



eNICLE Grade 1 and 2 Teacher Development Programme

Session Eight Teacher Handbook

Name

School

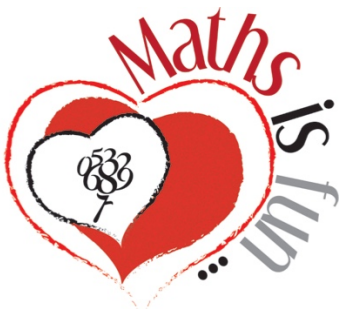
DECLARATION

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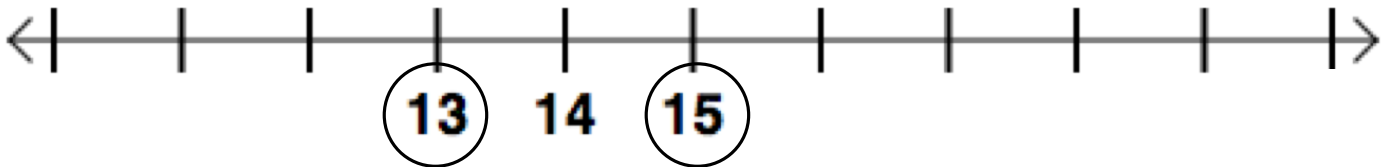
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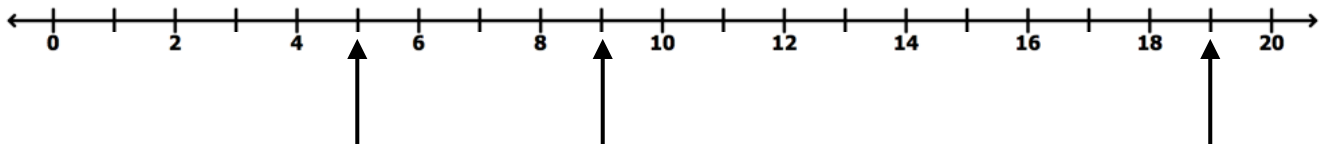
Today's Number Talk(s)

See page 27 for discussion

-
1.
Look at the numbers with circles. What numbers come before and after?
Explain how you know what comes before and after.
Fill in the missing numbers.

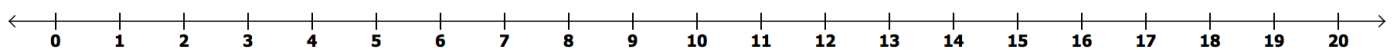


-
2.
What is the number shown by each arrow?
Explain how you know this.



-
3.
Calculate these using the number line.
Share your methods.

$3 + 4$	$5 + 6$	$8 + 7$	$9 + 8$
---------	---------	---------	---------



Linear representations of number: Bead strings to structured number lines

The regular use of a number line can help learners to form a *mental number line*. This can help learners to calculate mentally.

Research has found that many learners cannot use a number line effectively. This is why it is important to introduce number lines as early as possible.

In session 7, we started working with linear representations of number using **bead strings**. In this session, we will connect bead strings to a **counting line** and then move on to a **structured number line** (see Figure 1 below).

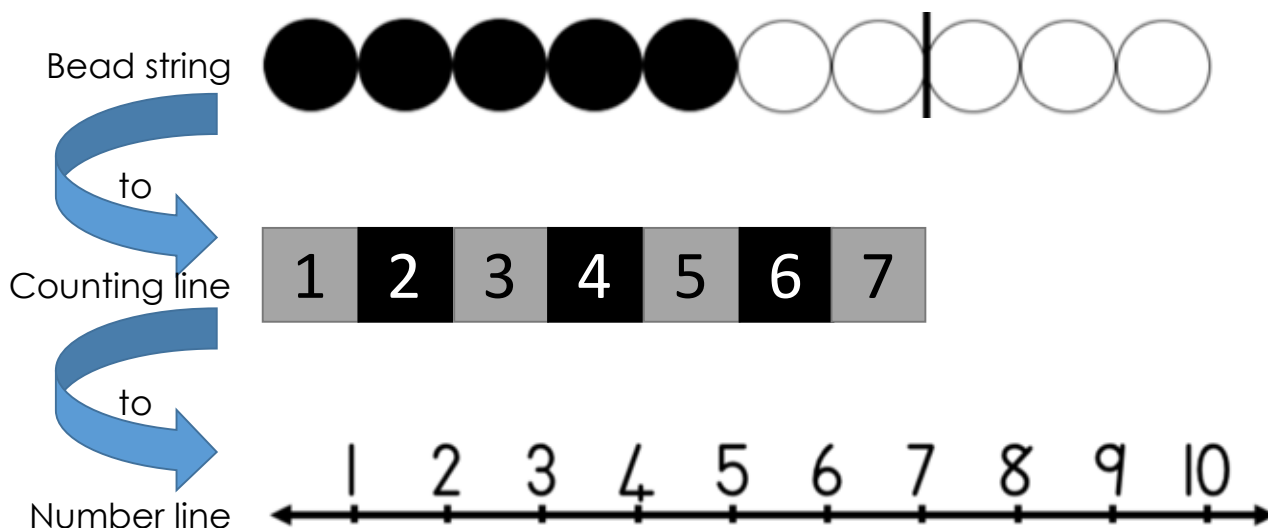


Figure 1: Introducing linear representations

For more information about linear representations of number, please see the Teacher Handbook from Session Seven.

Reasons to work with structured number lines

Working with structured number lines helps learners to:

- Visualise a mental number line in their heads
- Develop good number sense
 - Counting practice:
 - Count by 1s from 1 and other numbers (forward and backward)
 - Making numbers (number facts & fact families to 10, 20...100)
 - Skip counting in 5s and 10s
- Learning addition and subtraction strategies such as:
 - counting on / counting back
 - 1 more / 1 less (2 more / 2 less...)
- Visualise the **action** of the operation
- Provide support for later work with semi-structured and empty number lines

The South African Numeracy Handbook¹ supports these ideas as this extract shows.

Number-lines: As children move from a Level 1 sense of number to a sense of numbers at Levels 2 and 3 (see Unit 3) so they are developing a “mental number-line”. They are:

- Developing a sense of the relative sizes of numbers;
- Able to order numbers; and
- Starting to develop strategies to move with some comfort from one number to another (see *moving up and down the number line* – Unit 3).

In order both to record their thinking and also to allow them to keep track of their thinking (at first they cannot do all of this in their heads), we need to introduce children to a number-line and we need to encourage them to use it efficiently.

At first we might use a number lines with all of the numbers shown on it – such a number-line might well be displayed along the top of the board in the classroom. With time, however, children need to move away from number-lines that include each and every number and start using “blank number lines” on which they could identify say the starting number and result and then determine how to get from the one to the other.

