

Items to Assess The Presence of Multiplicative Thinking

Brickwedde, revised 2013

Directions: This interview is designed to draw out student thinking in solving tasks to assess the emergence of multiplicative thinking. Place value, at its core, is a multiplicative relations. The goal across third through fifth grade students is to begin the transition from additive ways of thinking to more multiplicative ones. In recording a student's thinking, note if the individual's approach is additive, show evidence of making composite units, or demonstrates levels of automaticity in being able to think in scale and/or in multiples.

Assessment Item	Student name:
3rd Grade	
<p>Place Value concepts – Unitizing across place</p> <p><i>On a sheet of paper, interviewer writes the number 783 and shows it to the student. Ask the following questions:</i></p> <ul style="list-style-type: none"> • How many ones are in 783? • How many tens? • How many hundreds? 	<p>Note: If the student initially answers '3' for how many ones in 783, redirect the student by saying <i>You would be correct if I was asking you how many ones are in the ones place. I am asking you a different question. I am asking you about the whole number. How many ones are in the number 783?</i></p>
<p>Multiplicative scaling questions (Base ten relationship)</p> <p><i>Interviewer writes on the paper</i> 10 10 100</p> <p><i>Say: Do you agree with me that there are 10 tens in 100?</i></p> <p><i>Write on paper directly under that statement</i> — 10 400</p> <p><i>Say: If that is true, can you use that to help you figure out how many tens are in 400?</i></p>	
<p>Place Value & Decomposition of Number (Distributive & Commutative Properties)</p> <p><i>– Interviewer writes just the number on the paper. The interviewer records the student's thinking – Ask student to first solve mentally, if necessary present paper to the student</i></p> <ul style="list-style-type: none"> • Double 63 • Triple 17 • Quadruple 13 	<p><i>Listen for student's use of language. Is he or she is speaking only in single digits, talking in number values, limited only to the standard algorithm... ?</i></p>
<p>Measurement Division – Unitizing across place</p> <ul style="list-style-type: none"> • The factory that makes colored markers has a bin filled with 265 markers. If the sorting machine places 10 markers in every box, how many full boxes can it fill? 	
<p>Get to a Number – Organizing around landmarks of ten</p> <p><i>Record for the student using arrow notation. Example: $14 + 6 \rightarrow 20 \xrightarrow{+80} 100$, answer is 86</i></p> <ul style="list-style-type: none"> • How much to get from 57 to 100? • How much to get from 246 to 300? • You are at 62. Go back 5. 	<p>Note: If the student has not ever seen or done this activity before, do a talk through with the first combination.</p>

***Algebraic/Relational Thinking -
Understanding equality***

• $8 + 4 = \underline{\quad} + 7$ What goes in the box to make this true?

• $17 = 5 + 12$ True or False?

• $24 + 73 = 72 + \underline{\quad}$ What goes in the box to make this true?

Examples of Items to Assess The Presence of Multiplicative Thinking

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Assessment Item	Student name:
4th Grade	
<p>Place Value concepts – Unitizing across place</p> <p><i>On a sheet of paper, interviewer writes the number 783 and shows it to the student. Ask the following questions:</i></p> <ul style="list-style-type: none"> • How many ones are in 783? • How many tens? • How many hundreds? 	<p>Note: If the student initially answers '3' for how many ones in 783, redirect the student by saying <i>You would be correct if I was asking you how many ones are in the ones place. I am asking you a different question. I am asking you about the whole number. How many ones are in the number 783?</i></p>
<p>Multiplicative scaling questions</p> <p><i>(Scale factor of 3)</i> <i>Interviewer writes on the paper</i> 5 5 25</p> <p><i>Say: Do you agree with me that there are 5 fives in 25?</i></p> <p><i>Write directly under that statement</i> — 5 75</p> <p><i>Say: If that is true, can you use that to help you figure out how many fives are in 75?</i></p> <p><i>(Base ten relationship)</i> <i>Write on the paper</i> 3 10 30</p> <p><i>Say: Do you agree with me that there are 3 tens in 30?</i></p> <p><i>Write on paper directly under that statement</i> — 10 300</p> <p><i>Say: If that is true, can you use that to help you figure out how many tens are in 300?</i></p>	
<p>Place Value & Decomposition of Number (Distributive & Commutative Properties)</p> <p><i>– Interviewer writes just the number on the paper. The interviewer records the student's thinking – Ask student to first solve mentally, if necessary present paper to the student</i></p> <ul style="list-style-type: none"> • Double 163 • Triple 27 • Quadruple 18 	<p><i>Listen for student's use of language. Is he or she speaking only in single digits, talking in number values, limited only to the standard algorithm... ?</i></p>
<p>Measurement Division – Unitizing across place</p> <ul style="list-style-type: none"> • The factory that makes colored markers has a bin filled with 465 markers. If the sorting machine places 10 markers in every box, how many full boxes can it fill? (1257 if automatic with 465) 	

