

Texas Early Mathematics Inventories – Progress Monitoring

The TWMI-PM consists of four 2-minute timed measures for kindergarten, grade 1, and grade 2. Each of the tests can be considered measures of fluency, because the student's score reflects both rate and accuracy. Total testing time, including administration instructions, is usually less than 30 minutes. The tests are designed to be administered by students' classroom teachers, who learn how to give the test by watching a training video on CD-ROM. All tests are group administered.

The four TEMI-PM component tests are described below, grouped by grade level.

Kindergarten Level

Magnitude Comparisons (MC): This test assesses a child's ability to differentiate the bigger of two numbers that are shown side by side within a box. The format is similar to that used by Clark and Shinn (in press) in their Quantity Discrimination Verbal 1-20 measure.

For kindergarten students, targeted numerals ranged from 0 through 20. Students are told to circle the larger of the two numbers. If two numbers are the same (e.g., 5 5), students are told to draw a circle around both numbers. This alternative response is designed to minimize somewhat the chances of arriving at a correct answer by guesswork alone (the odds become 1 in 3 instead of 1 in 2).

Two different numerals appear in boxed rows of a student stimulus worksheet, several boxed sets to a row. Several rows of numerals are provided on each stimulus sheet. The students circle their answer within each two-numeral set in left-to-right order for 2 minutes, and the amount of correctly identified numbers constitutes the raw score.

P

3	7	8	1	5	0	1	6
13	7	11	2	6	13	5	10
15	8	11	11	14	29	11	2
4	16	2	17	10	6	5	16

2	2	10	4
13	15	1	11
18	12	5	5
1	9	6	11
2	9	11	15
8	3	16	12


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Number Identification (NID): This test assesses a child's ability to match an Arabic numeral presented in print to a series of boxes. Numbering from 1 through 20, boxes appear five to a row, with additional boxes appearing side by side. For example, the number 3 is represented by three boxes side by side. The number 8 is represented by a row of five boxes, with three boxes side by side in the next row. The number 19 is represented by three rows of five boxes, with an additional four boxes side by side in the next row.


Targeted numerals ranged from 0 through 20. These numbers correspond to end-of-year standards based on the Texas Essential Knowledge and Skills (TEKS). The boxes appear in the far left column of the protocol, followed by four Arabic numerals. The students circle the numeral that corresponds to the number of boxes shown. The students do as many items as they can in 2 minutes, and the amount of correctly identified numerals constitutes the raw score.


P


	1	2	3	4
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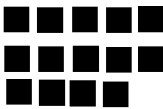
	1	2	3	4
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	1	2	3	4
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	1	2	3	4
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	2	3	4	5
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	5	6	7	8
---	---	---	---	---

	12	13	14	15
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Number Sequences (NS): This measure assesses a child's ability to identify a missing number from a sequence of three numbers. The missing number could appear in any of three positions: the first number, the second number, or the third number. The format is similar to that used by Clark and Shinn (in press) in their Missing Number Varied 1-20 measure.

For kindergarten students, targeted numerals ranged from 0 through 20. Two different numerals and one blank (the missing number was represented by a blank) constitute a set and appear in boxed rows of a student stimulus worksheet, several boxed sets to a row. For each item, four response choices are provided, and the students circle their choice for the blank in the sequence. The students have 2 minutes to do as many items as they can, and the amount of correctly identified missing numbers constitutes the raw score.

P

3 4 _____			_____ 2 3			4 _____ 6		
1	6		2	5		1	3	
4	5		1	6		0	5	
6 _____ 8			_____ 1 2			3 4 _____		
7	5		3	4		11	2	
3	10		0	11		5	6	
_____ 8 9			1 2 _____			13 14 _____		
1	4		5	0		14	15	
7	0		3	13		2	1	

1 _____ 3		_____ 14 15		12 13 _____	
3	2	1	9	7	4
17	1	13	12	14	9

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Quantity Recognition (QR): This test assesses a child’s ability to see a series of dots clustered together and identify how many dots there are in all. Kaufman, Lord, Reese, and Volkman (1949) used the term *subitizing* to describe the rapid, correct, and self-assured judgment of the quantity represented by small numbers of items. The format for this test has been used by several researchers, including Benoit, Lehalle, and Jouen (2004). These researchers differentiated “familiar” from “unfamiliar” dot configurations. Familiar configurations are similar to that used on dice; unfamiliar configurations are more random. We selected the unfamiliar configuration, because we wanted to reduce the effects of board game influence (i.e., we posited that students who played board games as preschoolers may have an advantage over those who did not, and we wanted subitizing to be assessed, not board game experience).

