DEVELOPING MATHEMATICAL INQUIRY COMMUNITIES

Number and Algebra

Level 1 (Year 1-2)

Teacher Booklet

Task 1	Can you find all the ten twins? Record the number sentences that match your ten twins using an addition sign. Choose a number between 11 – 19 and represent this in as many ways as you can using the tens frames. Record the number sentences that match.
Big Ideas	Quantity is an attribute of a set of objects and we use numbers (represented by words and symbols) to name specific quantities. A quantity (whole) can be decomposed into different parts, the parts can be composed to form the whole.
Curriculum Links	**NA1-1:** Use a range of counting, grouping, and equal-sharing strategies with whole numbers and fractions **NA1-3**: Know groupings with five, within ten, and with ten. **NA1-4**: Communicate and explain counting, grouping, and equal-sharing strategies, using words, numbers, and pictures **NA1-5:** Generalise that the next counting number gives the result of adding one object to a set and that counting the number of objects in a set tells how many. **NA2-3:** Know the basic addition and subtraction facts.
Learning Outcomes: Students will be able to:	Identify groupings that equal ten. Represent visual and symbolic patterns for numbers to ten so they can be recognised without counting (subitize). Represent and explain thinking using pictures, numbers, and symbols.
Mathematical language	Number words (e.g., one, two, three, …), add, subtract, equation, equal sign.
Sharing back/Connect	Select students to share different ways of making ten and record the matching equation. Select students to share the different ways that they made the number and ask other students to agree or disagree. **Connect:** Facilitate the students to consider how they could re-write their number sentence as subtraction [e.g., 10 + 5 = 15 so 15 – 5 = 10). Ask students to re-write one of their number sentences as subtraction.
Teacher Notes	• Explain to students during the launch that twin tens are two tens frames that add to ten. • Provide students with a variety of pre-printed tens frames to find combinations. The focus should be on finding combinations without counting so they are using the structure of the number representation. • Provide markers/pens for students to draw and record their number sentences

	• Notice their representations - are they showing an understanding of groups of ten? Are they using the addition sign accurately e.g. 7 + 5 = 12
Independent Tasks	Choose a number between 10 – 19 and draw two tens frames that would make the number and write the matching number sentences. Find as many different ways as possible to make the number and each time draw the two tens frames and record the matching number sentences.
Anticipations	

Task 2 (Whole class option)	Choose a number between 20 – 30 and represent this in as many ways as you can using the tens frames. Record addition and subtraction number sentences that match. Draw the tens frames.
Big Ideas	Quantity is an attribute of a set of objects and we use numbers (represented by words and symbols) to name specific quantities. A quantity (whole) can be decomposed into different parts, the parts can be composed to form the whole.
Curriculum Links	**NA1-1:** Use a range of counting, grouping, and equal-sharing strategies with whole numbers and fractions. **NA1-3**: Know groupings with five, within ten, and with ten. **NA1-4**: Communicate and explain counting, grouping, and equal-sharing strategies, using words, numbers, and pictures. **NA1-5:** Generalise that the next counting number gives the result of adding one object to a set and that counting the number of objects in a set tells how many. **NA2-3:** Know the basic addition and subtraction facts.
Learning Outcomes: Students will be able to:	Represent visual and symbolic patterns for the numbers between twenty and thirty. Represent and explain thinking using pictures, numbers, and symbols.
Mathematical language	Number words, add, subtract, equation.
Sharing back/Connect	Select students to share and record the number sentences generated through use of the tens frames and to draw the tens frames that match. **Connect:** Ask students to discuss any patterns in the number sentences: “What do you notice? Can you see any patterns in these number sentences?”
Teacher Notes	• Provide students with multiple tens frames. • Provide markers/pens to students to draw and record their number sentences and the tens frame. • Ask students to re-draw the tens frame until they have an accurate representation. • Notice their representations - are they showing an understanding of groupings of tens and one in place value? Are they using the addition and subtraction sign accurately? 10 + 10 + 3, if 2 tens = 20, then 20 + 3 = 23
Independent Tasks	Choose a number between 20 – 30 and draw tens frames that would make the number

	and write the matching number sentences. Find different ways to make the number. Draw the tens frames and record the matching number sentences.
Anticipations	