Number-lines are simply a way of recording and managing the thought process that is going on in the mind of the child who is starting to work and/or is working with a Level 3 number sense.

Teachers should be aware that number-lines are probably more useful when solving addition and subtraction type problems and not that useful when solving sharing and grouping problems. Counting frames (which are a kind of number line) may initially be helpful as children solve sharing and grouping problems.

NOTES

¹ Extract from Numeracy Handbook for Foundation Phase Teachers: Grades R–3, page 86

Generating number lines

If you have access to a computer and the internet, you can find a number of tools to create and print structured number lines to use in your classroom.

Pre-made number lines:

- This website has loads of different number lines to choose from.
https://www.helpingwithmath.com/resources/oth_number_lines.htm
- For example:
 - Number Line (0 to 100) - Showing just 5, 15, 25, 35, etc.
 - Number Line from 0 - 150
 - Number Line (0 to 100) - numbers at 1s - split into five lines
 - Number Line (0 to 10) / (0 to 20)
 - Number Line (0 to 50) / (0 to 100 - by 5s)
 - Skip counting patterns
 - Vertical number lines including thermometers
 - Time etc.

Generate your own

These are more complex but allow you to create your own number lines. Read the AMESA article for instructions.

- http://www.oliverboorman.biz/projects/tools/number_lines.php
- <https://www.helpingwithmath.com/printables/others/NumberLineGenerator01.htm>

Reflection Activity



Get into groups of 3-5 or work with the teachers at your table.
Reflect on your use of the following activities from the last session.

Thinking about Number Talks and Bead Strings

1. Did you do any **Number Talks** with your class this month?
If so, what did you do?
How did you find the experience?
Did you learn anything about how your learners think?
2. Reflect on your experiences of using **bead strings**.
3. Did you make any adaptations to the activities? If so, show / explain to the members of your group.
4. What were the learner experiences of using the bead strings?

NOTES:

This section provides details of the activities that are presented in this workshop.
Every workshop will have a similar section so you know where to look in the handbook.

Resources

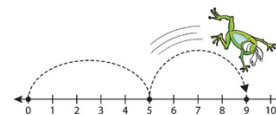
Number Talk Prompts

Page: 9

Structured Number Line activities

Page: 12

Number Talks: Number line prompts



Why use structured number lines for this number talk?

Structured number lines help learners to:

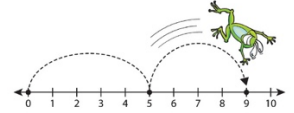
- Develop good number sense.
- Help to visualise a mental number line in their heads.
- Provides counting practice.
- Learning addition and subtraction strategies such as
 - counting on / counting back
 - 1 more / 1 less (2 more / 2 less...)
- Provide support for later work with semi-structured and empty number lines.

TYPE OF TALK	Number Lines <ul style="list-style-type: none"> • Do not suggest methods. • All learners should participate. 	<ul style="list-style-type: none"> • Increase confidence in talking about maths. • Develop maths vocabulary and build a word bank. • Allow use of linear representations.
OBJECT OF LEARNING	<ul style="list-style-type: none"> • Learners explain their thinking: HOW they SOLVE it and WHY it makes SENSE 	Learners begin to: <ul style="list-style-type: none"> • See and use numbers flexibly • Visualise mental number lines • Speak mathematically

SET ONE – BEFORE AND AFTER

1	
2	
3	
4	

Number Talks: Number line prompts continued



SET TWO – FINDING MISSING NUMBERS

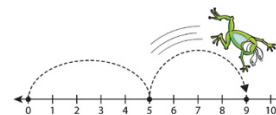
If learners struggle with these, encourage them to try this. Use this to help them explain their thinking too.

HOW TO FIND MISSING NUMBERS

- 1 Look at the entire number line.
- 2 Find out the number pattern.
- 3 Fill in the missing numbers.

1	
2	
3	
4	
5	

Number Talks: Number line prompts continued



SET THREE – USING THE NUMBER LINE TO CALCULATE IN RANGE 1 to 20

Use to 1 to 20 number line to calculate using these prompts. Increase the number range as learners gain confidence. (Master copies at the end of this handbook)

Doubles and near doubles

Aim: Children are able to recall doubles. This strategy makes the most of this.

Children learn to apply the same strategy to all the prompts when you use this carefully selected sequence of prompts.

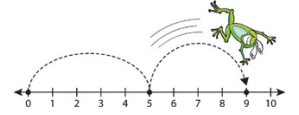
Making tens

Aim: Developing fluency with the number combinations that make ten. This is done by breaking numbers apart to make ten.

Again, children learn to apply the same strategy to all the prompts when you use this carefully selected sequence of prompts.

Doubles and near doubles			
$3 + 3$	$5 + 5$	$8 + 8$	$9 + 9$
$3 + 4$	$5 + 6$	$8 + 7$	$9 + 8$
$12 + 12$	$15 + 15$	$10 + 10$	$20 + 20$
$12 + 13$	$15 + 16$	$10 + 11$	$19 + 19$
Making tens			
$9 + 1$	$8 + 2$	$4 + 6$	$2 + 8$
$9 + 3 + 1$	$8 + 3 + 2$	$4 + 6 + 4$	$2 + 5 + 8$
$9 + 5 + 1$	$2 + 5 + 8$	$6 + 5 + 4$	$8 + 6 + 2$

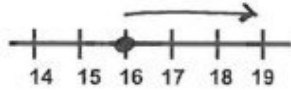
Number Line Activities



Create a number line to practice whatever you are currently teaching such as number sense or early calculation. You can create number lines indoors or outdoors. We suggest working with smaller groups so that all the learners can see the number line and have a chance to take turns using it.

