

**Concept/s in Focus:**

- Addition is joining quantities (parts) together to make a total (part + part = total)
- Addition Basic facts are situations where 1-digit numbers are added together.
- Subtraction is separating a *total* into *parts* or taking one *part* away from the total leaving a *part*
- Addition and subtraction are inverse operations. The action of one will undo the other. Addition joins parts to make a total and subtraction separates a total into parts.
- The order that numbers are joined in an addition situation doesn't matter, the total will stay the same (*commutative principle*) e.g.  $5+6=11=6+5$
- Knowing addition basic facts without needing to work them out (*automaticity*) can help with working out the related subtraction facts e.g.  $12-6 = 6$  because  $6+6 = 12$  (known basic fact)
- Basic fact families are the set of related addition and subtraction facts e.g.  $8+4=12$ ;  $4+8=12$ ;  $12-8=4$ ;  $12-4=8$ .
- When the addition fact is a double there are only two related facts e.g.  $8+8=16$ ;  $16-8=8$

**Introduction / Teacher Background Information:**

This lesson follows from a similar lesson that focussed on addition and subtraction basic fact families with totals to 10. In this lesson focusses on addition and subtraction basic facts families where the total is from 11 to 18. Basic facts, by definition are basic additions with just 2x 1-digit numbers being added. The largest total for addition and subtraction basic facts is 18 (9+9). This lesson has potential to be expanded and have students investigate situations where more than 2 numbers are added together to form a total from 11 to 19. The lesson described only deals with addition situations where 2x 1-digit numbers are added to give a particular total e.g.  $6+7=13$  and  $7+6=13$  as well as the related subtractions i.e.  $13-6=7$  and  $13-7=6$ . These four facts form what is known as a basic fact family.

The aim of learning basic facts is for them to be known automatically or 'off by heart'. Many teacher resources approach this automaticity by encouraging memorisation of the facts. Some resources use a triangle ( $\Delta$ ) with the total at the top and the parts in the bottom two corners to represent the relationship between the total and the parts. This lesson uses a length model to represent the relationship between the total and the parts and the connection between the addition facts and the related subtraction facts. This model provides a useful visual prompt that is meaningful and not simply a memory tool.

**Australian Curriculum:** ACMNA054, ACMNA055

**Resources:**

Whole Class Activity:

- The LTD Rods or enlarged copies (A3) from the file Rods Master 1-10
- A whiteboard marker pen

Hands-On Activity:

- 1 student set of LTD Rods per pair of students or commercial Cuisenaire Rods with the length number written on each rod (See Note at end of Lesson to set up the commercial resource)  
OR 2 copies of a paper set Rod Master 1-10 per pair of students (doesn't need to be in colour)
- 1 copy of the Add and Subtract Basic Fact family (Totals to 18) Activity per pair of students.

Independent Activity:

- 1 copy of the Add and Subtract Basic Fact family (Totals to 18) Worksheet per student

### Whole Class Activity:

- Have the class sit in a circle in an open space in the classroom or outside.
- Spread the Rods so the students can see the different sizes and numbers represented.

? *What do you notice about these rods? Have you seen these before? What can you tell us about them?*

- Accept answers from a number of students and acknowledge any comments that describe the features of the rods (each length is a different colour) and the numbers written on them and what the numbers might represent.
- Pick a 10 rod and lay it in a clear space on the floor where the students can see it.

? *Who can see or think of **two** rods that together will be the same total as this rod?*

- Note: Basic facts are basic additions with just the one addition so they only use 2 numbers. It is possible to have more than 2 numbers adding to make ten and this can be investigated in another lesson. For this lesson the focus is basic fact addition and subtraction families)
- Invite a student to come and select two rods that will have a combined length (total) of 10 and help the student to align them below the 10 side by side e.g.



? *Can you see an addition that makes ten? How would I write this addition on the whiteboard?*

- Listen for suggestions and write an equation on the whiteboard guided by the students i.e.  $6+4=10$  or  $4+6=10$

? *Is there another addition equation we could write for this arrangement of rods?*

- Listen for the other addition and record it below the first one on the whiteboard.
- Note: If the double  $5+5$  was chosen as the combination displayed there will only be one addition and one subtraction equation for that total because it is a double.

? *Can you see a subtraction equation represented by these rods as well?*

- Allow some thinking time as the representation is easy to interpret as addition but more challenging to interpret as subtraction.
- If the students need some prompting, remove one of the rods below the 10 e.g. the 6.

