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## Math-Curriculum Based Measurement (M-CBM)

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### Training Session Overview of Math Computation CBM (M-CBM) and Math Facts Probes for use with AIMSweb

Part of a training series developed to accompany the **AIMSweb Improvement System**.

Purpose is to provide the background information and data collection procedures necessary to administer and score Reading Comprehension- Curriculum Based Measurement (MAZE).

Designed to accompany:

- Administration and Scoring of M-CBM Workbook
- Standard Math-CBM probes
- AIMSweb Web-based Software

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### Training Session Goals

Brief review of M-CBM

- Its Purpose.
- Its Origins.

Learn how to administer and score through applied practice.

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### General Outcome Measures from Other Fields

Medicine measures height, weight, temperature, and/or blood pressure.

Federal Reserve Board measures the Consumer Price Index.

Wall Street measures the Dow-Jones Industrial Average.

Companies report earnings per share.

McDonald's measures how many hamburgers they sell.

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### Why Assess Math Computation via CBM:

- Computational skills are critical for math success.
- Using the algorithms for computation assist in building math skills needed to master higher-level math proficiency.
- Broad-range achievement tests in math cover many skills, but few of each type.

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Why assess Math via M-CBM Cont'd:

- Many broad-range math achievement tests have only one form.
  - Difficult to monitor progress repeatedly over time
  - Hard to determine where student's skill-levels start/stop
- M-CBM provides many, narrow-band tests (many items across a grade-level or problem type)
- Simple to administer, score, chart progress.

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M-CBM Methodology:

- Research has shown that having students write answers to computational problems for 2-4 minutes is a reliable, valid means of assessing student progress in math computation.
- Appropriate for average-performing students in Grades 1-6
- Appropriate for students enrolled above Grade 6, but are performing below this level.

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M-CBM Methodology:

- Based on expected math computation skills for Grades 1-6:
  - Benchmarking: M-CBM (10 probes available per grade level)
  - Strategic Monitoring: M-CBM (40 probes available per grade level)
- Progress Monitoring: M-CBM (40 probes available per grade level) or:
  - Progress Monitoring: Math Facts: (40 probes available per grade level)
- Each probe contains 2 pages of computations, (front/back)
- Students complete probes under standardized conditions (See specific directions)
- Administer individually, small group, or class-wide:
  - (Grade 1-3 = 2 minutes)
  - (Grade 4-6 = 4 minutes)

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M-CBM Grade-Level Probes

- All M-CBM Grade-level type probes level are based on Prototype Probe
- Prototype Probes: All types of problems contained within the scope of a grade-level skill spectrum are consistent in order/sequence across all probes for each specified grade level.

7	7	0
-7	-1	+9
0	6	9
(1)	(1)	(1)

6	6	3
-1	-3	+9
5	3	12
(1)	(1)	(2)

A-1: Same type of problem on each page

15	66	20
-14	+35	+6
1	101	26
(1)	(3)	(2)

Grade 2: Probe 1

-13	+9	+73
12	14	161
(2)	(2)	(3)

Grade 2: Probe 2

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M-CBM Sample 2nd Grade Probe (Student Copy)

AIMSweb® M-CBM Computation Benchmark #3 - Grade 2

Student Name: \_\_\_\_\_ Grade: \_\_\_\_\_ Teacher Name: \_\_\_\_\_

7	9	4	5	6	1
-1	-1	+9	-5	+0	+5
20	34	4	61	9	6
-12	+74	+13	+67	+4	+9
9	47	6	97	65	79
-1	-45	+3	+81	+57	+25

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M-CBM Sample 2nd Grade Probe (Teacher's Answer Key)

AIMSweb® M-CBM Computation Benchmark #3 - Grade 2 Answer Key

7	9	4	5	6	1	
-1	-1	+9	-5	+0	+5	
6	8	13	0	6	6	7 (7)
(1)	(1)	(2)	(1)	(1)	(1)	
20	34	4	61	9	6	
-12	+74	+13	+67	+4	+9	
8	108	17	128	17	15	13 (20)
(1)	(3)	(2)	(3)	(2)	(2)	
9	47	6	97	65	79	
-1	-45	+3	+81	+57	+25	
8	2	9	178	122	104	12 (32)
(1)	(1)	(1)	(3)	(3)	(3)	

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### M-CBM Math Facts: Addition

AIMSweb® Math Addition Facts 0-12 - Primary Answer Key

4	3	3	8	1	7
+9	+5	+9	+4	+7	+1
13	8	12	12	8	8

6 9 1 0 4 3  
+5 +0 +6 +0 +1 +0  
11 9 7 8 5 3

10 8 6 5 3 0  
+1 +5 +1 +5 +2 +10  
11 13 7 10 5 10

2 8 1 4 8 9  
+0 +3 +6 +0 +6 +9  
2 11 7 4 14 18

12 4 10 2 8 0  
+8 +6 +7 +1 +5 +5  
20 10 17 3 13 5

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AIMSweb® Math Addition Facts 0-12 - Intermediate Answer Key

