



Diagnostic Assessments for Numeracy

This document includes a series of diagnostic interview assessments. I designed them to be used to collect a 'snapshot' of basic number sense skills, knowledge, and understandings of primary students. My background teaching experience is in NSW schools where I used the NSW Department of Education SENAs (Schedules for Early Number Assessment) as diagnostic interviews at the beginning of each year with my students. Other states and countries use similar diagnostic interviews such as in Victoria where many schools use Ann Gervasoni's Mathematics Assessment Interview (MAI) from the Extending Mathematical Understanding (EMU) program – a great resource.

I still use the SENAs, but I didn't want to use the same assessment repeatedly throughout the year, so I needed an alternative. I also often get asked by teachers, *do you have any other assessments?* Designing assessments can be difficult so I tried to come up with a way to write assessments that simplified the process. The assessment essentially just focuses on one number, 16. I will give credit to [Peter Gould](#) who first introduced me to the '16 tiles' task. In the 16 tiles task students have to count out 16 tiles, write the number 16, then explain what the 'one' and the 'six' mean. I really like the simplicity of focusing on one number and asking a variety of questions to discover students' conceptual understanding. I took the 16 tiles task and designed several other questions all using the number 16. I have made three different assessment versions (a, b and c) that overlap and increase in sophistication so they can be used from Year 1 to Year 6. Teachers can choose which assessment to use, you also do not need to use all the questions.

By asking questions related to different number concepts but using the same number, it makes it easier to write alternative assessments. For example, I could now write a version of the assessment with very similar questions but using a different number such as: 12, 24 or 36. The structure of the assessment can remain the same, the numbers just change.

These assessments should be conducted one-to-one by the classroom teacher as students' reasoning is important to hear/collect along with the strategies they use. If time does not permit for one-to-one interviews, small groups can be used. Videoing or audio recording the interviews are also beneficial for later analysis or for collaborative validating of teacher judgement. I hope teachers find these assessments helpful! Feel free to adapt and add to them as required.

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Diagnostic Assessment for Numeracy- Number Sense and Algebra 16 (Version a)

Student name:

Date:

Class:

Task question	Comments/ possible student responses	Numeracy Progression levels (Version 2)	NSW Syllabus links and AC descriptors
Quantifying numbers			
What number comes after 16?	<ul style="list-style-type: none"> Starts count from one Counts from a few before 16 Counts on from 16 "16, 17" Says 17 	QuN3 – QuN6	MAe-4NA ACMNA001
What number comes before 16?	<ul style="list-style-type: none"> Starts count from one Counts down from a few after 16 Counts down from 16 "16, 15" Says 15 	QuN3 – QuN6	MAe- 4NA ACMNA001
Can you get 16 tiles for me?	<ul style="list-style-type: none"> Uses one-to-one to count a few tiles (up to 10) Counts tiles out one-by-ones to 16 Counts tiles out by twos 	QuN2 - QuN5	Mae-4NA ACMNA002 ACMNA289
Can you write the number 16?	<ul style="list-style-type: none"> Attempts to write 16, may write 61 Writes 16 	QuN6	MA1-4NA ACMNA013



Task question	Comments/ possible student responses	Numeracy Progression levels (Version 2)	NSW Syllabus links and AC descriptors
From Quantifying numbers to Additive strategies			
<p>Using the tiles can you show me what the 6 means?</p> <p>Prompt if needed: “You counted out 16 tiles and wrote the number 16, what does the 6 mean (point to the 6)?” “Can you show me, using the tiles?”</p>	<ul style="list-style-type: none"> • Is unable to count out 6 tiles to represent the 6, may use one tile • May count out six tiles and place them in a visual ‘6’ • Counts out six tiles • Says 16 is ten and 6 ones so then gets out 6 tiles from the counted pile <p>May draw place value ‘columns’ on page</p>	<p>QuN2 – QuN8</p>	<p>MA1-4NA MA1-5NA MA1-2WM</p> <p>ACMNA014 ACMNA015</p>
<p>Using these tiles can you show me what the one means?</p> <p>Prompt if needed: “What does the one mean?” “In 16?” “Can you show me using the tiles?”</p> <p>“You counted out 16 tiles and wrote the number 16, what does the 1 mean (point to the 1)?”</p> <p><i>If students get out one tile - Point or gesture to remaining tiles the student counted – “What about these ones?”</i></p>	<ul style="list-style-type: none"> • Takes one tile to represent the ‘one’ or ‘ten’ (needs bold prompt question) • Moves all the remaining tiles to represent the one but may not make connection to the ‘ten’ • Counts out all remaining tiles (10) and says the 1 means 10 	<p>QuN8</p>	<p>MA1-4NA MA1-5NA MA1-2WM</p> <p>ACMNA014 ACMNA015</p>