The test is administered to kindergarten students only. Several boxes appear in rows and columns on a page. Each box contains a series of randomly placed dots clustered together, but not touching. The children identify how many dots are in each box and circles one of six response choices (1 through 6). Early boxes contain one, two, or three dots—with later items adding a fourth, fifth, and sixth dot. A 2-minute timing is imposed, and the number of correctly identified items constitutes the raw score. Children with good subitizing skills will presumably not have to count each dot in order to identify “how many,” while less mature students will likely have to count each dot in a cluster in order to provide a response.

P

1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6

●	● ● ●	● ● ●	● ● ●	● ●
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6

● ●	● ● ● ● ●	● ● ●	● ●	● ●
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6

●	● ● ● ● ●	● ● ●	● ● ● ● ●	●
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6

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Grade 1 Level

Magnitude Comparisons (MC): This test assesses a child's ability to differentiate the smaller of two numbers that are shown side by side within a box. The format is similar to that used by Clark and Shinn (in press) in their Quantity Discrimination Verbal 1-20 measure.

For first-grade students, targeted numerals ranged from 0 through 99. Students are told to circle the smaller of the two numbers. Once again, if two numbers are equal (e.g., 35 = 35), students are told to draw a circle around both numbers. Later items have larger numbers, allowing for more proficient students to continue responding to more difficult, mature items.

Two different numerals appear in boxed rows of a student stimulus worksheet, several boxed sets to a row. Several rows of numerals are provided on each stimulus sheet. The students circle their answer within each two-numeral set in left-to-right order for 2 minutes, and the amount of correctly identified numbers constitutes the raw score.

P

13	5	7	10	58	62	63	63
13	7	11	2	6	13	5	10
15	8	33	33	54	29	11	42
64	16	52	47	80	46	75	46
42	42	60	74	83	35	51	11
38	22	45	45	61	79	56	71

92	89	41	35	28	53	76	82
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Number Sequences (NS): This measure assesses a child’s ability to identify a missing number from a sequence of three numbers. The missing number could appear in any of three positions: the first number, the second number, or the third number. The format is similar to that used by Clark and Shinn (in press) in their Missing Number Varied 1-20 measure.

For first-grade students, targeted numerals ranged from 0 through 99. Two different numerals and one blank (the missing number was represented by a blank) constitute a set and appear in boxed rows of a student stimulus worksheet, several boxed sets to a row. For each item, four response choices are provided, and the students circle their choice that goes in the blank in the sequence. The students have 2 minutes to do as many items as they can, and the amount of correctly identified missing numbers constitutes the raw score.

P

1	2	_____	16	_____	18	_____	81	82
1	3		5	19		19	79	
5	13		17	21		83	80	
6	_____	8	_____	1	2	3	4	_____
7	5		3	4		11	2	
3	10		0	11		5	6	

_____ 8 9		1 2 _____		13 14 _____	
1	4	5	0	14	15
7	0	3	13	2	1
1 _____ 3		_____ 14 15		12 13 _____	
3	2	1	9	7	4
17	1	13	12	14	9