Task 3 (Whole class option)	Malakai has collected 30 pinecones in two bags. What are all the different ways that he could put the pinecones into the two bags? Can you record your ideas using drawings and number sentences?
Big Ideas	Quantity is an attribute of a set of objects and we use numbers (represented by words and symbols) to name specific quantities. A quantity (whole) can be decomposed into different parts, the parts can be composed to form the whole. Equations show relationships of equality between parts on either side of the equal sign. The properties of equality are: If the same real number is added or subtracted to both sides of an equation, equality is maintained; If both sides of an equation are multiplied or divided by the same real number (not dividing by 0), equality is maintained; Two quantities equal to the same third quantity are equal to each other.
Curriculum Links	**NA1-1:** Use a range of counting, grouping, and equal-sharing strategies with whole numbers and fractions. **NA1-4**: Communicate and explain counting, grouping, and equal-sharing strategies, using words, numbers, and pictures. **NA1-5:** Generalise that the next counting number gives the result of adding one object to a set and that counting the number of objects in a set tells how many. **NA2-3:** Know the basic addition and subtraction facts.
Learning Outcomes: Students will be able to:	Split and recombine numbers to make groupings to 30. Use patterns and relationships to solve problems.
Mathematical language	Number words, add, subtract, equation, equal sign.
Sharing back/Connect	Select students who have used patterns to find different possibilities to share their solution strategies. Record these using both pictorial representations (tens frames and equations). **Connect:** Select a student who has developed a systematic way to find all possibilities and ask students to use that way to find all the possibilities for 25 pinecones. Otherwise use the following example… Malakai has worked out a way to find all the different combinations. He begins by putting 30 pinecones in one bag and none in the other. *Show using tens frames and record 30 + 0 = 30* Then he knows that the next one will be 29 pinecones in one bag and one pinecone in the other. *Show using tens frames and record 29 + 1 = 30*

	Can you use Malakai's idea to find all of the different combinations?
Teacher Notes	• Provide students with bags of 30 counters and or other materials (multi-link cubes, etc) to represent pinecones. • Provide markers/pens to students to draw and record their number sentences. • Notice their representations - are they showing an understanding of groupings of ten and place value? Are they using the addition sign accurately e.g. 22 + 8 = 30 • Highlight different combinations during sharing back.
Independent Tasks	Litea has 26 leaves and two bags. What are the different ways that she could put the leaves into the bags? Can you record your ideas using drawings and number sentences?
Anticipations	

Task 4	Sita has 9 toy cars and is given another 6 toy cars for her birthday. How many toy cars does Sita have now? Leon has 6 toy cars and is given 19 toy cars for his birthday. How many toy cars does Leon have now? Maka has 7 toy cars and is given another 8 toy cars for his birthday. How many toy cars does Maka have now? Arapera has 18 toy cars and is given another 7 toy cars for her birthday. How many toy cars does Arapera have now?
Big Ideas	Numbers are used to name specific quantities. Numbers can be decomposed into parts in an infinite number of ways without the quantity changing. There are arithmetic properties that characterise addition and multiplication as operations. These are the commutative, associative, distributive, and identity properties. Addition and subtraction and multiplication and division have an inverse relationship. Equations show relationships of equality between parts on either side of the equal sign. The properties of equality are: If the same real number is added or subtracted to both sides of an equation, equality is maintained; If both sides of an equation are multiplied or divided by the same real number (not dividing by 0), equality is maintained; Two quantities equal to the same third quantity are equal to each other.
Curriculum Links	**NA1-1:** Use a range of counting, grouping, and equal-sharing strategies with whole numbers and fractions. **NA1-4**: Communicate and explain counting, grouping, and equal-sharing strategies, using words, numbers, and pictures. **NA1-5:** Generalise that the next counting number gives the result of adding one object to a set and that counting the number of objects in a set tells how many. **NA2-1:** Use simple additive strategies with whole numbers and fractions. **NA2-3:** Know the basic addition and subtraction facts.
Learning Outcomes: Students will be able to:	Use counting on to solve addition problems. Use bridging decades to solve addition problems. Use equivalence and compensation to solve addition problems. Represent and explain thinking using pictures, numbers, and symbols.
Mathematical language	Add
Sharing back/Connect	Year One - Select students who are using counting on to solve the problem to share. Record this on board or if no students are using counting on, then model as another way the teacher has seen used before. If students are mainly using counting on, then select students using equivalence and compensation or bridging to a decade to share or model this as an alternative solution strategy.