Task question	Comments/ possible student responses	Numeracy Progression levels (Version 2)	NSW Syllabus links and AC descriptors
<p>If I had 16 apples and I buy 5 more, how many do I have now?</p> <p>How did you work that out?</p>	<ul style="list-style-type: none">• Starts count from one for 16 then does the same for 5 and is unable to solve the task• Says 16, then counts on by ones to get 21• Says 5 and 6 is 11 and 10 more is 21• Says 16 and 4 is 20 and one more is 21	AdS3 – AdS6	MA1-5NA MA1-1WM ACMNA015 ACMNA030
<p>If I had 16 apples and I ate 7, how many apples do I have left?</p> <p>How did you work it out?</p>	<ul style="list-style-type: none">• Counts up from one to 16 then back seven (may use fingers) to get to 9• Counts down from 16 by ones to get to 9• Counts up from 7 to 16• Says I took 6 away from 16 to get 10 then one more to get 9• Says if it was 17 that would be ten but its 16 so it's 9	AdS3 – AdS6	MA1-5NA MA1-1WM ACMNA015 ACMNA029 ACMNA030
<p>What is the difference between 12 and 16? How do you know?</p> <p><i>If students do not relate to subtraction and do not get 4, ask this:</i></p> <p>I played netball on the weekend and we lost 12 to 16. What was the difference in scores? (Or How much did we lose by?)</p>	<ul style="list-style-type: none">• Students talk about what is 'different' e.g. 12 is smaller than 16 • Attempted to count up or down from 12 or 16 but counted the starting number so got 5• Counted up from 12 to 16 and got 4• Counted down from 16 to 12 and got four	AdS5	MA1-5NA ACMNA015 ACMNA029 ACMNA030



Task question	Comments/ possible student responses	Numeracy Progression levels (Version 2)	NSW Syllabus links and AC descriptors
From Additive to Multiplicative strategies			
<p>Think about the number 16.</p> <p>How could I divide 16 tiles into equal rows?</p> <p>How many tiles would be in each row?</p>	<ul style="list-style-type: none"> Says 2 groups of eight (8 tiles in each group) Says 2 rows of 8 (8 tiles in each row, may say 2) Says 4 rows of 4 (4 tiles in each row) Says one row of 16 (16 tiles in the row) 	MuS3- MuS6	MA1-6NA ACMNA012 ACMNA032 ACMNA031
<p>Here are 16 tiles, can you show me what the equal rows look like?</p> <p>How would you describe what you have done?</p>	<ul style="list-style-type: none"> Makes 2 groups of 8 Tries to make groups of 3, 5 or other numbers Makes 2 rows of 8 Makes 4 rows of 4 Continues to make other representations and relates it to known multiples or factors 	MuS1 – MuS7	MA1-6NA MA1-2WM ACMNA012 ACMNA032 ACMNA031
<p>Is there another way to put the tiles in equal rows?</p> <p>What about another way?</p>	See above suggestions	MuS4- MuS7	MA1-6NA MA1-3WM ACMNA012 ACMNA032 ACMNA031



Diagnostic Assessment for Numeracy- Number Sense and Algebra 16 (Version b)

Student name:

Date:

Class:

Task question	Comments/ possible student responses	Numeracy Progression levels (Version 2)	NSW Syllabus links and AC descriptors
Quantifying numbers			
Can you get 16 tiles for me?	<ul style="list-style-type: none"> • Uses one-to-one to count a few tiles (up to 10) • Counts tiles out one-by-ones to 16 • Counts tiles out by twos 	QuN2 - QuN5	Mae-4NA ACMNA002 ACMNA289
Can you write the number 16?	<ul style="list-style-type: none"> • Attempts to write 16, may write 61 • Writes 16 	QuN6	MA1-4NA ACMNA013
From Quantifying numbers to Additive strategies			
Using the tiles can you show me what the 6 means? Prompt if needed: "You counted out 16 tiles and wrote the number 16, what does the 6 mean (point to the 6)?" "Can you show me, using the tiles?"	<ul style="list-style-type: none"> • Is unable to count out 6 tiles to represent the 6, may use one tile • May count out six tiles and place them in a visual '6' • Counts out six tiles • Says 16 is ten and 6 ones so then gets out 6 tiles from the counted pile 	QuN2 – QuN8	MA1-4NA MA1-5NA MA1-2WM ACMNA014 ACMNA015



Task question	Comments/ possible student responses	Numeracy Progression levels (Version 2)	NSW Syllabus links and AC descriptors
<p>Using these tiles can you show me what the one means? Prompt if needed: “What does the one mean?” “In 16?” “Can you show me using the tiles?”</p> <p>“You counted out 16 tiles and wrote the number 16, what does the 1 mean (point to the 1)?”</p> <p><i>If students get out one tile - Point or gesture to remaining tiles the student counted – “What about these ones?”</i></p>	<ul style="list-style-type: none"> • Takes one tile to represent the ‘one’ or ‘ten’ (needs bold prompt question) • Moves all the remaining tiles to represent the one but may not make connection to the ‘ten’ • Counts out all remaining tiles (10) and says the 1 means 10 	<p>QuN8</p>	<p>MA1-4NA MA1-5NA MA1-2WM</p> <p>ACMNA014 ACMNA015</p>
<p>If I had 16 apples and I buy 5 more, how many do I have now?</p> <p>How did you work that out?</p>	<ul style="list-style-type: none"> • Starts count from one for 16 then does the same for 5 and is unable to solve the task • Says 16, then counts on by ones to get 21 • Says 5 and 6 is 11 and 10 more is 21 • Says 16 and 4 is 20 and one more is 21 	<p>AdS3 – AdS6</p>	<p>MA1-5NA MA1-1WM</p> <p>ACMNA015 ACMNA030</p>
<p>What are two numbers that add to make 16?</p>	<ul style="list-style-type: none"> • Attempts to say two numbers, may say 10 and 10 or 6 and 6 or other response • Says 10 and 6 • Says 11 and 5 etc • Is unable to use 3 numbers to make 16 	<p>AdS6 – AdS7</p>	<p>MA1-5NA MA1-8NA</p> <p>ACMNA015 ACMNA030 ACMNA036</p>



Task question	Comments/ possible student responses	Numeracy Progression levels (Version 2)	NSW Syllabus links and AC descriptors
<p>Can you tell me another two numbers that make 16? What about three numbers that add to make 16?</p>	<ul style="list-style-type: none"> • Uses guess and check or working through from a random number (e.g. 3... and 9... and 4?) • Uses knowledge fo 10 as a base and makes combinations of 10 and adds 6 (e.g. 7 and 3 is 10 then 6 more is 16) • Uses info above (e.g. 10+6 to then say 5 and 5 and 6) • 14 and 1 and 1 or other responses 		
<p>If I had 16 apples and I ate 7, how many apples do I have left? How did you work it out?</p>	<ul style="list-style-type: none"> • Counts up from one to 16 then back seven (may use fingers) to get to 9 • Counts down from 16 by ones to get to 9 • Counts up from 7 to 16 • Says I took 6 away from 16 to get 10 then one more to get 9 • Says if it was 17 that would be ten but its 16 so it's 9 	AdS3 – AdS6	MA1-5NA MA1-1WM ACMNA015 ACMNA029 ACMNA030
<p>What is the difference between 12 and 16? How do you know? <i>If students do not relate to subtraction and do not get 4, ask this:</i> I played netball on the weekend and we lost 12 to 16. What was the difference in scores?</p>	<ul style="list-style-type: none"> • Students talk about what is 'different' e.g. 12 is smaller than 16 • Attempted to count up or down from 12 or 16 but counted the starting number so got 5 • Counted up from 12 to 16 and got 4 • Counted down from 16 to 12 and got four 	AdS5	MA1-5NA ACMNA015 ACMNA029 ACMNA030