Mathematical object of learning:

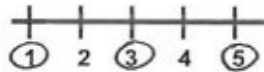
- Developing number sense:
 - working with greater than/less than



- finding numbers that come before and after another number



- finding odd and even numbers



You need:

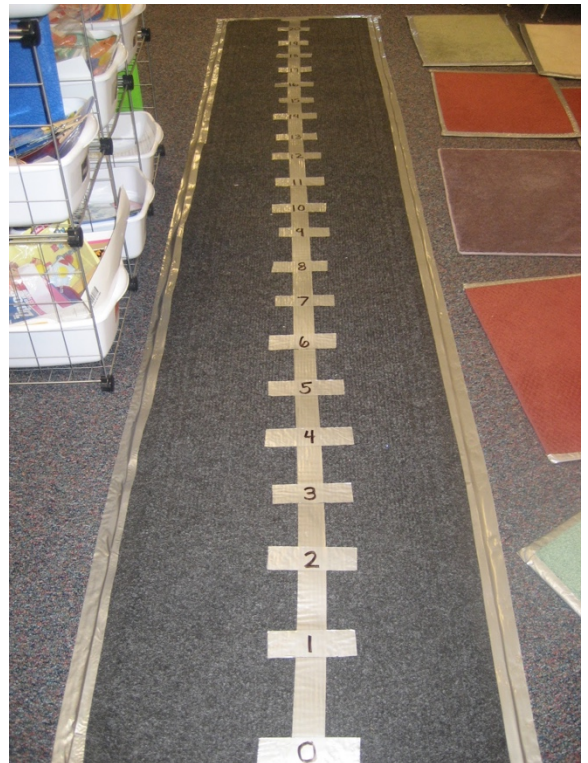
- Roll of thick masking tape
- Permanent marker
- Clear space in or outside the classroom

PREPARING YOUR NUMBER LINE

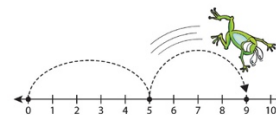
- Decide on your number range (i.e. 1 to 10; 1 to 20; 1 to 30).
- Prepare the number line on the floor using tape before class.
- An example is shown to the right.

IMPORTANT NOTES

- Make sure that the spaces between the numbers are equal. This is important for learners to understand.
- Add the arrows at each end. You should discuss that numbers keep going beyond the end of the number line.



Number Line activities continued



Number Sense Activities

Before and After

- Ask a child to stand at zero and jump/move to a specified number e.g. 5.
- Ask another child to go and stand on:
 - The number before
 - The number after
- Repeat with a different number and different children.

More and less (1 and 2 more)

- Ask a child to stand at zero and jump/move to a specified number e.g. 5.
- Ask another child to go and stand on:
 - One more than that number
 - One less than that number
- Repeat with a different number and different children.
- Introduce 2 more and 2 less.

How Many More To...

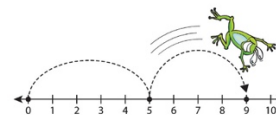
- Ask a child to stand at zero and jump/move to a specified number e.g. 5.
- Ask the class how many more they will need to jump to get to a number e.g. 8.
- Ask the child on the number line to jump to the number and check.
- Repeat with other numbers moving forward and backwards.

More Number Sense

- Jump on all the odd numbers.
- Jump on the number that is one less than 9.
- Jump on a number smaller than 12. Lots of learners can do this one to see how many can squeeze onto the available numbers.
- Jump on a number between 5 and 8.
- Combine two or more instructions: "Jump on an even number that is greater than 6."

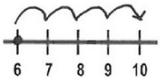
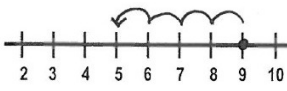
NOTES:

Number Line Activities continued



These activities move on to use the number line for early calculations. We suggest working with smaller groups so that all the learners can see the number line and have a chance to take turns using it.

The number line allows learners to visualise the **action** of the operation.

<p>Mathematical object of learning:</p> <ul style="list-style-type: none">• Developing a mental line of numbers in their head for doing early calculations<ul style="list-style-type: none">◦ addition  <ul style="list-style-type: none">◦ subtraction 	<p>You need:</p> <ul style="list-style-type: none">• Roll of thick masking tape• Permanent marker• Clear space in or outside the classroom
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Activities

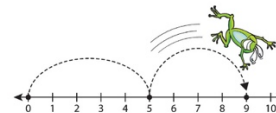
Early Calculation - Addition

- "Jump on a 7. Add 3. What did you get?"
- Repeat.
- Give the class an addition problem to solve on the number line.
For example $5 + 3$
- Ask for learners to show how the problem could be solved using the number line.

Early Calculation - Subtraction

- "Jump on a 15. Subtract 4. What did you get?"
- Repeat.
- Have two learners stand at zero.
- Ask one learner to walk 8 spaces along the line and the other to walk 3.
- Example questions:
 - How many steps farther did learner one walk than learner two?
 - How many more steps did learner one walk than learner two?
 - What is the difference in the steps walked by learner one and learner two?
- Mix up your questions as you repeat the activity. This helps learners to understand subtraction in all of its forms.

Birthday Line Up²



This is a fun activity to use the number line to find class birthdays. You could develop this into a Data Handling task if you wanted to.

PREPARATION

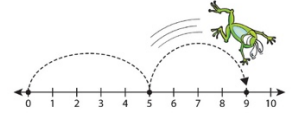
- Use chalk to make a large number line from 1 to 31.

ACTIVITY

- Ask learners to think of their birthday number, then stand on it on the number line. A child who was born on May 7 and one who was born on December 7 would both stand on the 7.
- Ask learners to look around and see who else has a birthday on their same date and share what month they were born in.
- While learners are standing there, give instructions like:
 - "If you have a birthday on an odd number stand up. If your birthday is on an even number, sit down."
 - "If your birthday date is greater than 20, stand up. If it is less than 20, sit down."
 - "If your birthday is on the 20th, jump up and down."
 - "If your birthday is between 3 and 7, put your hands in the air."
 - "Mpho, what is your birthday plus 2? Siya, what is your birthday minus three?"
 - And so on...

² Source and adapted from: <http://www.smartfirstgraders.com/number-line.html>

Alternative Number Lines



Number Line Variations

You can repeat all the above activities with other number lines:

- Draw a number line outside using sidewalk chalk → →
- Use the yellow number lines. These are two sided:
 - One side is marked from 0 to 100 with tick marks at every 5.
 - The other side is blank – good for proportional reasoning work (see Session Nine handbook).



“Up and Down the Number Line”³ Activity

These number sense and early calculation activities are taken from *The Foundation Phase Numeracy Handbook*.

Being able to break down, reorganise and build up numbers requires that children have a well developed mental number line. This allows children to sequence numbers and to move flexibly between them.

The activity below will help learners to develop this number line and move flexibly on it.

“Up and down the number line” is an activity that should be completed mentally. If children are doing the calculations on their fingers then use the activities mentioned earlier in the handbook or do the same activity with smaller numbers at each stage.

Completing tens

- I have 17, what do I get if I add 3?
- What must I add to 27 to get 30?

Bridging tens

- I have 17, what do I get if I add 8?

The child should first complete the ten and then add on the remainder. Their thinking could be: *“I have 17, I need 3 to make 20. $8 - 3 = 5$ so the answer is $20 + 5 = 25$.”*

- What must I add to 27 to get 32?

Adding to multiples of ten

- I have 17, what will I get if I add 33?
- What must I add to 27 to get 60?