	Year Two – Select students who are using bridging to a decade or equivalence and compensation to solve the problem to share. Record this on the board. If no students are using bridging to a decade or equivalence and compensation, then model as another way the teacher has seen used previously. **Connect** Ask students to describe how you would solve the following problems using bridging to a decade or equivalence and compensation: 29 + 6 = 8 + 39 = Represent using an empty number line and equations.
Teacher Notes	• Introduce each problem one at a time and give students an opportunity to solve it and share back before introducing the next problem. • Have concrete material available if needed for students to select (e.g., tens frames, counters, hundreds board). • Expect to students to draw/record their number sentences. • Notice if students see patterns in each set of problems.
Independent Tasks	Sita has 9 toy cars and is given another 5 toy cars for her birthday. How many toy cars does Sita have now? Leon has 5 toy cars and is given 19 toy cars for his birthday. How many toy cars does Leon have now? Maka has 4 toy cars and is given another 8 toy cars for his birthday. How many toy cars does Maka have now? Arapera has 18 toy cars and is given another 4 toy cars for her birthday. How many toy cars does Arapera have now? 3 + 9 = 3 + 19 = 8 + 9 = 18 + 9 =
Anticipations	

Task 5	Solve the following problems: 7 + 8 = 7 + 18 = 17 + 18 = 28 + 17 =
Big Ideas	Numbers are used to name specific quantities. Numbers can be decomposed into parts in an infinite number of ways without the quantity changing. There are arithmetic properties that characterise addition and multiplication as operations. These are the commutative, associative, distributive, and identity properties. Addition and subtraction and multiplication and division have an inverse relationship. Equations show relationships of equality between parts on either side of the equal sign. The properties of equality are: If the same real number is added or subtracted to both sides of an equation, equality is maintained; If both sides of an equation are multiplied or divided by the same real number (not dividing by 0), equality is maintained; Two quantities equal to the same third quantity are equal to each other.
Curriculum Links	**NA1-1:** Use a range of counting, grouping, and equal-sharing strategies with whole numbers and fractions. **NA1-2:** Know the forward and backward counting sequences of whole numbers to 100. **NA1-4:** Communicate and explain counting, grouping, and equal-sharing strategies, using words, numbers, and pictures. **NA1-5:** Generalise that the next counting number gives the result of adding one object to a set and that counting the number of objects in a set tells how many. **NA2-1:** Use simple additive strategies with whole numbers and fractions. **NA2-6:** Communicate and interpret simple additive strategies, using words, diagrams (pictures), and symbols. **NA2-7:** Generalise that whole numbers can be partitioned in many ways.
Learning Outcomes: Students will be able to:	Use counting on to solve addition problems. Use place value to solve addition problems. Use bridging decades to solve addition problems. Use equivalence and compensation to solve addition problems. Represent and explain thinking using pictures, numbers, and symbols.
Mathematical language	Add, tens, ones, equation, place value.

Sharing back/Connect	Select students who are using the patterns and relationships to solve the problems (e.g., doubles, drawing on the previous solution). Have pre-printed tens frames available as a resource to show the representation. **Connect** Present as a string with one equation written at a time: 4 + 3 = 14 + 3 = 14 + 13 = 23 + 14 What patterns did you use to help you solve these equations?
Teacher Notes	• Introduce each problem one at a time and give students an opportunity to solve it and share back before introducing the next problem. • Have concrete material available if needed for students to select (e.g., tens frames, counters, hundreds board). • Expect to students to draw/record their number sentences. • Notice if students see patterns in each set of problems.
Independent Tasks	Look for patterns and use these to help you solve the problems below: 3 + 2 = 3 + 12 = 13 + 12 = 12 + 23= 6 + 5 = 16 + 5 = 16 + 15 = 25 + 26 = What patterns did you notice as you solved these problems?
Anticipations	

Task 6	Meilani is collecting shells. She has 29 shells and picks up another 6 shells. How many does she have now? Timo is collecting shells. He has 7 shells and picks up another 48 shells. How many does he have now? Raj is collecting shells. She has 23 shells and picks up another 19 shells. How many does she have now?
Big Ideas	Numbers are used to name specific quantities. Numbers can be decomposed into parts in an infinite number of ways without the quantity changing. There are arithmetic properties that characterise addition and multiplication as operations. These are the commutative, associative, distributive, and identity properties. Addition and subtraction and multiplication and division have an inverse relationship. Equations show relationships of equality between parts on either side of the equal sign. The properties of equality are: If the same real number is added or subtracted to both sides of an equation, equality is maintained; If both sides of an equation are multiplied or divided by the same real number (not dividing by 0), equality is maintained; Two quantities equal to the same third quantity are equal to each other.
Curriculum Links	**NA1-1:** Use a range of counting, grouping, and equal-sharing strategies with whole numbers and fractions. **NA1-4:** Communicate and explain counting, grouping, and equal-sharing strategies, using words, numbers, and pictures. **NA1-5:** Generalise that the next counting number gives the result of adding one object to a set and that counting the number of objects in a set tells how many. **NA2-3:** Know the basic addition and subtraction facts. **NA2-6:** Communicate and interpret simple additive strategies, using words, diagrams (pictures), and symbols. **NA2-7:** Generalise that whole numbers can be partitioned in many ways.
Learning Outcomes: Students will be able to:	Use place value to solve addition problems. Use bridging to decades to solve addition problems. Use equivalence and compensation to solve addition problems. Explain and represent solutions using materials, words, pictures, empty number lines and symbols.