Task question	Comments/ possible student responses	Numeracy Progression levels (Version 2)	NSW Syllabus links and AC descriptors
From Additive to Multiplicative strategies			
<p>Think about the number 16.</p> <p>How could I divide 16 tiles into equal rows?</p> <p>How many tiles would be in each row?</p>	<ul style="list-style-type: none"> Says 2 groups of eight (8 tiles in each group) Says 2 rows of 8 (8 tiles in each row, may say 2) Says 4 rows of 4 (4 tiles in each row) Says one row of 16 (16 tiles in the row) 	<p>MuS3- MuS6</p>	<p>MA1-6NA MA2-6NA MA2-8NA</p> <p>ACMNA012 ACMNA032 ACMNA031</p>
<p>Here are 16 tiles, can you show me what the equal rows look like?</p> <p>How would you describe what you have done?</p> <p>If students make 'groups of' ... ask them to make rows.</p> <p><i>Prompt: Can you put the 16 tiles into equal rows, so that each row has the 'same amount' of tiles? Like an array.</i></p>	<ul style="list-style-type: none"> Makes 2 groups of 8 Tries to make groups of 3, 5 or other numbers Makes 2 rows of 8 Makes 4 rows of 4 Continues to make other representations and relates it to known multiples or factors 	<p>MuS1 – MuS7</p>	<p>MA1-6NA MA1-2WM</p> <p>ACMNA012 ACMNA032 ACMNA031</p>
<p>Is there another way to put the tiles in equal rows?</p> <p>What about another way?</p>	<p>See above suggestions</p>	<p>MuS4- MuS7</p>	<p>MA1-6NA MA1-3WM</p> <p>ACMNA012 ACMNA032 ACMNA031</p>



Task question	Comments/ possible student responses	Numeracy Progression levels (Version 2)	NSW Syllabus links and AC descriptors
Interpreting fractions			
<p>Teacher note: (Arrange the 16 tiles in 4 rows of 4 for the student.)</p> <p>Using the tiles, can you show me what half of 16 is?</p> <p>What about one quarter?</p>	<ul style="list-style-type: none"> • Takes all the tiles away and shares them out into two piles • Similar to above, starts moving tiles into two piles from the rows • Puts their hand down the middle to show 'halfway' and says "8" • Moves half of tiles away either vertically or horizontally and says "8" <p>Note: students may be able to show half physically but not be able to say that half of 16 is 8</p> <ul style="list-style-type: none"> • Shares out the tiles into groups of 4 • Halves both halves to show four quarters • Halves one of their halves to make 4 	InF1_2, InF2_1	MA1-7NA MA2-7NA ACMNA016 ACMNA033 ACMNA058
<p>What number is 16, a quarter of?</p>	<ul style="list-style-type: none"> • Says 4 • Says I need to add 16 four times • Says 16 and 16 are 32 and double 32 is 64 • 16 is half of 32 therefore 16 is a quarter of 64 	MuS6 – MuS7 InF3 – InF6	MA3-7NA ACMNA127
Quantifying numbers (decimals)			
<p>Can you write the decimal: one point 6?</p> <p>Teacher draws a number line with ends marked 0 and 2.</p>	<ul style="list-style-type: none"> • Student attempts to write the decimals but may write .16, 0.16, 1.06 etc • Writes 1.6 	QuN9 – QuN10	MA2-7NA MA3-7NA ACMNA079 ACMNA104 ACMNA105 ACMNA130



Task question	Comments/ possible student responses	Numeracy Progression levels (Version 2)	NSW Syllabus links and AC descriptors
<p>On this number line, where would you put 1.6?</p> <p><i>Have students draw a mark and write 1.6 (if they didn't write 1.6 correctly above, write it for them)</i></p> <p>If I multiply 1.6 by 10 what does it equal?</p> <p>What if I divide 1.6 by 10, what does it equal?</p>	<ul style="list-style-type: none">• Incorrectly places 1.6 close to 0• Incorrectly places 1.6 close to 2• Correctly place 1.6 somewhere past halfway (may say, "1.5 would be halfway so its past that") <ul style="list-style-type: none">• Says 1.60 thinking when you multiply you 'just add zero'• Says 10.6 or other incorrect response that shows lack of place value knowledge with decimals• Says 16 (may say they 'move the decimal' or say I'm making the number 10 times bigger or larger) <ul style="list-style-type: none">• Says 1.60 or other incorrect response• Says 0.16 (either by 'moving the decimal' or knowing that I want to make the number ten times smaller, so numbers change place value)		