0	1	3	9	0	4	5
+2	+5	+0	+2	+2	+1	+5
3	6	3	18	2	8	10

4 3 5 6 7 3 4  
+2 +1 +2 +1 +11 +4 +2  
8 4 7 7 18 8 4

1 0 2 8 8 2 5  
+2 +3 +11 +7 +3 +8 +11  
16 3 13 16 8 10 16

8 1 2 7 1 0 7  
+0 +6 +4 +3 +2 +2 +4  
8 7 6 10 3 2 11

4 9 1 3 3 12 6  
+5 +2 +7 +11 +0 +1 +1  
9 11 8 14 10 13 7

2 2 2 6 8 2 9  
+8 +0 +0 +0 +7 +2 +4 +2  
11 2 2 13 11 6 9

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Grades 1-3 (fewer problems)      Grades 4-6 (more problems)

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### M-CBM Math Facts: Probe options

- Addition (+) facts
- Subtraction (-) facts
- Addition/Subtraction (+ / -) mixed facts
- Multiplication facts (x)
- Division facts (÷)
- Multiplication/Division mixed facts (x / ÷)
- Addition/Subtraction/Multiplication/Division mixed facts (+, -, x, ÷)

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### AIMSweb Math Fact Probes

Used primarily for instructional planning and short-term progress monitoring

AIMSweb Math Fact Probes (p.8 in M-CBM Workbook)

Content of Facts Probe	Timing	Test Arrangements	What is Scored
Addition Fact Families 0-12 (0+0 to 12+12)	2 minutes	Individual, small or large group	Correct digits in answer
Subtraction Fact Families 0-12 (0-0 to 24-12)	2 minutes	Individual, small or large group	Correct digits in answer
Addition and Subtraction Fact Families 0-12	2 minutes	Individual, small or large group	Correct digits in answer
Multiplication Fact Families 0-12 (0+0 to 12+12)	2 minutes	Individual, small or large group	Correct digits in answer
Division Fact Families 0-12 (0/0 to 144/12)	2 minutes	Individual, small or large group	Correct digits in answer
Multiplication and Division Fact Families 0-12	2 minutes	Individual, small or large group	Correct digits in answer
Addition, Subtraction, Multiplication and Division Fact Families 0-12	2 minutes	Individual, small or large group	Correct digits in answer

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### M-CBM Administration Setup

**Things you will need:**

1. Appropriate M-CBM or Math Facts Probes
2. Students need pencils.
3. Stopwatch or timers

**Setting up the testing room:**

1. Large group: Monitor carefully to ensure students are not skipping and X-ing out items
2. Small group/individual: Monitor similarly.
3. If students are off task, cue with statements such as:

*"Try to do EACH problem."  
OR  
"You can do this kind of problem so don't skip."*

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### M-CBM Directions for Administration

**Different M-CBM's require different instructions (4 versions):**

**Standard Math-Curriculum Based Measurement Probe instructions:**

- Grades 1-3: Page 13 of workbook
- Grades 4-6: Page 14 of workbook

**Single-Skill Math Fact Probes—Standard Directions:**

- Grades 1-6 probes: Page 15 of workbook

**Multiple Skill Math Fact Probes—Standard Directions:**

- Grades 1-6 probes: Page 16 of workbook

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### M-CBM After Testing—Scoring

What is Correct?

- Grades 1-6: Score Digits Correct (DC). Each digit correct in any answer = 1 point.
- If problem is "X"-ed out, ignore X and score anyway.
- Use Answer Key for quick scoring.
- See Page 18 of workbook for examples.

**M-CBM: How to score Correct Digits (CD)**

**Correct Digits** - Each correct digit that a student writes is marked with an underline and counted.

$\begin{array}{r} 12 \\ \times 7 \\ \hline 84 \end{array}$	(2 CD Possible) Score = 2 CD	$\begin{array}{r} 12 \\ \times 7 \\ \hline 89 \end{array}$	(2 CD Possible) Score = 1 CD
$\begin{array}{r} 12 \\ \times 7 \\ \hline 74 \end{array}$	(2 CD Possible) Score = 1 CD	$\begin{array}{r} 12 \\ \times 7 \\ \hline 19 \end{array}$	(2 CD Possible) Score = 0 CD
$\begin{array}{r} 9588 \\ - 6519 \\ \hline 3039 \end{array}$	(4 CD Possible) Score = 4 CD	$\begin{array}{r} 9558 \\ - 6519 \\ \hline 3041 \end{array}$	(4 CD Possible) Score = 2 CD

**M-CBM: How to score Incomplete Problems**

**Incomplete Problems** - Sometimes students don't finish a problem. Score for the number of correct digits that are written.