Mathematical language	Add, subtract.
Connect	Year One - Select students who are using counting on to solve the problem to share. Record this on board or if no students are using counting on, then model as another way the teacher has seen used before. If students are mainly using counting on, then select students using equivalence and compensation or bridging to a decade to share or model this as an alternative solution strategy. Year Two – Select students who are using equivalence and compensation or bridging to a decade to solve the problem to share. Record this on the board. If no students are using equivalence and compensation or bridging to a decade, then model as another way a student has used previously. **Connect** Ask students to describe how you would solve the following problems using equivalence and compensation or bridging to a decade: 7 + 49 = 99 + 8 =
Teacher Notes	• Introduce each problem one at a time and give students an opportunity to solve it and share back before introducing the next problem. • Have concrete material available if needed for students to select (e.g., tens frames, counters, hundreds board). • Expect to students to draw/record their number sentences. • Notice if students see patterns in each set of problems.
Independent Tasks	Meilani is collecting shells. She has 28 shells and picks up another 4 shells. How many does she have now? Timo is collecting shells. He has 6 shells and picks up another 49 shells. How many does he have now? Raj is collecting shells. She has 25 shells and picks up another 18 shells. How many does she have now? 27 + 6 = 9 + 35 = 22 + 19 =
Anticipations	

Task 7	Mala has 15 marbles in her collection, and she gave 6 marbles to her brother. How many marbles does she have now? Haki has 25 marbles in her collection, and she gave 6 marbles to her sister. How many marbles does she have now? Sima has 18 marbles in his collection, and he gave 9 marbles to her sister. How many marbles does he have now? Ali has 38 marbles in his collection, and he gave 9 marbles to his brother. How many marbles does he have now?
Big Ideas	Numbers are used to name specific quantities. Numbers can be decomposed into parts in an infinite number of ways without the quantity changing. There are arithmetic properties that characterise addition and multiplication as operations. These are the commutative, associative, distributive, and identity properties. Addition and subtraction and multiplication and division have an inverse relationship. Equations show relationships of equality between parts on either side of the equal sign. The properties of equality are: If the same real number is added or subtracted to both sides of an equation, equality is maintained; If both sides of an equation are multiplied or divided by the same real number (not dividing by 0), equality is maintained; Two quantities equal to the same third quantity are equal to each other.
Curriculum Links	**NA1-1:** Use a range of counting, grouping, and equal-sharing strategies with whole numbers and fractions. **NA1-4:** Communicate and explain counting, grouping, and equal-sharing strategies, using words, numbers, and pictures. **NA2-1:** Use simple additive strategies with whole numbers and fractions. **NA2-3:** Know the basic addition and subtraction facts. **NA2-6:** Communicate and interpret simple additive strategies, using words, diagrams (pictures), and symbols. **NA2-7:** Generalise that whole numbers can be partitioned in many ways.
Learning Outcomes: Students will be able to:	Use bridging decades to solve subtraction problems. Use equivalence and compensation to solve subtraction. Explain and represent solution strategies using materials, words, pictures, empty number lines and symbols.
Mathematical language	Tens, ones, add, subtract.
Sharing back/Connect	Notice and select student solution strategies where they have subtracted by bridging decades or used equivalence and compensation. Represent this using equations and with tens frames. *Bridging decades*

	15 – 6 = *15 – 5 = 10* *10 – 1 = 9* *Equivalence and compensation* *18 - 9 =* *18 – 10 = 8* *8 + 1 = 9* If no students are using bridging to decades or equivalence and compensation, then model as another way a student has used previously. **Connect:** Ask students to describe how you would solve the following problems using bridging to decades and/or equivalence and compensation: 34 – 5 = 23 - 9 =
Teacher Notes	• Introduce each problem one at a time and give students an opportunity to solve it and share back before introducing the next problem. • Have concrete material available if needed for students to select (e.g., tens frames, counters, hundreds board). • Expect to students to draw/record their number sentences. Model how to represent this on an empty number line. • Notice if students use patterns to help them solve the problems.
Independent Tasks	Mala has 13 marbles in her collection, and she gave 4 marbles to her brother. How many marbles does she have now? Haki has 23 marbles in her collection, and she gave 4 marbles to her sister. How many marbles does she have now? Sima has 27 marbles in his collection, and he gave 8 marbles to her sister. How many marbles does he have now? Ali has 37 marbles in his collection, and he gave 8 marbles to his brother. How many marbles does he have now? 14 – 5 = 24 – 5 = 16 – 7 =