? *When I have a total of 10 and I take away the 6, what is left? (4)  
How would we write this as a subtraction equation?*

- Listen for suggestions of how to record the related subtraction equation that was modelled i.e.  $10-6=4$ . (Substitute numbers in the equation to match the on the rods chosen as the example)
- Record the subtraction equation under the addition equation/s already on the whiteboard.


? *What other equation could we show for these rods? What if we took away the 4 instead of the 6?*

- Listen for a description of the other subtraction equation (unless the addition was a double) and record it under the others on the whiteboard. Note: Writing the equations under each other matches the format used to record the family of facts in the other sections of the lesson.
- Ensure the students can identify the total in each equation and that for addition equations the total is at the end of the equation and for subtraction equations it is the first number.

- ?** *What is the total in these equations? (10) Where is the total in the addition equations? (At the end)  
Where is the total in the subtraction equations? (At the start)  
Why is the total at the end for addition but at the start for subtraction?*

- Help the students see that the 10 is the total and that the rods below are the same as the total but also that the total is the answer when completing an addition but the total is the start for a subtraction because the part is taken away from the total.

- ?** *What other equations could we make and write that have a total of 10?*

- Accept suggestions from students and record them on the whiteboard to show / remind students of the different pairs of numbers that add to make a total of ten. Prompt the students to include the related subtraction facts.
- Each addition can be modelled using the rods if this assists the students to connect the equation to the resource.
- Remove the rods showing equations that total 10 and replace the single 10 with a 10 and a 2 rod together to make a total of 12 i.e. 

- ?** *How long are these rods when we put them together like this? (12)  
Who would like to come and show **two** rods that when added together make a total of 12?*

- Select a student to find and place two rods under the 10+2 that have the same total e.g. 9+3, 8+4, 7+5 or 6+6 e.g.



- ?** *What are all the equations we can write for this set of rods?*

- Record the full set of related addition and subtraction facts for the rods chosen on the whiteboard under each other i.e.
 
$$\begin{array}{l} 8+4=12 \\ 4+8=12 \\ 12-8=4 \\ 12-4=8 \end{array}$$

- ?** *What other pairs of rods could we use to show a total of 12?*


- Select a student to choose two other rods that have a total of 12. Replace the previous 2 rods (8+4) with the new ones but be sure to leave the total (10+2) to show the equivalence.
- When the double is represented ask an extra question when the equations have been recorded to draw the students' attention to the difference i.e.

- ?** *Why are there only two equations this time?*


- Listen for mention of the fact represented being a double and that it doesn't change if the two parts are swapped in either the addition or subtraction equations.
- Choose other numbers from 11 to 18 to represent using a 10 rod and another rod as the total and repeat the process of asking for volunteers to find **two** rods that make the new total and then recording the addition and subtraction basic fact family equations for each example.
- Continue until the concept is understood and the process is starting to become automated – find the pairs and write all the equations.

### Hands On Activity:


- Have the students work with a partner to assist with manipulating the materials and recording the equations.
- Provide each pair of students with a prepared set of Student LTD Rods OR a commercial set with the numbers they represent written on the rods OR **two** sets of the paper equivalent (so doubles can be included) Rods 1-10 Master
- Provide each pair of students with 1 copy of the Add and Subtract Fact Families (to 18) Activity page. The activity page has space for 8 fact families.

 *For this activity I am going to choose a total for you to make with your rods. The total will be greater than 10 so please use a 10 rod and another rod to represent the total. The first total to make is 15.*


- Watch as the pairs of students find a 10 rod and a 5 rod and check that they place them end to end to make a length of 15.
- Note: The choice of a 10 and other rod is done so the total is easy to identify using place value knowledge i.e.  $10+5=15$ .

 *Now your job is to find **two** other rods that will also make a total of 15. You can only choose **2** rods. When you find two rods that make 15, place them underneath your 10 and 5 rods to show they are equal.*

- Move around the room and identify the different pairs of numbers that add to make a total of 15 that different pairs of students are finding.

 *Now write the total of 15 in the first space on your activity sheet and then record the addition and subtraction equations that match the rods you chose in the space below the total. Just write the equations that match the rods you found.*


- Invite students who chose different pairs of numbers that make a total of 15 to share the addition and subtraction fact family they have represented for this total. Each pair of students could just state the four equations, or they could write them on the class whiteboard to provide a visual reference for the class of the process and what a fact family looks like.
- Keep asking other pairs to share until all combinations of parts that total 15 and the related equations have been shared.
- Choose another total from 11 to 18 that will have a double as one of the fact families (i.e. an even number) e.g. 14.
- Have the pairs of students represent the total using a 10 and one other rod i.e. 4 to make 14 and ensure they place them side-by-side.