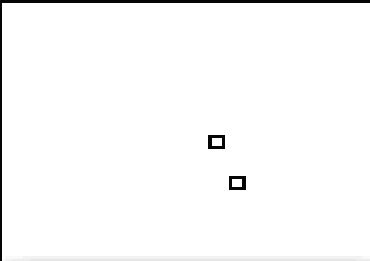
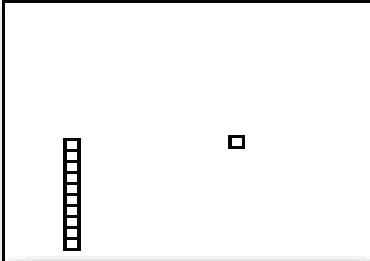
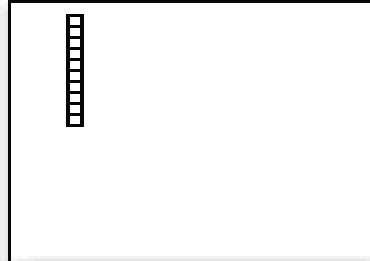
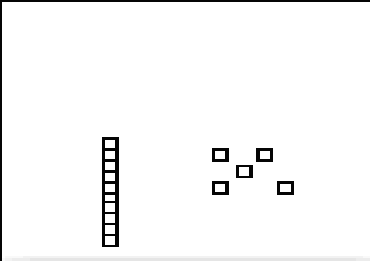
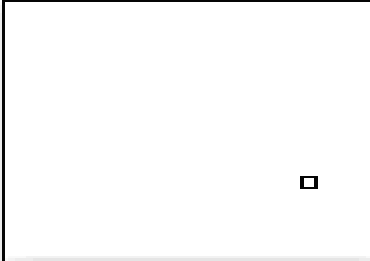
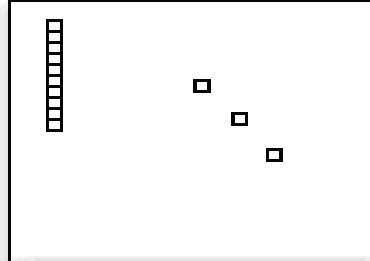
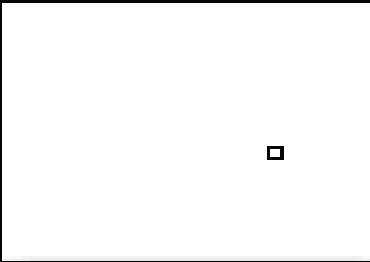
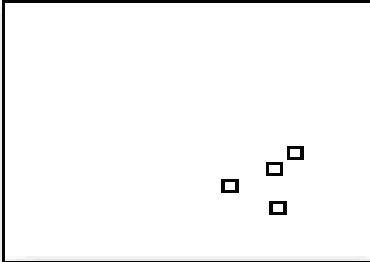
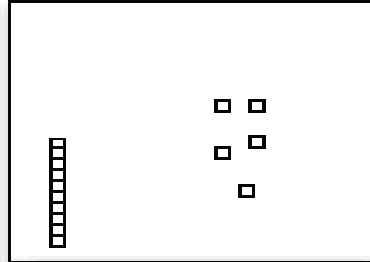
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Place Value (PV): This test is designed to assess first graders' knowledge of place value. The test uses a similar format to what is commonly seen in early math textbooks (e.g., Addison-Wesley Scott Foresman, SRA). For first graders, values range from 1 to 99.

Students are shown boxes of figures depicting tens and ones. For example, the number 34 is depicted by showing three pictures of tens (i.e., three pictures of stacked squares in a vertical position) and four ones (i.e., a picture of four squares placed randomly in a cluster). Four response choices are provided, and the students circle the quantity shown (i.e., how many), in this case 34. Some early items depict no tens, just ones (e.g., 6). Later items are more challenging. They may depict 2 tens and 14 ones to show 34.

P

		
2 4	26 11	10 1
1 0	12 18	14 16
		
8 15	1 4	10 15
17 13	2 10	14 13
		
1 16	6 4	10 17
2 12	5 7	15 16

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Addition/Subtraction Combinations (ASC): This test assesses first graders' ability to correctly write the answers to addition and subtraction facts to and from 18. Items appear five to a row, with eight rows of problems in all. Students compute and write their answers to as many items as they can for 2 minutes. The total number of correctly computed problems, written correctly (e.g., with no reversals or gross illegibility), constitutes the raw score.