	26 – 7 =
Anticipations	

Task 8	17 – 9 = 37 – 19 = 13 – 7 = 43 – 17 =
Big Ideas	Numbers are used to name specific quantities. Numbers can be decomposed into parts in an infinite number of ways without the quantity changing. There are arithmetic properties that characterise addition and multiplication as operations. These are the commutative, associative, distributive, and identity properties. Addition and subtraction and multiplication and division have an inverse relationship. Equations show relationships of equality between parts on either side of the equal sign. The properties of equality are: If the same real number is added or subtracted to both sides of an equation, equality is maintained; If both sides of an equation are multiplied or divided by the same real number (not dividing by 0), equality is maintained; Two quantities equal to the same third quantity are equal to each other.
Curriculum Links	**NA1-1:** Use a range of counting, grouping, and equal-sharing strategies with whole numbers and fractions. **NA1-4:** Communicate and explain counting, grouping, and equal-sharing strategies, using words, numbers, and pictures. **NA2-1:** Use simple additive strategies with whole numbers and fractions. **NA2-3:** Know the basic addition and subtraction facts. **NA2-6:** Communicate and interpret simple additive strategies, using words, diagrams (pictures), and symbols. **NA2-7:** Generalise that whole numbers can be partitioned in many ways.
Learning Outcomes: Students will be able to:	Use bridging decades to solve subtraction problems. Use equivalence and compensation to solve subtraction problems. Explain and represent solution strategies using materials, words, pictures, empty number lines and symbols.
Mathematical language	Tens, ones, add, subtract.
Sharing back/Connect	Select student solution strategies where they have bridged decades or used equivalence and compensation. Represent this using equations and with tens frames. Select students to share who use patterns between the first and second number sentence to help them solve the second problem. **Connect** Present as a string with one equation written at a time:

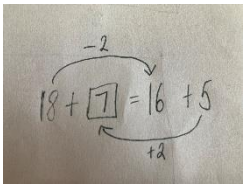
	24 – 8 = 34 – 8 = 44 – 18 = What patterns did you use to help you solve these equations?
Teacher Notes	• Introduce each problem one at a time and give students an opportunity to solve it and share back before introducing the next problem. • Have concrete material available if needed for students to select (e.g., tens frames, counters, hundreds board). • Expect to students to draw/record their number sentences. • Notice if students use patterns to help them solve the problems.
Independent Tasks	Solve these problems. Look for patterns that will help you solve them. 15 – 9 = 25 – 19 = 16 – 7 = 46 – 17 = 12 – 6 = 22 – 6 = 18 – 9 = 38 – 19 = What patterns did you notice? How did they help you?
Anticipations	

Task 9	Sesimani helped to pick 26 mandarins from the tree. She gave 17 mandarins away. How many does she have left? Damon helped to pick 38 mandarins from the tree. He gave 19 mandarins away. How many does he have left? Daisy helped to pick 44 mandarins from the tree. She gave 16 mandarins away. How many does she have left?
Big Ideas	Numbers are used to name specific quantities. Numbers can be decomposed into parts in an infinite number of ways without the quantity changing. There are arithmetic properties that characterise addition and multiplication as operations. These are the commutative, associative, distributive, and identity properties. Addition and subtraction and multiplication and division have an inverse relationship. Equations show relationships of equality between parts on either side of the equal sign. The properties of equality are: If the same real number is added or subtracted to both sides of an equation, equality is maintained; If both sides of an equation are multiplied or divided by the same real number (not dividing by 0), equality is maintained; Two quantities equal to the same third quantity are equal to each other.
Curriculum Links	**NA1-1:** Use a range of counting, grouping, and equal-sharing strategies with whole numbers and fractions **NA1-4:** Communicate and explain counting, grouping, and equal-sharing strategies, using words, numbers, and pictures **NA2-1:** Use simple additive strategies with whole numbers and fractions. **NA2-3:** Know the basic addition and subtraction facts. **NA2-6:** Communicate and interpret simple additive strategies, using words, diagrams (pictures), and symbols. **NA2-7:** Generalise that whole numbers can be partitioned in many ways.
Learning Outcomes: Students will be able to:	Use bridging decades to solve subtraction problems. Use equivalence and compensation to solve subtraction problems. Use place value knowledge to solve subtraction problems. Explain and represent solution strategies using materials, words, pictures, empty number lines and symbols.
Mathematical language	Tens, ones, add, subtract.
Connect	Select student solution strategies where they have bridged decades, equivalence and compensation or place value knowledge. Represent this using equations and with tens frames.