Diagnostic Assessment for Numeracy- Number Sense 16 (Version c)

Student name:

Date:

Class:

Task question	Comments	Numeracy Progression levels (Version 2)	NSW Syllabus links and AC descriptors
Quantifying numbers (decimal place value)			
<p>Can you write the decimal one point 6?</p> <p>Teacher draws a number line with ends marked 0 and 2.</p> <p>On this number line, where would you put 1.6?</p> <p>Have students draw a mark and write 1.6 (if they didn't write 1.6 correctly above, write it for them)</p> <p>If I multiply 1.6 by 10 what does it equal?</p> <p>What if I divide 1.6 by 10, what does it equal?</p>	<ul style="list-style-type: none"> • Student attempts to write the decimals but may write .16, 0.16, 1.06 etc • Writes 1.6 • Incorrectly places 1.6 close to 0 • Incorrectly places 1.6 close to 2 • Correctly place 1.6 somewhere past halfway (may say, "1.5 would be halfway so its past that") • Says 1.60 thinking when you multiply you 'just add zero' • Says 10.6 or other incorrect response that shows lack of place value knowledge with decimals • Says 16 (may say they 'move the decimal' or say I'm making the number 10 times bigger or larger) • Says 1.60 or other incorrect response • Says 0.16 (either by 'moving the decimal' or knowing that I want to make the number ten times smaller, so numbers change place value) 	<p>QuN9 – QuN10</p>	<p>MA2-7NA MA3-7NA MA4-5NA</p> <p>ACMNA079 ACMNA104 ACMNA105 ACMNA130</p>



Task question	Comments	Numeracy Progression levels (Version 2)	NSW Syllabus links and AC descriptors
<p>(Cards needed for this task- see end page)</p> <p>Can you put these decimals in order from largest to smallest?</p> <p>0.16, 0.6, 1.6, 0.016</p> <p>Explain why you placed them in that order.</p> <p>How did you make your decision where to put them?</p>	<ul style="list-style-type: none"> • Incorrectly arranges by length of decimal e.g. 0.6, 1.6, 0.16, 0.016 • Incorrectly arranges seeing decimal part as whole number e.g. 0.016, 0.16, 1.6, 0.6 • Other incorrect method of arranging • Correctly arranges from largest to smallest 1.6, 0.6, 0.16, 0.016 • May describe misunderstandings above • Talks about place value or that one number has a whole number and a decimal so that's largest etc... may mention 6 tenths, 16 hundredths ... 	<p>QuN10 – QuN11</p>	<p>MA2-7NA MA3-7NA MA4-5NA</p> <p>ACMNA079 ACMNA104 ACMNA105 ACMNA130 ACMNA156 ACMNA157</p>
<p>IF the student can correctly order the decimals, ask this question:</p> <p>How much larger is 0.16 compared to 0.016?</p>	<ul style="list-style-type: none"> • Unsure or provides incorrect response e.g. no larger as they both have the number 16 in them • Ten times larger, may include – 0.16 is 16 hundredths whereas 0.016 is 16 thousandths, or, 16/100 is larger than 16/1000 	<p>QuN11_6</p>	<p>MA3-7NA MA4-5NA</p> <p>ACMNA104 ACMNA105 ACMNA130 ACMNA154</p>