 *Write this new total in the next space on your activity sheet and work together to find **2** rods that will join together to make the same total. Write the new addition and subtraction basic fact equations on your page.*

- Observe the basic fact families being represented using the resources and as equations.
- Pairs of students can be invited to share the combinations they found that made the new total.
- Focus on the double and reinforce that this combination of parts will only form two equations.
- Continue providing totals from 11 to 18 for the pairs of students to represent using the rods and then record the basic fact equations for each total.
- When the class has completed the activity the activity sheets can be cut up so each fact family they recorded is separated. A display for each total could be created to place around the classroom as a reference e.g. use a large sheet of chart paper for each total and the fact families can be stuck on the poster for each total.

**Independent Activity:**

- Provide each student with a copy of the [Add and Subtract Fact Families \(to18\) worksheet](#).
- The worksheet shows 6 sets of rods and has spaces for the students to record the numbers to form the four equations for each fact family.
- Move around the classroom as the students work on the activity and ask questions to check understanding e.g.

 *What is the total for this set of rods? What rods are in this picture that add to make this total? What is one addition equation you can see in the rods? Is there another addition equation you can write in this fact family? What would be one subtraction equation for this total.*

- There are no doubles included in the worksheet so students will record four equations for each basic fact family.
- When the students have completed the worksheet the responses can be shared or the worksheet can be collected for assessment purposes.

**Understandings to look for:**

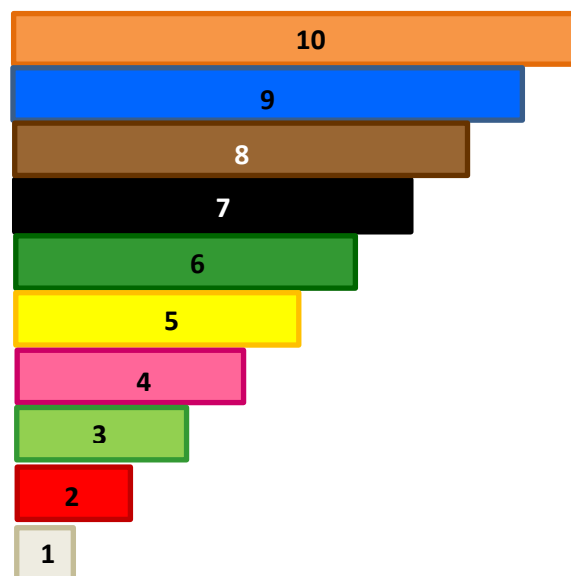
- Students who can identify the total and parts in an addition and subtraction situation represented using a length model.
- Students who can represent addition and subtraction situations as equations.
- Students who can represent a complete addition and subtraction fact family for a given total from 11 to 18.
- Students who understand that double facts only have two equations in their fact family.
- Students who recognise the positioning of the total in addition equations (at the end) compared to in subtraction equations (at the start).

### Preparation for the Hands On activity:

Cuisenaire Rods are a hands-on resource for teaching number that originated back in the 1950s. The rods that were used in hands activities for basic operations, fractions and some division work. The rods are metric lengths of 1cm to 10cm with a particular rod length a different colour to represent numbers. They were created by Georges Cuisenaire who was a Belgian primary teacher.

There are 10 different rods to represent the numbers 1-10 as lengths.

Number	Rod colour (traditionally)	Rod length
1	White	1cm
2	Red	2cm
3	Light Green	3cm
4	Pink	4cm
5	Yellow	5cm
6	Dark Green	6cm
7	Black	7cm
8	Brown	8cm
9	Blue	9cm
10	Orange	10cm



Many schools would still have boxes of these rods in storerooms but commercial versions are available from education supply companies.

It is preferred that the number that the rod is representing (i.e. its length) is **written on the rods** so the students don't need to remember what colour each number is or end up working out addition and subtraction fact families based on colours rather than numbers. Some modern, commercially available versions of this material have the numbers written on the rods already.

If actual rods are not available the file [Rods Master 1-10](#) can be used to make paper / cardboard sets of the rods.

For this lesson the total length is important so the rods from this file need to be cut precisely along the border. It is therefore not recommended to laminate them as the overlap will interfere with the smaller rods representing the same length as the longer rod.

The file could be copied onto thin cardboard if desired.