	Connect Ask students to describe how you would solve the following problems using bridging decades, equivalence and compensation or place value knowledge: 37 – 18 = 45 – 27 =
Teacher Notes	• Introduce each problem one at a time and give students an opportunity to solve it and share back before introducing the next problem. • Have concrete material available if needed for students to select (e.g., tens frames, counters, hundreds boards). • Expect to students to draw/record their number sentences. • Notice if students use patterns to help them solve the problems.
Independent Tasks	Sesimani helped to pick 23 mandarins from the tree. She gave 19 mandarins away. How many does she have left? Damon helped to pick 35 mandarins from the tree. He gave 17 mandarins away. How many does he have left? Daisy helped to pick 47 mandarins from the tree. She gave 18 mandarins away. How many does she have left? 24 – 18 = 37 – 19 = 45 – 16 =
Anticipations	

Task 10 (Whole class option)	Work with your partner to work out which number sentences are true or false. 25 = 25 9 + 6 = 15 + 4 18 = 9 + 9 16 + 8 = 15 + 9 15 – 8 = 16 – 9 23 – 17 = 23 – 17 17 = 25 Explain why you think the number sentences are true or false.
Big Ideas	Equations show relationships of equality between parts on either side of the equal sign. The properties of equality are: If the same real number is added or subtracted to both sides of an equation, equality is maintained; If both sides of an equation are multiplied or divided by the same real number (not dividing by 0), equality is maintained; Two quantities equal to the same third quantity are equal to each other.
Curriculum Links	**NA1-1:** Use a range of counting, grouping, and equal-sharing strategies with whole numbers and fractions. **NA1-4:** Communicate and explain counting, grouping, and equal-sharing strategies, using words, numbers, and pictures. **NA2-7:** Generalise that whole numbers can be partitioned in many ways. **NA3-6:** Record and interpret additive and simple multiplicative strategies, using words, diagrams, and symbols, with an understanding of equality.
Learning Outcomes: Students will be able to:	Explain and justify relationships between numbers in an equation. Write statements of equivalence in words and using notation. Solve equivalence problems and explain and justify the solutions.
Mathematical language	Equal sign, relationship, same, different.
Sharing back/Connect	Allow students to share misconceptions related to the equal sign to position them to engage in argumentation. Select students to share who have used patterns and relationships to recognise equivalence. **Connect:** Ask students to write their own true and false number sentences. Note students who use the equal sign flexibly.

Teacher Notes	• Ensure that students understand what true and false means. Introduce notation of not equal (≠) for the number sentences that they think are false. • Students may begin by demonstrating misconceptions (9 + 6 = 15 + 4 is true because 9 + 6 = 15). This can be used to position students to agree/disagree. • Teacher to notice students who are able to accept the use of the equals sign to show balance/relationship. • Use arrows and notation to show relationships on the equations to the students.
Independent Tasks	• Write your own set of true and false number sentences. • Give your true and false number sentences to your classmates to solve. • Make sure you ask them to explain and justify why they think they are true or false and see if you agree!
Anticipations	

Task 11	Can you find the missing numbers? 9 + 4 = __ + 5 5 + 9 = 7 + __ 18 + __ = 16 + 5 __ + 24 = 7 + 26
Big Ideas	Equations show relationships of equality between parts on either side of the equal sign. The properties of equality are: If the same real number is added or subtracted to both sides of an equation, equality is maintained; If both sides of an equation are multiplied or divided by the same real number (not dividing by 0), equality is maintained; Two quantities equal to the same third quantity are equal to each other.
Curriculum Links	**NA1-1:** Use a range of counting, grouping, and equal-sharing strategies with whole numbers and fractions. **NA1-4:** Communicate and explain counting, grouping, and equal-sharing strategies, using words, numbers, and pictures. **NA2-7:** Generalise that whole numbers can be partitioned in many ways. **NA3-6:** Record and interpret additive and simple multiplicative strategies, using words, diagrams, and symbols, with an understanding of equality.
Learning Outcomes: Students will be able to:	Explain and justify relationships between numbers in an equation. Write statements of equivalence in words and using notation. Solve equivalence problems and explain and justify the solutions.
Mathematical language	Equal sign, relationship, same, difference, add, subtract.
Sharing back/Connect	Allow students to share misconceptions related to the equal sign (e.g., 9 + 4 = 13 + 5) to position them to engage in argumentation. Select students to share who have used a relational strategy to find the missing number. If no students use a relational strategy, introduce this to them using arrows and explanations.  **Connect:** Ask the students to find the missing numbers by looking for the relationship across the equal sign and show this using arrows.

