ADMINISTRATION DIRECTIONS</mark>

**Before distributing tests, read:**

*Content Analysis is a short assessment, or probe, to monitor your learning in math. This probe is different from classroom tests or quizzes and is <u>not</u> meant to be completely finished. There may be problems that are difficult or unfamiliar. As you learn more about math in this class, your scores will improve.*

**Distribute probes with Page 2 facing up, and direct students to write their name and teacher on the page. Continue reading:**

*Please turn your paper over. The sample page shows examples of the types of problems on the Content Analysis probe. The problems are multiple choice. Each problem is worth 3 points, but you can earn partial credit by showing your work. If you do not know the answer, you should NOT make wild guesses, because you could lose points.*

*Look at the box for student A. She circled the wrong answer and did not show any work; she will <u>lose</u> a point for this problem. . Student B circled the wrong answer, but because she showed some correct work, she will earn 1 out of 3 points. Student C showed his work, but did not finish the problem. He will earn 1 out of 3 points*

*Take 1 minute to practice doing the sample page. If you finish before I say "Stop," please do NOT turn to the next page. Any questions? [pause] Ready, begin. [time for 1 minute] Stop, pencils down. Are there any questions? [answer procedural questions only; DO NOT suggest ways to solve the problems]*

*You will have 7 minutes to complete this two-page probe. Please look at each problem. If you do not know how to answer it, skip it, and go on to the next problem. If you have time at the end, go back to the problems you skipped. Try to complete as many problems correctly as you can in the time allowed, and do your best work. Remember that you can earn partial credit by showing your work even if you do not complete the problem. Do NOT make wild guesses, because you could lose points.*

*When I say "begin," turn the page and begin on Page 1. If you finish the first side, turn it over and continue working. Do you have any questions? Ready, begin. [time for 7 minutes] Stop. Please put your pencils down and hold up your papers so that I can collect them.*

***CALCULATORS MAY <u>NOT</u> BE USED ON THE PROBE.***

# AAIMS Content Analysis (E)
## WINTER and SPRING ADMINISTRATION DIRECTIONS

**<u>Before</u> distributing tests, read:**

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**Distribute probes with Page 2 facing up, and direct students to write their name and teacher on the page. Continue reading:**

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*When I say "begin," turn your paper over and begin on Page 1. If you finish the first side, turn it over and continue working. Do you have any questions? Ready, begin.* [time for 7 minutes] *Stop. Please put your pencils down and hold up your papers so that I can collect them.*

***CALCULATORS MAY <u>NOT</u> BE USED ON THE PROBE.***