<p><i>Get to a Number – Organizing around landmarks of ten</i></p> <p><i>Record for the student using arrow notation. Example: $14 + 6 \rightarrow 20 + 80 \rightarrow 100$, answer is 86</i></p> <ul style="list-style-type: none"> • How much to get from 57 to 100? • How much to get from 246 to 300? • You are at 62. Go back 5. 	<p>Note: If the student has not ever seen or done this activity before, do a talk through with the first combination.</p>
<p><i>Algebraic/Relational Thinking – Understanding equality</i></p> <ul style="list-style-type: none"> • $8 + 4 = \underline{\quad} + 7$ What goes in the box to make this true? • $17 = 5 + 12$ True or False? • $24 + 73 = 72 + \underline{\quad}$ What goes in the box to make this true? 	

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Assessment Item	Student name:
5th Grade	
<p>Place Value concepts – Unitizing across place</p> <p><i>On a sheet of paper, interviewer writes the number 783 and shows it to the student. Ask the following questions:</i></p> <ul style="list-style-type: none"> • How many ones are in 783? • How many tens? • How many hundreds? 	<p>Note: If the student initially answers '3' for how many ones in 783, redirect the student by saying <i>You would be correct if I was asking you how many ones are in the ones place. I am asking you a different question. I am asking you about the whole number. How many ones are in the number 783?</i></p>
<p>Multiplicative scaling questions</p> <p><i>(Scale factor of 3)</i> <i>Write on the paper</i> 5 5 25 <i>Say: Do you agree with me that there are 5 fives in 25?</i></p> <p><i>Write directly under that statement</i> — 5 75 <i>Say: If that is true, can you use that to help you figure out how many fives are in 75?</i></p> <p><i>(Base ten relationship)</i> <i>Write on the paper</i> 3 10 30 <i>Say: Do you agree with me that there are 3 tens in 30?</i></p> <p><i>Write on paper directly under that statement</i> — 10 300 <i>Say: If that is true, can you use that to help you figure out how many tens are in 300?</i></p>	
<p>Place Value & Decomposition of Number (Distributive & Commutative Properties) <i>– Interviewer writes just the number on the paper. The interviewer records the student's thinking – Ask student to first solve mentally, if necessary present paper to the student</i></p> <ul style="list-style-type: none"> • Double 461 • Triple 47 • Quadruple 28 	<p><i>Listen for student's use of language. Is he or she speaking only in single digits, talking in number values,, limited only to the standard algorithm... ?</i></p>
<p>Measurement Division – Unitizing across place</p> <ul style="list-style-type: none"> • The factory that makes colored markers has a bin filled with 1465 markers. If the sorting machine places 10 markers in every box, how many full boxes can it fill? (6257 if automatic with 1465) 	

<p>Multiplicative Compare Problem – Scaling task</p> <ul style="list-style-type: none"> • There are two bins of markers ready to go to the sorting machine on the factory floor. One bin has 360 markers in it. That's ten times as many as in the second bin. How many markers are in the second bin? 	
<p>Get to a Number – Organizing around landmarks of ten</p> <p><i>Record for the student using arrow notation. Example: $14 + 6 \rightarrow 20 + 80 \rightarrow 100$, answer is 86</i></p> <ul style="list-style-type: none"> • How much to get from 246 to 300? • How much to get from 457 to 1000? • How much to get to 872 to 2,138 • How much to get from 1,000 to 364? 	<p>Note: If the student has not ever seen or done this activity before, do a talk through with the first combination.</p>
<p>Algebraic/Relational Thinking – Understanding equality</p> <ul style="list-style-type: none"> • $8 + 4 = \underline{\quad} + 7$ What goes in the box to make this true? • $17 = 5 + 12$ True or False? • $24 + 73 = 72 + \underline{\quad}$ What goes in the box to make this true? 	