P

$$\begin{array}{r} 1 \\ + 0 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ - 2 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ + 1 \\ \hline \end{array}$$

$$\begin{array}{r} 2 \\ - 1 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ - 2 \\ \hline \end{array}$$

$$\begin{array}{r} 5 \\ + 0 \\ \hline \end{array}$$

$$\begin{array}{r} 0 \\ + 3 \\ \hline \end{array}$$

$$\begin{array}{r} 5 \\ - 1 \\ \hline \end{array}$$

$$\begin{array}{r} 2 \\ - 0 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ + 3 \\ \hline \end{array}$$

$$\begin{array}{r} 1 \\ + 0 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ - 0 \\ \hline \end{array}$$

$$\begin{array}{r} 12 \\ - 7 \\ \hline \end{array}$$

$$\begin{array}{r} 13 \\ - 4 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ - 0 \\ \hline \end{array}$$

$$\begin{array}{r} 10 \\ - 2 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ + 8 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ + 3 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ - 1 \\ \hline \end{array}$$

$$\begin{array}{r} 7 \\ - 2 \\ \hline \end{array}$$

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Grade 2 Level

Magnitude Comparisons (MC): This test assesses a child's ability to differentiate which number is less from two numbers that are shown side by side within a box. The format is similar to that used by Clark and Shinn (in press) in their Quantity Discrimination Verbal 1-20 measure.

For second-grade students, targeted numerals range from 0 through 999. Students identify which of the two numbers is "less" and circle the number. If two numbers are the same and of equal magnitude, students draw a

circle around both numbers. The use of the word “less” is designed to match vocabulary that should have been mastered by the end of the second grade.

Two different numerals appear in boxed rows of a student stimulus worksheet, several boxed sets to a row. Several rows of numerals are provided on each stimulus sheet. The students circle their answer within each two-numeral set in left-to-right order for 2 minutes, and the amount of correctly identified numbers constitutes the raw score.

P

0	5	43	79	58	58	100	363
13	7	11	2	6	13	5	10
15	8	33	33	54	29	11	42
164	216	352	47	80	246	175	146
442	442	160	274	583	435	251	311
538	122	245	245	761	279	356	471

192	689	341	235
428	253	176	82

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Number Sequences (NS): This measure assesses a child's ability to identify a missing number from a sequence of three numbers. The missing number could appear in any of three positions: the first number, the second number, or the third number. The format is similar to that used by Clark and Shinn (in press) in their Missing Number Varied 1-20 measure.

For second-grade students, targeted numerals ranged from 0 through 999. Two different numerals and one blank (the missing number was represented by a blank) constitute a set and appear in boxed rows of a student stimulus worksheet, several boxed sets to a row. For each item, students write the missing number in the blank. The amount of correctly written missing numbers constitutes the raw score.

P

_____ 4 5	16 _____ 18	7 _____ 9
16 17 _____	54 _____ 56	197 198 _____
342 343 _____	_____ 164 165	_____ 180 181

330 331 _____	_____ 451 452	318 319 _____
640 _____ 642	333 334 _____	_____ 765 766
840 841 _____	_____ 339 340	911 _____ 913