Adding and subtracting multiples of ten

Children need to know that if $2 + 3 = 5$ then $20 + 30 = 50$ and $200 + 300 = 500$

- I have 30, what will I get if I add 50?
- I have 70, what will I get if I take away 30?
- What must I add to 10 to get 70?
- What must I take away from 90 to be left with 30?

Subtracting to multiples of ten

- I have 27, what do I get if I take away 7?
- What must I take from 45 to get 40?

Subtracting from multiples of ten

- I have 70 what do I get when I take away 8?
- What must I take away from 40 to get 36?

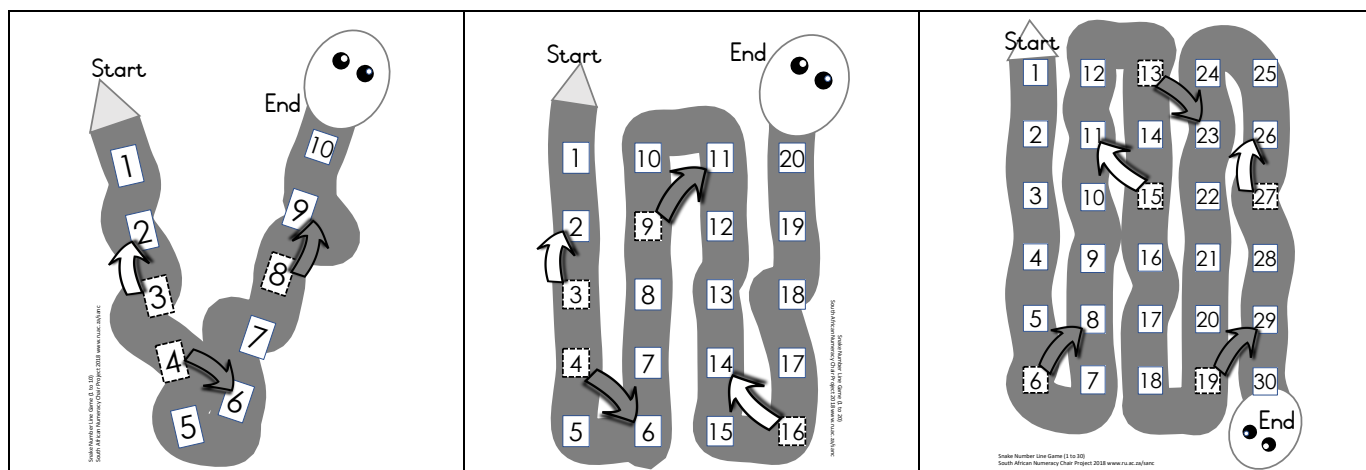
³ Source: Numeracy Handbook for Foundation Phase Teachers: Grades R–3, page 43

Snake Number Line Game

This game is a fun way for learners to practice jumping on a number line. It is a variation of Snakes and Ladders. The aim of the game is to get the correct number to land on the end number (10, 20 or 30).

There are three game boards for number ranges. These could be laminated or slipped into A4 plastic sleeves so that they can be re-used.

1. One to ten
2. One to twenty
3. One to thirty



<p>Mathematical object of learning:</p> <ul style="list-style-type: none"> • Understanding how to move along a number line • Counting practice: <ul style="list-style-type: none"> ○ In 1s (forward & backward) ○ more / less 	<p>You need:</p> <ul style="list-style-type: none"> • Dice for groups of learners • One game board per pair • Counters / stones / beans 	<p>Work with:</p> <p>Children work in pairs or threes.</p>
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Instructions for play

- Learners work in pairs or threes.
- Learners take turns to throw the dice.
- Move that many moves on the board.
- Follow the arrows to jump to another number.

NOTE: some of these jump forward and some jump backwards.

- Encourage the learners to say what they are doing as they follow an arrow

For Example:

- "I am jumping forward by 2 / backwards by 1" and so on.
- The learners must throw exactly the right number to land on the end number.

For example:

- If one learner is on 8 and they throw a three, this is too much to land exactly on ten. So they must jump to 9, 10 and then back to 9. They need a 1 to land exactly in the ten.
- Encourage them to say **how many** they need to get to the end number.

Worksheets – Skip Counting and Jumping

On the following pages, there are some worksheets that you can copy and use with the learners.

- A: Number Line Skip Counting
- B: Jump to a Number

<i>Mathematical object of learning:</i> <ul style="list-style-type: none">• Use the number line to skip count• Move along the number line without jumping in ones	<i>You need:</i> <ul style="list-style-type: none">• Copies of worksheets for each learner
---	---

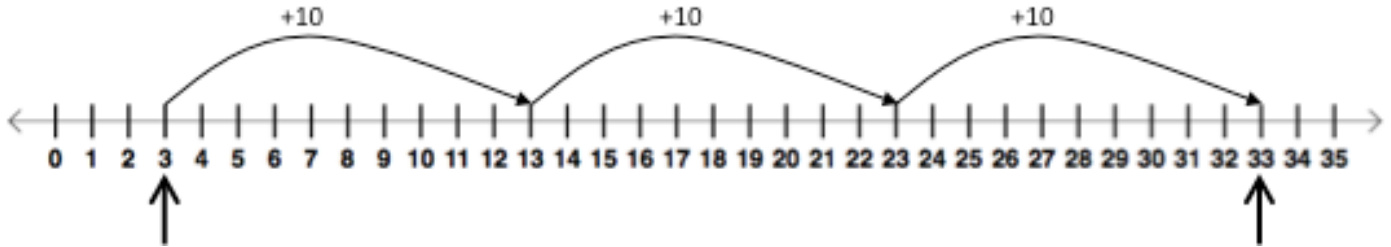
NUMBER LINE SKIP COUNTING

Use the number line to count in groups. Mark your jumps each time.

EXAMPLE

Count in tens from 3.