$\begin{array}{r} 360 \\ \times 9 \\ \hline 40 \end{array}$	(4 CD Possible) Score = 2 CD	<b>Answer Key</b> $\begin{array}{r} 360 \\ \times 9 \\ \hline 3240 \end{array}$ (4)
$\begin{array}{r} 9488 \\ - 8084 \\ \hline 404 \end{array}$	(4 CD Possible) Score = 3 CD	$\begin{array}{r} 9488 \\ - 8084 \\ \hline 1404 \end{array}$ (4)

**M-CBM: How to score "X"-ed out problems**

**X-ed Out Problems** - Sometimes students start a problem and then cross it out. Sometimes students go back and write answers for problems they have crossed out. Ignore the X and score what you see.

$\begin{array}{r} \cancel{98} \\ \times \cancel{7} \\ \hline \cancel{56} \end{array}$	(3 CD Possible) Score = 1 CD	<b>Answer Key</b> $\begin{array}{r} 98 \\ \times 7 \\ \hline 686 \end{array}$ (3)
$\begin{array}{r} \cancel{925} \\ - \cancel{28} \\ \hline 897 \end{array}$	(3 CD Possible) Score = 3 CD	$\begin{array}{r} 925 \\ - 28 \\ \hline 897 \end{array}$ (3)

**M-CBM: How to score reversals**

**Legibility and Reversed or Rotated Numbers** - Sometimes trying to figure out what number the student wrote can be challenging, especially with younger students or older students with mathematics achievement problems. To make scoring efficient and reliable, we recommend attention to three rules:

- If it is difficult to determine what the number is at all, count it wrong.
- If the reversed number is obvious, but correct, count it as a correct digit.
- If the numbers 6 or 9 are potentially rotated and the digit is currently incorrect, count it as an incorrect digit.

$\begin{array}{r} 10 \\ + 4 \\ \hline 14 \end{array}$	(2 CD Possible) Score = 2 CD	$\begin{array}{r} 7 \\ + 6 \\ \hline 1E \end{array}$	(2 CD Possible) Score = 1 CD
$\begin{array}{r} 6 \\ - 0 \\ \hline 9 \end{array}$	(1 CD Possible) Score = 0 CD	$3 \overline{) 27}$	(1 CD Possible) Score = 0 CD

**How to score M-CBM: Critical Processes (CP) Scoring**

**Scoring Rules for Answer and Critical Processes:**

When students' Grade 5 or Grade 6 M-CBM probes are scored for the number of CDs in the **answer only and critical processes**, the examiner uses the answer key that details which digits are to be counted. Each problem has an "assigned CD value" based on what AIMSweb believes is the most conventional method of solving the computational problem. Compare how the same multi-step multiplication problem would be scored using the different methods.

<b>Use error patterns diagnostically</b>	<b>Answer Only:</b>	<b>Answer &amp; Critical Processes:</b>
	$\begin{array}{r} 630 \\ \times 48 \\ \hline 30240 \end{array}$ (5) <i>Answer Only</i> 5 CD Possible	$\begin{array}{r} 630 \\ \times 48 \\ \hline 5040 \\ 2520 \\ \hline 30240 \end{array}$ (13) <i>Answer and Critical Processes</i> 13 CD Possible

**How to score M-CBM: Critical Processes (CP) Scoring (Correct vs. Incorrect)**

Should the student solve the problem correctly, their score would be 13 CD.	<b>Answer Key</b> $\begin{array}{r} 630 \\ \times 48 \\ \hline 5040 \\ 2520 \\ \hline 30240 \end{array}$ (13)	Should the student solve the problem and not write any of the CD, the score would be 0 CD.
$\begin{array}{r} 630 \\ \times 48 \\ \hline 5040 \\ 2520 \\ \hline 30,240 \end{array}$ (13 CD Possible) Score = 13 CD		$\begin{array}{r} 630 \\ \times 48 \\ \hline 678 \end{array}$ (13 CD Possible) Score = 0 CD

(p. 21 in M-CBM Workbook)

Although you don't need to count every digit written in a correct answer, it is important to write the number of CDs awarded to the problem next to the answer.

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### How to score M-CBM: Critical Processes (CP) Scoring (Work not shown)

If the answer is correct as shown below-left, their score is the number of CDs possible shown in the answer key.

630
x 48
5040
2520
30240
(13)

630  
x 48 **13** (13 CD Possible)  
30240  
Score = 13 CD

If they do *not* show their work and the answer is incorrect, the examiner can only "score what they see" as shown below.

630
x 48
3
30348
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630  
x 48 **3** (13 CD Possible)  
30348  
Score = 3 CD

(p. 21 in M-CBM Workbook)

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### How to score M-CBM: Answer & Critical Processes (CP) Scoring (Alignment)

When students' answers are not aligned correctly according to place value:

If the answer is correct, ignore the alignment problem and count the digits as correct as shown below.

703
358
+ 307
1368
(4)

(4 CD Possible)  
Score = 4 CD

Answer Key

703
358
+ 307
1368
(4)

If the answer is incorrect, count the digits as they appear in approximate place value as shown below, even if a place value error may seem obvious.

2
630
x 48
5040
2520
30240
(13)

(13 CD Possible)  
Score = 1 CD

Answer Key

630
x 48
5040
2520
30240
(13)

(p. 22 in M-CBM Workbook)

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# The End

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