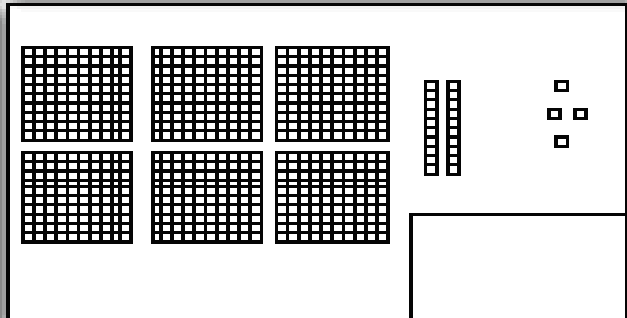
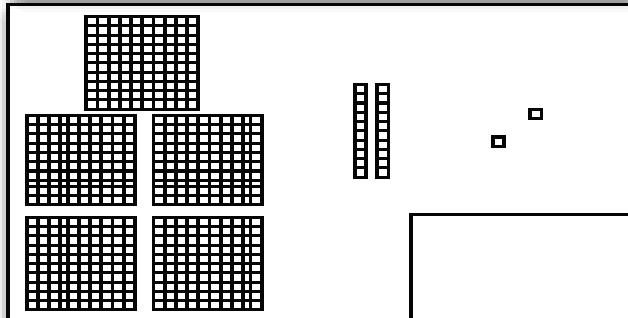
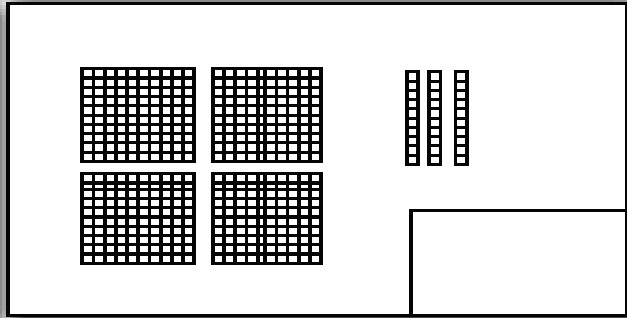
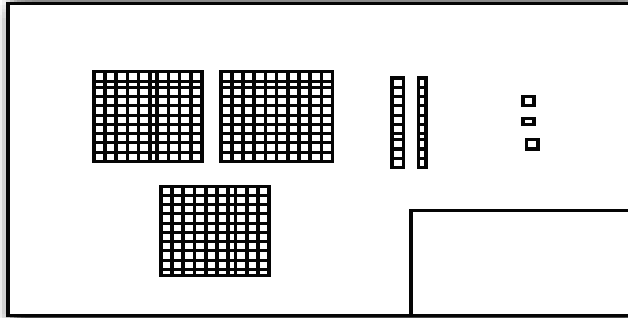
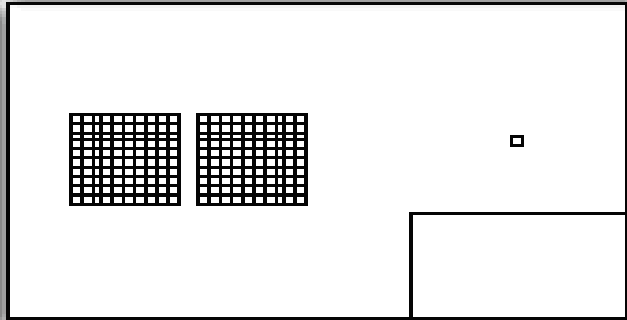
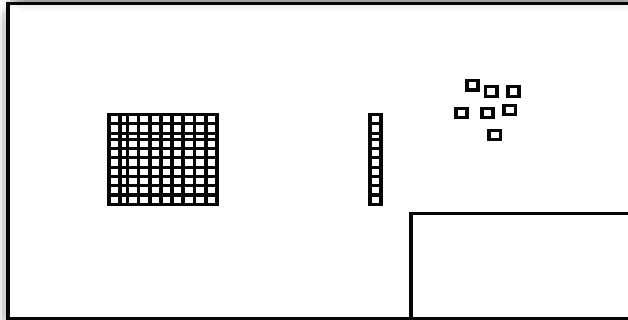
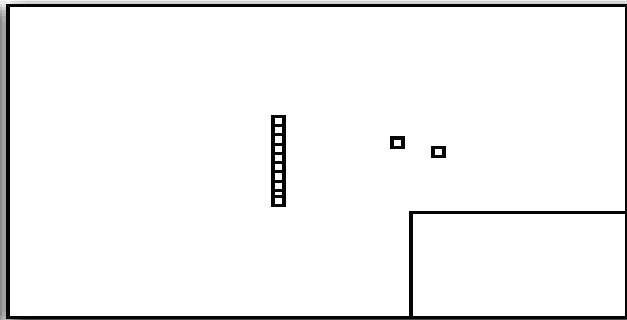
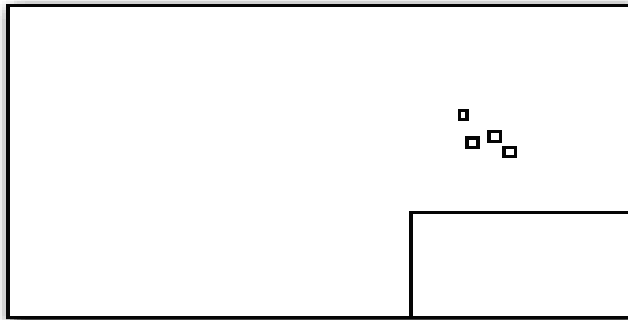
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Place Value (PV): This test is designed to assess second graders' knowledge of place value. The test uses a similar format to what is commonly seen in early math textbooks (e.g., Addison-Wesley Scott Foresman, SRA). For first graders, values range from 1 to 99. For second graders, values range from 1 to 999.

