re(Solve) MATHS BY INQUIRY Jump!

Y3

Summary of learning goals

- This sequence focuses on developing students' skills in measuring metres and centimetres. It also develops students' appreciation for distance as they make estimates and compile and compare data from experiments.
- Students also explore and apply the concept of 'times as many'.

Australian Curriculum: Mathematics (Year 3)

ACMNA053: Apply place value to partition, rearrange and regroup numbers to at least 10 000 to assist calculations and solve problems.

ACMNA054: Recognise and explain the connection between addition and subtraction.

ACMNA057: Represent and solve problems involving multiplication using efficient mental and written strategies and appropriate digital technologies.

ACMMG061: Measure, order and compare objects using familiar metric units of length, mass and capacity.

Summary of lessons

Who is this sequence for?

- Students who can use appropriate tools to measure metres and centimetres.
- Students who have knowledge of multiplication and multiply numbers using doubling, 10 × and 100 ×.

Lesson 1: How Far?

Students estimate the distance they can jump and then undertake an investigation by jumping, using a range of techniques. Class data are recorded and displayed. Students compare their jumping distance with each other.

Lesson 2: What If?

Students learn about the jumping distance of several animals and then estimate the lengths of jumps they would make if they were those animals.

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Australian Academy of Science

Reflection on this sequence

Rationale

One of the first measurement contexts introduced in the *Australian Curriculum: Mathematics* is length. Students start measuring using informal units and then in Year 3 standard metric units for length are introduced. This sequence uses metres and centimetres to emphasise the power of a formal unit. These include:

- A standard unit provides a common language for measurements to be quantified and compared.
- Smaller units allow for more precision.
- Appropriate tools need to be selected according to the distance being measured.
- Particular tools produce more accurate measurements.

The sequence also asks students to estimate lengths. The purpose of estimation is to help develop a sense of the size and structure of the unit. Sharing estimation strategies promotes estimation as an informed, but informal, form of measurement. It also emphasises that estimation is not a 'guess' that is either right or wrong. Estimation is a powerful tool that can be used by a teacher to assess students' understanding of a unit.

reSolve mathematics is purposeful

- The formal units of metres and centimetres are used to measure and quantify distance.
- Estimations and comparisons between measurements help students build an appreciation for the size and structure of the units being used.

reSolve tasks are inclusive and challenging

- The activity of jumping and the class graph in Lesson 1 provides a common experience for all students.
- Access is provided through enabling prompts and the extending prompts allow students to explore the concept more deeply.
- Students are asked to use their own strategies to multiply small and large numbers. The numbers that are to be multiplied in Lesson 2 have been carefully chosen so that the calculations build on each other.

reSolve classrooms have a knowledge-building culture

- Discussions and collaboration around the selection and use of tools for measuring help build shared understandings and provide practise when measuring length.
- Students are asked to share and refine strategies for calculating 'times as many'. They are introduced to the ratio table as a tool to assist in sense-making and to aid calculations.

LESSON 1

re(Solve) MATHS BY INQUIRY Jump!

How Far?

Y3

About this lesson

Students estimate the distance they can jump and then undertake an investigation by jumping, using a range of techniques. Class data are recorded and displayed. Students compare their jumping distance with each other.

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Mathematical purpose

- To make estimates about distance and measure to the nearest centimetre. Students collect data from experiments and compare each others' results.

Learning intention

- To find how far we can jump using different jumping techniques.

Time

A lesson of approximately 1 hour.

Vocabulary

- difference
- estimate

Resources

- metre ruler
- measuring tapes
- chalk (or similar) to mark starting and landing points
  - ◊ An outdoor sandpit could also be used.
- sticky notes
- Student Sheet 1 – Recording Sheet
  (one copy per student, also included as reSolve PDF *1a Recording Sheet*)

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Estimating jumps

Ask students:

- *How far can we jump?*
- *Is it easier to jump with two feet together or from just one foot?*
- *Does it help to have a running start?*
- *In what ways have you seen athletes jump (e.g. at school athletics carnival or on television)?*

Have students estimate the length of 1 metre and compare their estimates with a metre ruler.

Resources: Provide students with Student Sheet 1 – Recording Sheet.

Ask them to estimate how far they can jump for each of the following:

- two feet together
- one-foot leap from standing
- one-foot leap with a small run-up.

Students record their estimates in the 'Estimate 1' column, then discuss their estimates with a classmate. Based on these discussions, have students make another estimate. Discuss the different estimates as a class and have the students make a third estimate. This process allows students to refine their estimates.

Measuring jumps

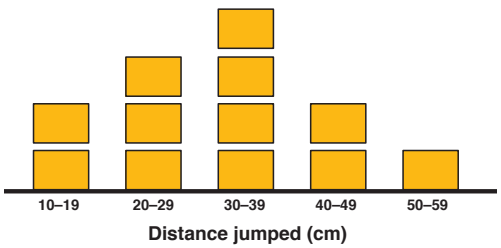
Mark a clear starting line for jumps. Allow students to make three attempts for each type of jump, measuring and recording on their recording sheet how far they jump on each attempt. Jumps should be measured from the starting line to the back of the foot (as in long jump), in metres and whole centimetres.