	16 + 7 = __ + 8 __ + 19 = 15 + 18
Teacher Notes	• Students may begin by demonstrating misconceptions. This can be used to position students to agree/disagree. • Some students may work out one side and then the other to equal the same number. However, the key focus should be on positioning students to use the relationships across the equal sign. • Draw attention to students who use relational types of thinking and notate the number sentences with arrows to highlight this (shown above).
Independent Tasks	Find the missing number 7 + 8 = __ + 6 9 + 5 = 7 + __ __ + 14 = 19 + 15 17 + __ = 15 + 16
Anticipations	

Task 12	Can you find the missing numbers? 13 – 8 = 14 – __ 14 – 9 = __ – 7 21 – __ = 23 – 6 __ – 8 = 31 – 7
Big Ideas	Equations show relationships of equality between parts on either side of the equal sign. The properties of equality are: If the same real number is added or subtracted to both sides of an equation, equality is maintained; If both sides of an equation are multiplied or divided by the same real number (not dividing by 0), equality is maintained; Two quantities equal to the same third quantity are equal to each other.
Curriculum Links	**NA1-1:** Use a range of counting, grouping, and equal-sharing strategies with whole numbers and fractions. **NA1-4:** Communicate and explain counting, grouping, and equal-sharing strategies, using words, numbers, and pictures. **NA2-7:** Generalise that whole numbers can be partitioned in many ways. **NA3-6:** Record and interpret additive and simple multiplicative strategies, using words, diagrams, and symbols, with an understanding of equality.
Learning Outcomes: Students will be able to:	Explain and justify relationships between numbers in an equation. Write statements of equivalence in words and using notation. Solve equivalence problems and explain and justify the solutions.
Mathematical language	Equal sign, relationship, same, different.
Connect	Select students to share who have used a relational strategy to find the missing number. If no students use a relational strategy, introduce this again using arrows and explanations. **Connect:** Ask the students to find the missing numbers by looking for the relationship across the equal sign and show this using arrows. 12 – 7 = __ - 8 45 – 9 = 43 - __
Teacher Notes	• Present each number sentence one by one and ask students to share back before introducing the next one. • Students may begin by demonstrating misconceptions. This can be used to position students to agree/disagree.

	• Note that the order of directionality is different between addition and subtraction and students may adjust as you do with addition and end up with an incorrect solution such as 13 – 8 = 12 – 9. Facilitate a discussion with the students to notice the difference between open number sentences with addition and subtraction (e.g., addition involves an adjustment of +1, -1 while subtraction involves an adjustment of +1, +1, or -1, -1). • Some students may work out one side and then the other to equal the same number. However, the key focus should be on positioning students to use the relationships across the equal sign. • Draw attention to students who use relational types of thinking and notate the number sentences with arrows to highlight this (shown above).
Independent Tasks	Find the missing numbers: 11 – 7 = 12 – __ 15 – 8 = __ – 6 23 – __ = 25 – 17 __ – 36 = 63 – 26
Anticipations	

Task 13	Josiah solves the following problems: 8 – 0 = 56 – 0 = 122 – 0 = 1359 – 0 = He notices a pattern as he solves the problems. What do you think he notices? Does this pattern always work? What other patterns can you find that involve zero? Do they always work?
Big Ideas	There are arithmetic properties that characterise addition and multiplication as operations. These are the commutative, associative, distributive, and identity properties. Addition and subtraction and multiplication and division have an inverse relationship.
Curriculum Links	**NA1-1:** Use a range of counting, grouping, and equal-sharing strategies with whole numbers and fractions. **NA1-4:** Communicate and explain counting, grouping, and equal-sharing strategies, using words, numbers, and pictures.
Learning Outcomes: Students will be able to:	Identify and describe the properties of zero when adding or subtracting. Make a conjecture and prove this with materials and symbols. Describe patterns and relationships using mathematical language.
Mathematical language	Zero, conjecture, prove, addition, subtraction.
Connect	Select students who have developed conjectures to share these (e.g., if you take zero away from a number, you get the number you started with). Facilitate students to notice other patterns related to zero and ask them to explain and justify whether they will always work using equipment. Select students that have built concrete models to share their generalisations. **Connect** Explain that in mathematics, we can use symbols or letters to represent any number. Model how to represent a rule that works for any numbers … e.g., $\Delta - 0 = \Delta$ Ask students to use symbols to represent the rules that they have created.