Students in the second grade see boxes of figures depicting hundreds, tens, and ones. For example, the number 134 is depicted by showing one picture of hundreds (i.e., one picture of a 100 block, 10 ten stacks together), three pictures of tens (i.e., three pictures of stacked squares in a vertical position) and four ones (i.e., a picture of four squares placed randomly in a cluster). The student has to name the quantity shown (i.e., how many), in this case 134. Some early items depict no hundreds, just tens and ones (e.g., 6). Later items are more challenging. They may depict 3 one hundreds, 15 tens and 2 ones to show 452. Students write their response in a box that is part of each item.

P



Addition/Subtraction Combinations (ASC): This test assesses second graders' ability to correctly write the answers to addition and subtraction facts to and from 18. Items appear five to a row, with eight rows of problems in all. Students compute and write their answers to as many items as they can for 2 minutes. The total number of correctly computed problems, written correctly (e.g., with no reversals or gross illegibility), constitutes the raw score.

P

$$\begin{array}{r} 1 \\ + 0 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ - 2 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ + 1 \\ \hline \end{array}$$

$$\begin{array}{r} 2 \\ - 1 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ - 2 \\ \hline \end{array}$$

$$\begin{array}{r} 5 \\ + 0 \\ \hline \end{array}$$

$$\begin{array}{r} 0 \\ + 3 \\ \hline \end{array}$$

$$\begin{array}{r} 5 \\ - 1 \\ \hline \end{array}$$

$$\begin{array}{r} 2 \\ - 0 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ + 3 \\ \hline \end{array}$$

$$\begin{array}{r} 1 \\ + 0 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ - 0 \\ \hline \end{array}$$

$$\begin{array}{r} 12 \\ - 7 \\ \hline \end{array}$$

$$\begin{array}{r} 13 \\ - 4 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ - 0 \\ \hline \end{array}$$

$$\begin{array}{r} 10 \\ - 2 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ + 8 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ + 3 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ - 1 \\ \hline \end{array}$$

$$\begin{array}{r} 7 \\ - 2 \\ \hline \end{array}$$



Test of Early Mathematics Inventories – Outcome

The TEMI-O provides separate tests for kindergarten, grade 1, and grade 2. All three measures are designed to assess content found in the Texas Essential Knowledge and Skills (TEKS), which mirrors the areas delineated in the NCTM Standards. Each measure is described briefly below, again presented by grade level.

Kindergarten Level

The kindergarten level has only one test, which contains 37 items. The items assess number, operation, and quantitative reasoning; patterns, relationships, and algebraic thinking; geometry and spatial reasoning; measurement; probability and statistics; and underlying processes and mathematical tools. The teacher reads aloud a stimulus prompt (e.g., “Mark the box that shows a rectangle.”), and the students select their responses from among three response choices. Some items are marked with an asterisk (*) on the administration instructions—teachers should give students up to 30 seconds to complete these items because they involve more time to answer. But most of the items take only about 10 seconds to answer. Testing should be conducted over two consecutive days, with the first 20 items administered on Day 1 and the remaining items given on Day 2.