Task question	Comments	Numeracy Progression levels (Version 2)	NSW Syllabus links and AC descriptors
Multiplicative strategies			
<p>Think about the number 16, what 2 numbers can you multiply to make 16?</p> <p>Do you know two other numbers that multiplied make 16?</p> <p>What about three numbers that multiply to make 16?</p>	<ul style="list-style-type: none"> • Uses repeated addition to solve the task e.g. $4 + 4 + 4 + 4$ is 16 so 4 fours • Says 8 times 2 or 2 times 8 • Says 4 times 4 • Says 1 times 16 etc • Suggests $16 \times 1 \times 1$ • Suggests $2 \times 8 \times 1$ • Uses solutions above to make an additional factor e.g. 8×2 is 16 so $(4 \times 2) \times 2$ 	MuS4 – MuS7	MA1-6NA ACMNA012 ACMNA032 ACMNA031 MA2-6NA MA3-6NA MA2-8NA MA3-8NA MA4-4NA ACMNA056 ACMNA057 ACMNA075 ACMNA076 ACMNA081 ACMNA082 ACMNA101 ACMNA123 ACMNA121 ACMNA151 ACMNA183
<p>Think about the number 16. How many ways can I divide 16 to make equal rows? (with no remainder)</p> <p>How do you know you have them all?</p>	<ul style="list-style-type: none"> • Says 2 rows of 8 • 8 rows of 2 • Says 4 rows of 4 • Says one row of 16 • Says 16 rows of 1 • Just says "I know the factors of 16" • Says can't be any odd numbers e.g. 3 or 5 as 3 fives is 15 and 3 sixes is 18... or talks about 16 as a square number • Uses a halving and doubling strategy to justify solutions 	MuS43 – MuS6	MA1-6NA MA2-6NA MA3-6NA MA3-8NA MA4-4NA ACMNA056 ACMNA057 ACMNA075 ACMNA076 ACMNA081 ACMNA082 ACMNA101 ACMNA123 ACMNA121 ACMNA151 ACMNA183



Task question	Comments	Numeracy Progression levels (Version 2)	NSW Syllabus links and AC descriptors
<p>How would you solve 16×9</p> <p>In your head (without pen and paper)</p> <p>Talk through how you are working it out.</p>	<ul style="list-style-type: none"> Imagines the vertical algorithm to complete the multiplication e.g. uses language of algorithm e.g. 6×9 is 54 write the 4 then 'carry the 5' 'one times 9' 9 and 5 is 14 Similar to above but Says 6×9 is 54 and 10×9 is 90, $90 + 54$ is 144 Uses partial products (similar to dot point 2 but starts with tens) 10×9 is 90, 6×9 is 54 ... Uses compensation, 16×10 is 160 then take away one group of 16 is 144 Uses factors to work out 16×3 is 48, 3×144 ($120 + 24$) Uses doubling and halving technique 16×9 is the same as 8×18 or 4 times 36 ($120 + 24$) 	<p>MuS6 – MuS7</p>	<p>MA2-6NA MA2-8NA MA3-6NA MA3-8NA MA4-4NA</p> <p>ACMNA056 ACMNA057 ACMNA075 ACMNA076 ACMNA081 ACMNA082 ACMNA101 ACMNA123 ACMNA121 ACMNA151 ACMNA183</p>
Interpreting fractions			
<p>Teacher note: (Arrange the 16 tiles in 4 rows of 4 for the student.)</p> <p>Using the tiles, can you show me what half of 16 is?</p> <p>What about one quarter?</p>	<ul style="list-style-type: none"> Takes all the tiles away and shares them out into two piles Similar to above, starts moving tiles into two piles from the rows Puts their hand down the middle to show 'halfway' and says "8" Moves half of tiles away either vertically or horizontally and says "8" <p>Note: students may be able to show half physically but not be able to say that half of 16 is 8</p> <ul style="list-style-type: none"> Shares out the tiles into groups of 4 Halves both halves to show four quarters Halves one of their halves to make 4 	<p>InF1_2, InF2_1</p>	<p>MA1-7NA MA2-7NA</p> <p>ACMNA016 ACMNA033 ACMNA058</p>



Task question	Comments	Numeracy Progression levels (Version 2)	NSW Syllabus links and AC descriptors
What number is 16, a quarter of?	<ul style="list-style-type: none">Says 4 (incorrectly)Says I need to add 16 four timesSays 16 and 16 are 32 and double 32 is 6416 is half of 32 therefore 16 is a quarter of 64	MuS6 – MuS7 InF3 – InF6	MA3-7NA ACMNA127
What is three quarters of 16? How do you know? Draw a diagram to support your solution	<ul style="list-style-type: none">Says 12 (need to ask <i>How</i> question)Breaks 16 into 4 and says one quarter is 4 so three quarters is 3 x 4 which is 12Uses answer to above question and multiplies 3 x 4 to get 12May use halving half strategy – half of 16 is 8, half again is 4 so 8 + 4 is 12Other response	InF7_3	MA3-7NA MA4-5NA ACMNA127 ACMNA155

Cards to use for decimals task (cut out and give to student)

0.16

0.6

1.6

0.016