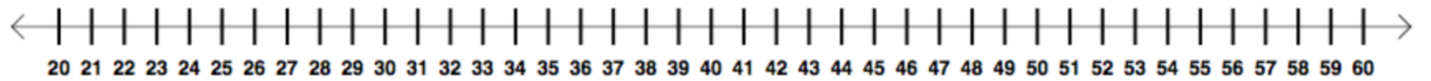
Mark your jumps on the number line like this:



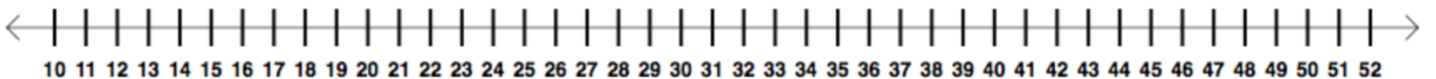
Count in 5s from 6



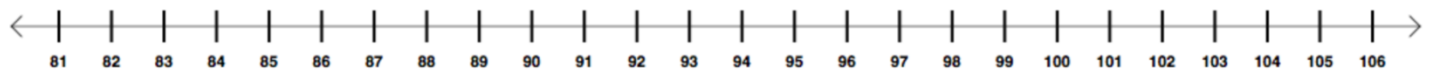
Count in 5s from 22



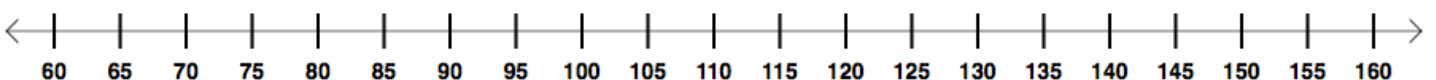
Count in 10s from 11



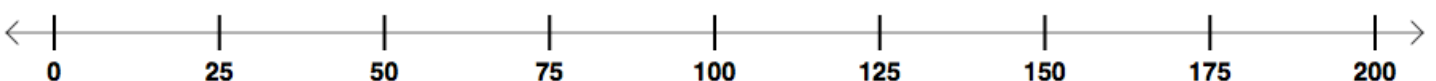
Count in 10s from 81



Count in 20s from 60



Count in 50s from 25

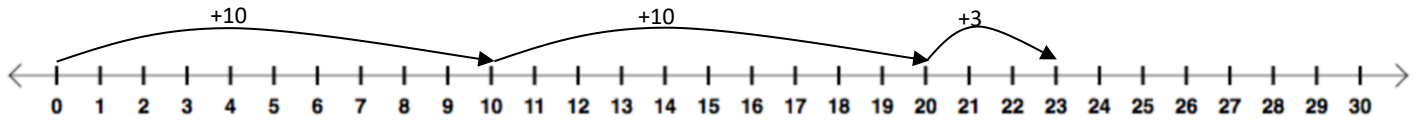


JUMP TO A NUMBER

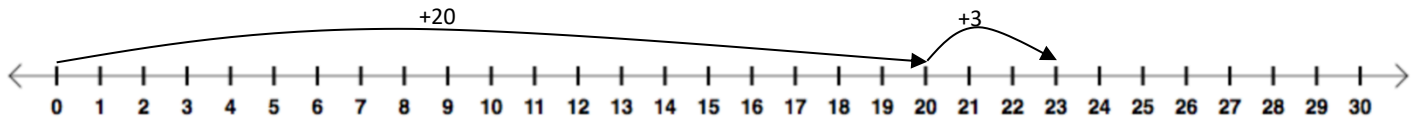
B

EXAMPLE

How can you jump to 23?
Show how you can jump in 3 jumps.



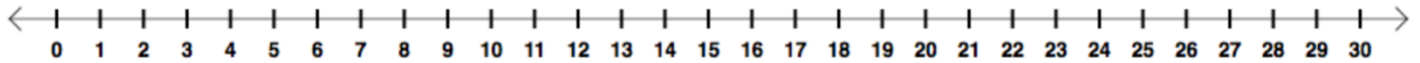
Show how you can jump in 2 jumps.



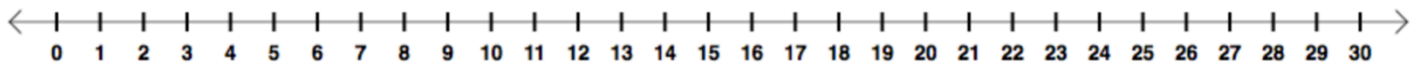
Which way is quicker?

Now try these. For each one show how you can jump in **2 jumps** and **3 jumps**.

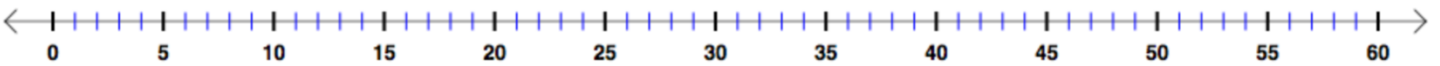
Show how can you jump to 18



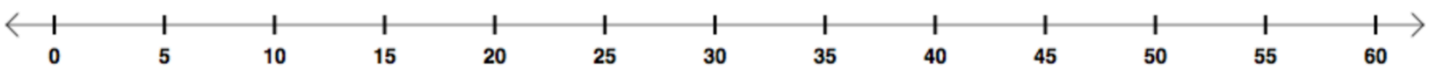
Show how can you jump to 29



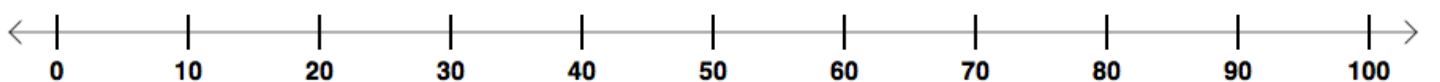
Show how can you jump to 46



Show how can you jump to 55



Show how can you jump to 85



Problem solving with structured number lines

The following pages present word problems that can be solved using the number line.

The items are structured as follows:

- The first page shows two worked examples. You might choose to do these with the whole class first, perhaps even as a Number Talk.
- The next two pages provide pre-drawn number lines for the learners to use to solve the problems.
- The final page requires the learners to draw their own number lines.

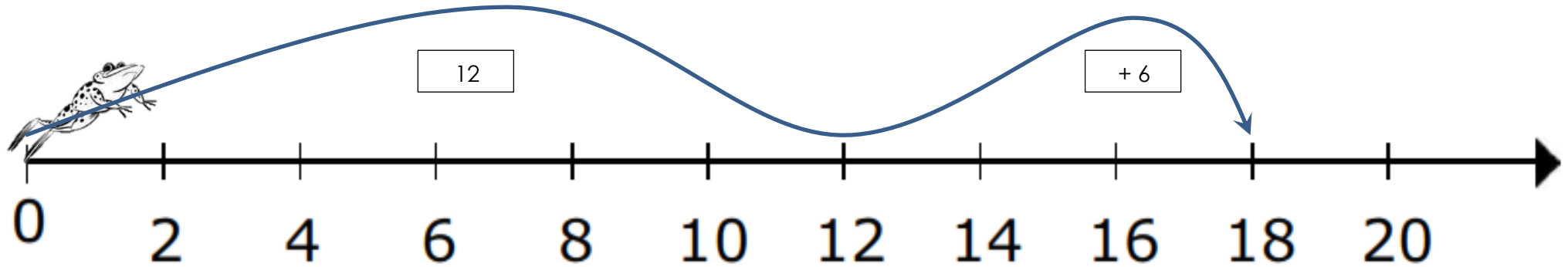
Mathematical object of learning: <ul style="list-style-type: none">• Using a number line to solve addition and subtraction problems	You need: <ul style="list-style-type: none">• Copies of worksheets for each pair of learners	Work with: <p>Learners can work on the problems in pairs over a number of days.</p>
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Problem Solving with Number Lines

I have 12 sweets. My friend gives me 6 more. How many sweets do I have now?