Grade 1 Level

The first-grade level comprises two tests, Mathematics Problem Solving (MPS) and Mathematics Computation (MCo). The MPS measure contains 39 items that assess number, operation, and quantitative reasoning; patterns, relationships, and algebraic thinking; geometry and spatial reasoning; measurement; probability and statistics; and underlying processes and mathematical tools. As with the kindergarten level, teachers read aloud the stimulus item prompts, one at a time. Students have about 10 seconds to mark their answer from among four response choices. Some items are marked with an asterisk (*) on the administration instructions—teachers should give students up to 30 seconds to complete these items because they involve more time to answer. The last response choice for each item is “Not Shown,” which increases the complexity of the item. That is, the answer may not be provided by the first three response choices. This format is similar to multiple-choice items that have “None of the Above” as a possible answer.


The MCo measure for grade 1 contains 30 items that assess addition and subtraction skills. Students are given 25 minutes to complete the items. Testing should be conducted over two days, with MPS administered on Day 1 and MCo given the second day.













Grade 2 Level

Like the first-grade level, the grade 2 level comprises two tests, Mathematics Problem Solving (MPS) and Mathematics Computation (MCo). The MPS measure contains 39 items that assess a variety of TEKS: number, operation, and quantitative reasoning; patterns, relationships, and algebraic thinking; geometry and spatial reasoning; measurement; probability and statistics; and underlying processes and mathematical tools. As with the other levels, teachers read aloud the stimulus items prompts, one at a time. Students have about 10 seconds to mark their answers from among four response choices. Some items are marked with an asterisk (*) on the administration instructions—teachers should give the students up to 30 seconds to complete these items because they involve more time to answer. As with the grade 1 level, the last response choice for each item is “Not Shown,” which increases the complexity of the item. Again, the answer may not be among the first three response choices, so the format mirrors multiple-choice tests that contain “None of the Above” as a response choice.

Grade 2 MCo contains 55 items that assess addition and subtraction (with and without renaming) and early multiplication and division skills; students have 30 minutes to complete the items. Testing should be conducted over two days, with MPS administered on Day 1 and MCo given the second day.

Below is an example of the types of items assessed on the Math Problem Solving Subscale. The same format is used with all three grades: K, 1, and 2, except the kindergarten version has no NS (Not Shown) as a response choice.

5 

		$3+2=5$	$3+2=4$	$4+1=5$	NS
					NS
					NS

First Grade, Form A First Grade TEMI
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Flower

- | | | |
|----|-----|--|
| 10 | 3 | <ul style="list-style-type: none"> • Turn to the page where you see a flower at the top. • Move your marker under the row with the lollipop. See the stickers in the first box and listen to this story. • Gena was given three stickers for her good behavior during reading. She got two more stickers during mathematics class. She wants to know how many stickers she got in all. She was given three stickers, then two more. • Now look at the number sentences in the other boxes. Mark the box that has the number sentence to answer how many stickers Gena had in all. • Mark the box with the NS if you don't see the answer. |
| 11 | K-2 | <ul style="list-style-type: none"> • Move your marker under the row with the lion. • See the ear in the first box. This means that you need to listen carefully. • Look at the other boxes. Mark the box that shows the second circle filled in. • Mark the box with the NS if you don't see the answer. |
| 12 | K-5 | <ul style="list-style-type: none"> • Move your marker under the row with the ball. • See the pattern in the first box. • Now look at the other boxes. Mark the box that shows what should go next in the sequence. • Mark the box with the NS if you don't see the answer. |

PRACTICE:

$1 + 0 =$		$\begin{array}{r} 3 \\ - 1 \\ \hline \end{array}$		$0 + 1 =$	
2	3	5	2	6	5
1	30	8	1	3	0
NS		NS		NS	
$\begin{array}{r} 3 \\ + 2 \\ \hline \end{array}$		$\begin{array}{r} 2 \\ - 2 \\ \hline \end{array}$		$\begin{array}{r} 4 \\ + 1 \\ \hline \end{array}$	
6	2	0	4	2	9
5	3	22	7	16	5
NS		NS		NS	