Teacher Notes	• Have appropriate equipment for students to build concrete models to prove their conjectures (e.g., counters, cubes). • Encourage students to explore multiple patterns with zero.
Independent Tasks	Find the missing numbers. 18 = 7 + __ 10 – 2 = 6 + __ 15 – 8 = __ – 7 17 + __ = 18 + 5 __ + 29 = 17 + 28 23 – 18 = 20 – __
Anticipations	

Task 14	Mere's teacher asked her to solve 18 + 7 = ? Mere adds the two numbers and writes 18 + 7 = 25. The teacher then asks her to solve 25 – 18 =? Mere says she already knows the answer. a) How does she know? b) Do you think this will work for all numbers? If so, how do you know? c) Can you write your own examples with other numbers where this relationship works?
Big Ideas	There are arithmetic properties that characterise addition and multiplication as operations. These are the commutative, associative, distributive, and identity properties. Addition and subtraction and multiplication and division have an inverse relationship.
Curriculum Links	**NA1-1:** Use a range of counting, grouping, and equal-sharing strategies with whole numbers and fractions. **NA1-4:** Communicate and explain counting, grouping, and equal-sharing strategies, using words, numbers, and pictures. **NA2-3:** Know the basic addition and subtraction facts. **NA2-7:** Generalise that whole numbers can be partitioned in many ways. **NA3-6:** Record and interpret additive and simple multiplicative strategies, using words, diagrams, and symbols, with an understanding of equality.
Learning Outcomes: Students will be able to:	Explain and show how patterns and relationships help solve equations. Explain and justify the inverse relationship of addition and subtraction.
Mathematical language	Conjecture, inverse relationship, generalisation, addition, subtraction.
Share back/Connect	Select students who use the inverse relationship rather than calculating. Highlight to the students that you do not need to calculate but can use the relationship to solve different equations. Ask students to consider whether this will always work and when it will not work. For example: 5 + 8 = 13 8 – 5 ≠ 3 **Connect**

	Use quasi-variables to press the students to generalise the relationship. If 71 – 56 = 15 What other number sentences can you write using the same numbers?
Teacher Notes	• Students may compute each sum separately or draw on the inverse relationship between addition and subtraction. Draw student attention to those who draw on the inverse relationship. Allow students opportunities to explore inverse relationships. • Push students to generalise by finding their own equations. • Encourage students to prove and justify why the inverse relationship is true. • A quasi-variable is a large number that can represent any number. Students do not need to solve these examples, rather they look at the relationships and use that to explain what they notice/ what is happening mathematically.
Independent Tasks	Select one or more of the following assessment tasks (attached at the end of the document) as the independent activity: N1: Addition and subtraction problems to solve. NA1: Write number sentences related to a dot pattern. NA2: Properties of numbers and operations.
Anticipations	

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DEVELOPING MATHEMATICAL INQUIRY COMMUNITIES
ASSESSMENT TASK

NUMBER.- ADD/SUB: LEVEL 1 TASK N1

Write one or more word problems for a friend involving addition or subtraction. Show how you would solve them.

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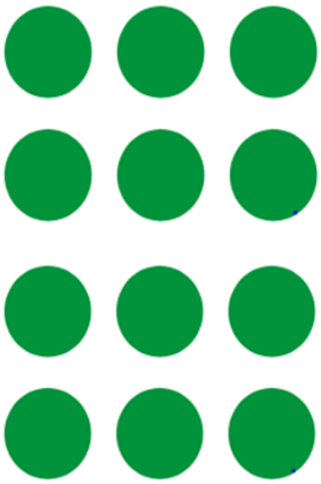
DEVELOPING MATHEMATICAL INQUIRY COMMUNITIES
ASSESSMENT TASK

NUMBER - PATTERNS: LEVEL 1 Task NA1



Write number sentences about the dots above.
Describe what patterns you can find.
Why do your patterns work?
Do they work with other numbers?

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DEVELOPING MATHEMATICAL INQUIRY COMMUNITIES
ASSESSMENT TASK

NUMBER - PATTERNS: LEVEL 1 Task NA2

3 + 4 = 9 + 5 = 2 + 2 + 2 = 4 + 3 =

7 + 3 = 3 + 7 = 10 – 7 =

10 – 3 = 3 x 2 = 10 + 5 = 2 x 3 =

Look at the number sentences above.

- Describe what patterns you can find.
- Why do your patterns work?
- Do they work with other numbers?