First of all, look at the line. What is the pattern on these numbers?

Jump the frog to 12 and then jump another 6. Where are you now on the line?

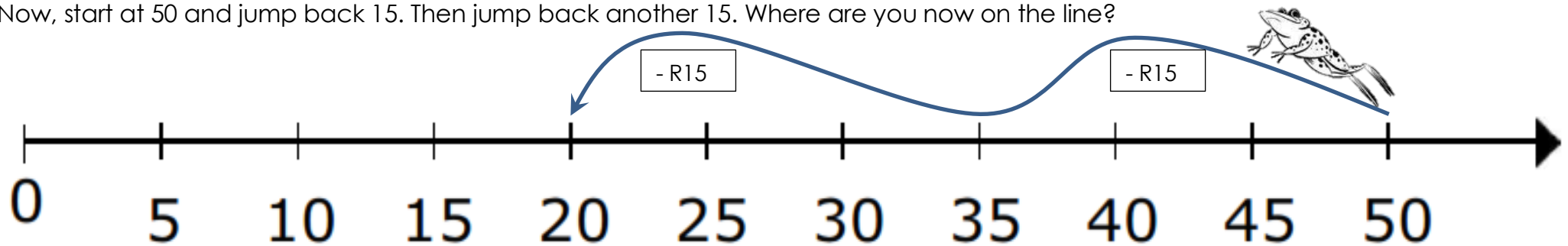


Now try this one

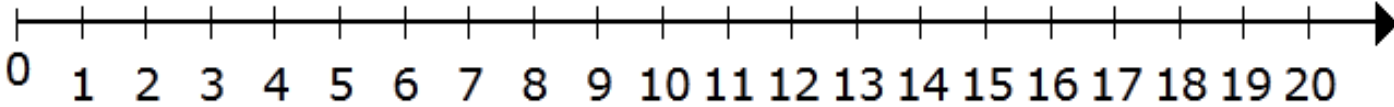
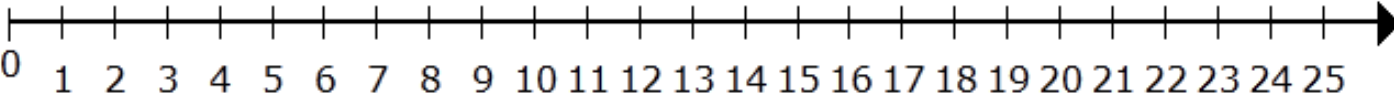
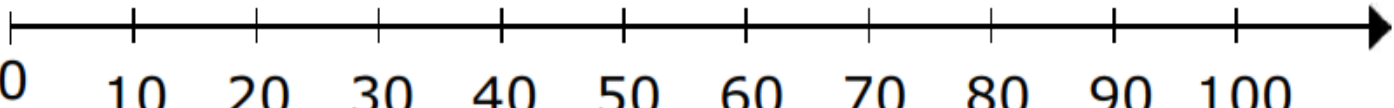
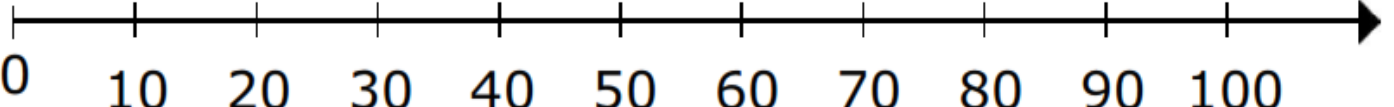
My mother gave me R50 to spend. I spent R15 on drinks. Then I spent R15 on a burger. How much do I have left?

First of all, look at the line. What is the pattern on these numbers?

Now, start at 50 and jump back 15. Then jump back another 15. Where are you now on the line?

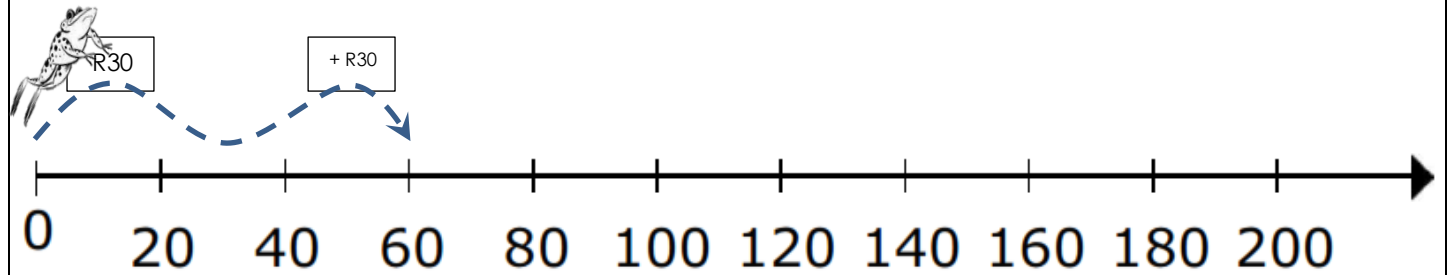


Now try these problems... For each problem, show your workings on the number lines

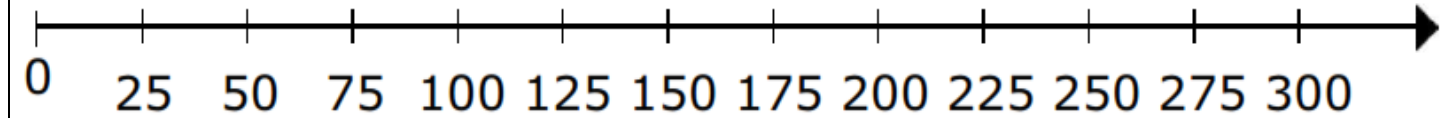
Name(s)		Date:
<p>There were 13 children at a party. Nine of them were boys. How many were girls?</p>		
<p>I drink 4 cups of water every day. How many cups of water do I drink in:</p> <p>4 days: _____</p> <p>6 days: _____</p> <p>5 days: _____?</p>		
<p>My collection has 90 shells. I give 10 to my friend and 30 get broken. How many shells have I got in my collection now?</p>		
<p>A tree has 95 leaves on it. After a bad storm, 40 leaves blow off in the wind. How many leaves does the tree still have?</p> <p>Mark where you think 95 will be on the number line.</p>		

For my birthday, 3 friends gave me R30 each. Then my parents gave me R50. How much money did I get for my birthday?