Ask students to look at the **difference** between their different jumps. A number line can be used as a tool to assist with calculations. Consider the addition and subtraction strategies students use to calculate the differences. Prompt students:

- *What is the difference between your shortest and longest jump?*
- *How much further can you leap with a short run-up?*

Graphing results

Have students record their longest jump for each technique on a different sticky note (three sticky notes in total) and use the sticky notes to create three class dot plots, one for each type of jump. The *x*-axis should be labelled 'Distance jumped (cm)' and use a scale appropriate for the class data (e.g. 20–29 cm, 30–39 cm, etc. See example at right.).



Look at the **difference** between the class data on the different jumps.

- What is the *difference* between the shortest and longest jump in each category?
- What is the *difference* between the shortest and longest jump across all categories?
- *How much further* can most students in the class leap with a short run-up?

Reflection

What if we were Olympic athletes? Measure out the World record/Olympic record long jumps for men and women and discuss. What is the **difference** between our jumps and their jumps?

Where to next?

Lesson 2: What If? is the second activity in this sequence. It asks students to estimate how far they could jump if they were different animals.

Recording Sheet

Name: _____

Type of jump	Estimate 1	Estimate 2	Estimate 3
Two feet together			
One-foot leap from standing			
One-foot leap with a run-up			

Type of jump	Jump 1	Jump 2	Jump 3
Two feet together			
One-foot leap from standing			
One-foot leap with a run-up			

My longest jumps:

Two feet together _____

One-foot leap from standing _____

One-foot leap with a run-up _____

LESSON 2

reSolve MATHS BY INQUIRY Jump!

What If?

Y3

About this lesson

Students learn about the jumping distance of several animals, and then estimate the lengths of jumps they would make if they were those animals.

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ACMMG061: Measure, order and compare objects using familiar metric units of length, mass and capacity.

Mathematical purpose

- To measure accurately and to explore and apply the concept of 'times as many'.

Learning intention

- To accurately measure your height and calculate how far you could jump if you were different animals.

Time

A lesson of approximately 1 hour.

Resources

- reSolve PowerPoint *2a What If?* (for display)
- measuring tapes

Vocabulary

- accuracy
- precision
- ratio table
- times as many

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Animal jumps

Look at the data about student jumps from Lesson 1: How Far?

Resources: Show the reSolve PowerPoint *2a What if*?

Pose the questions: *What if you were a kangaroo? A frog? A grasshopper? A flea? How far could you jump?*

Discuss what **times as many** means. For example, *a kangaroo can jump four times its height* means it could jump over four kangaroos lying on the ground head to toe. This means if you were a kangaroo, you could jump over four of you lying head to toe. This could be physically demonstrated by having four students of a similar height lying head to toe along the ground.

If I were a kangaroo

Have students measure and record their height, in metres and centimetres (e.g. 95 cm, 1 m 3 cm).

Ask students to work out how far they could jump if they were a kangaroo. Allow them to use their own strategies. Some strategies might include:

- measuring out four height lengths
- adding together their height four times and then measuring
- multiplying their height four times and then measuring
- doubling their height and then doubling again.

Students will need to recognise that 100 cm = 1 m and know how to apply this to their calculations.

If I were a flea, frog or grasshopper

Discuss with students the strategies they used to calculate their kangaroo jump lengths. Discuss any generalisations or observations they made from their experiences and calculations.

A useful tool to help students work out the length of jumps is a **ratio table**, as shown. This can be introduced and linked to the strategies that students used.

Four height lengths will be the same as adding one height length four times. You could also add together two of the two height lengths.

Prompt students: *How could you make 10 times your height?*

Some possible strategies:

- 8 heights + 2 heights
- 2 heights + 2 heights + 2 heights + 2 heights + 2 heights
- (4 heights + 1 height) + (4 heights + 1 height)

Height	Times as many
130 cm	1
260 cm	2
520 cm	4
1040 cm	8
2080 cm	16
etc.	

Ask students to calculate how far they could jump if they could jump 20 times their height (grasshopper), 30 times their height (frog) or 200 times their height (flea).

Where possible, have students mark out their kangaroo, frog, grasshopper or flea jumps around the school. Discuss those that were easy to measure and those that presented a challenge. What were the best tools to make the measurements?

Questioning:

- *What tools did you use to measure your jumps?*
- *What would be the best tool to use to measure how far you could jump if you were:*
  - ◊ *a kangaroo?*
  - ◊ *a frog?*
  - ◊ *a grasshopper?*
  - ◊ *a flea?*
- *How do the tools you use differ? Why would you use different tools? Would some tools produce more accurate measurements?*
- *What do you think about the statement* 'The smaller the distance, the more accurate you tend to be.'?

Reflection

Compare the jump lengths from Lesson 1 and Lesson 2. How do the actual lengths that students could jump differ from the imagined animal jump lengths?

Ask students to consider: *If their original jumps were more than one, two or three times their own height, what sort of animal might they be?*