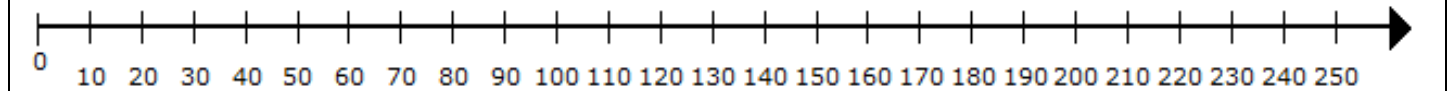
This problem has been started for you. First of all, mark where you think 30 will be. Finish it.



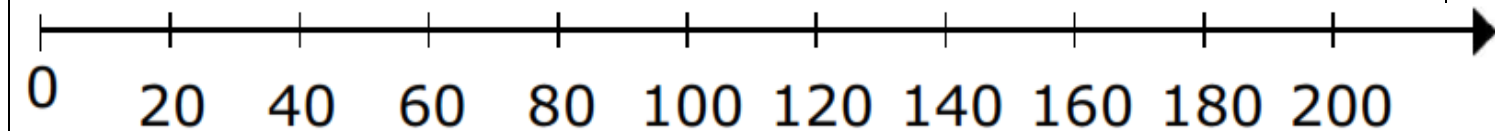
I get R25 per week for pocket money. How much money would I have after 7 weeks?



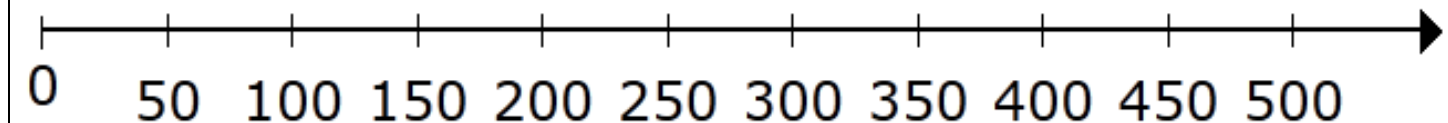
Abongile has R220 to spend on school stuff. She buys a backpack for R130. She also wants to buy some shoes for R110. Does she have enough money to buy the shoes?



One bag has 10 oranges. How many bags could I fill with 180 oranges?



We invite 450 people to a party. On the day 390 people come to the party. How many people did not come?



<p>I need R110 to buy a school tracksuit. I already have R65. How much more do I need?</p>	<p>Draw your own number line to solve this problem</p>
<p>I have 3 friends and 23 suckers. If I share the sweets equally, how many suckers will each friend get? Will there be any suckers left over?</p>	<p>Draw your own number line to solve this problem</p>

Today's number talk discussion

Think about:

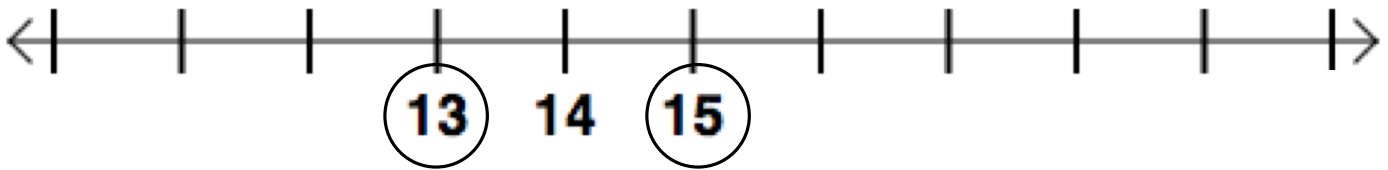
1. What are we trying to develop with each type of talk?
2. What kind of vocabulary will learners need for the talks?

1.

Look at the numbers with circles. What numbers come before and after?

Explain how you know what comes before and after.

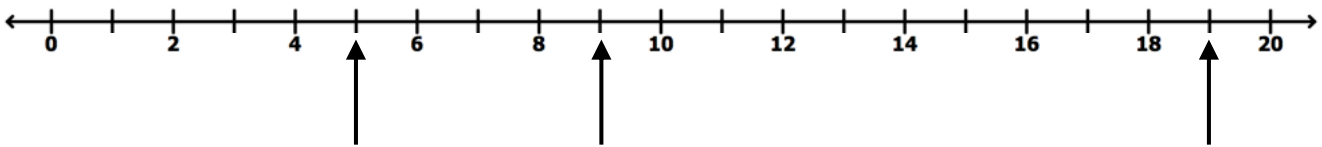
Fill in the missing numbers.



2.

What is the number shown by each arrow?

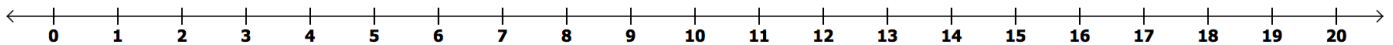
Explain how you know this.



3.

Calculate these using the number line

$3 + 4$	$5 + 6$	$8 + 7$	$9 + 8$
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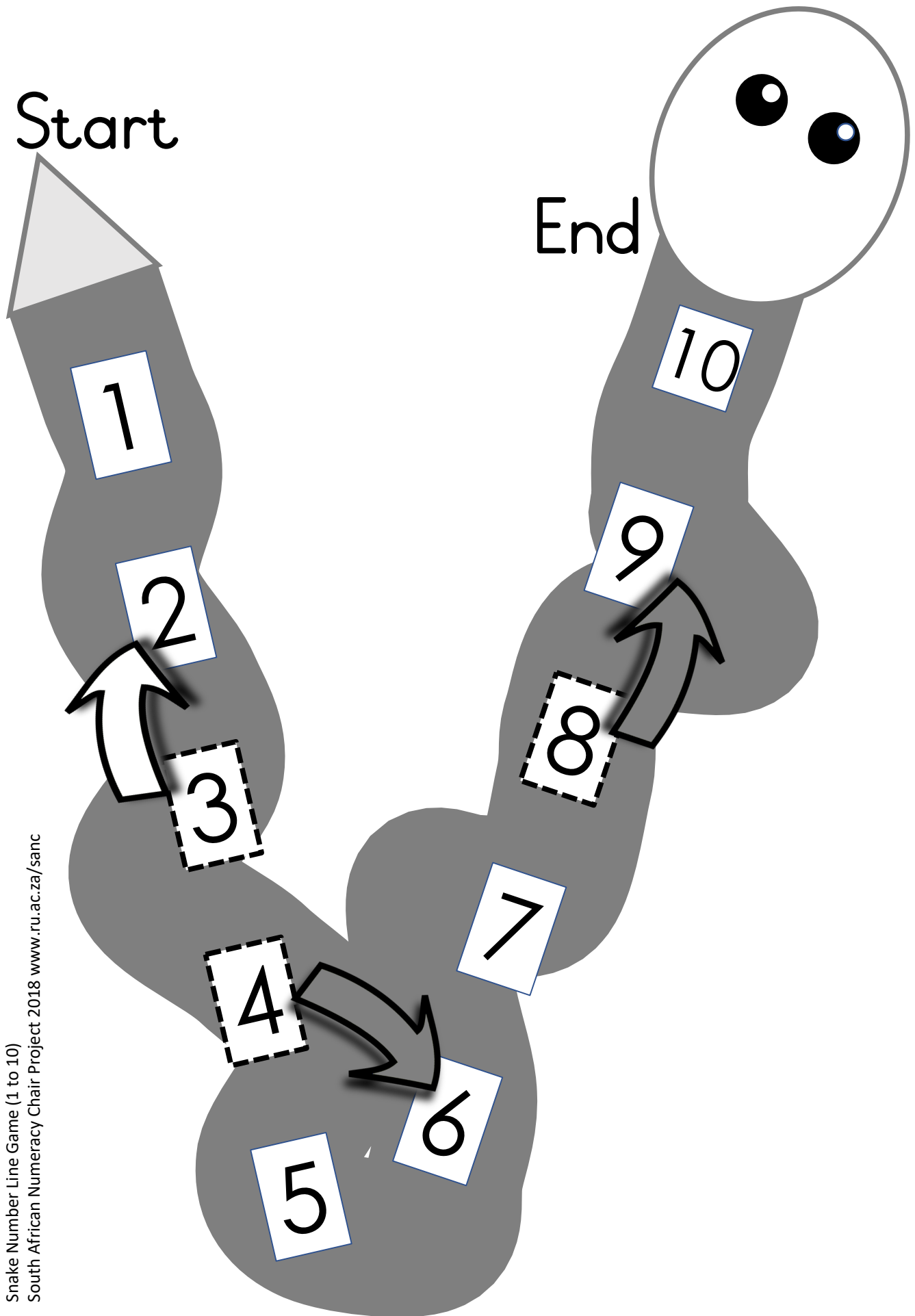


Learner number lines (1 to 20)

Print and cut out one for each learner

Number line	← 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 →	Name
Number line	← 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 →	Name
Number line	← 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 →	Name
Number line	← 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 →	Name
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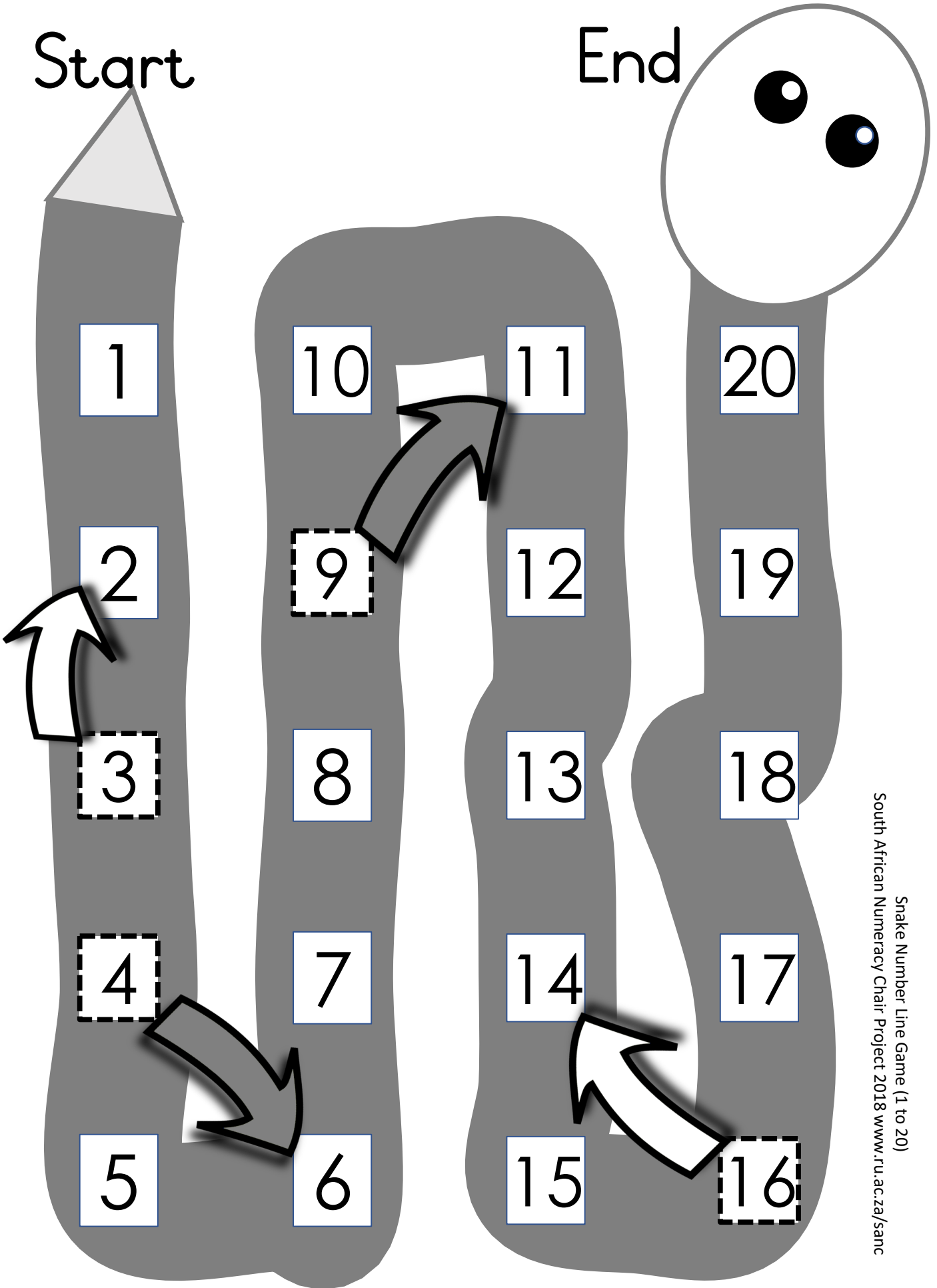
Snake Number Line Game Boards



Snake Number Line Game (1 to 10)
South African Numeracy Chair Project 2018 www.ru.ac.za/sanc

Start

End



Snake Number Line Game (1 to 20)
South African Numeracy Chair Project 2018 www.ru.ac.za/sanc

