

## Year 3 Exemplar Is It True?

### 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.

- Justifying choices about partitioning and regrouping numbers in terms of their usefulness for particular calculations.

### Abstract

This task asks students to decide whether an addition is correct or not and to explain their reasons. The content focus is on place value and grouping, re-grouping and renaming for multi-digit addition. The reasoning foci of this task are explaining and justifying statements, and exploring and noticing relationships (analysing). The task is easy to adapt to other content and year levels.

### Mathematical purpose (for students)

Thinking about number facts and place value knowledge can help us test the accuracy of calculations.

### Mathematical purpose (for teachers)

Teachers support and challenge students to justify their conjectures by:

- Exploring and noticing relationships between numerical structures (Analysing).
- Verifying or refuting statements as true (Justifying).
- Explaining why the statement is true or false (Justifying).

Time Needed                      60 minutes approximately

#### Vocabulary Encountered

- true
- explain
- justify
- regrouping
- partition

#### Materials

- MAB (optional)
- [Student Sheet 1 - Is it true? Number Task](#) (1 per student)
- [Student Sheet 2 - Is it true? Bakery Task](#) (optional, 1 per student)
- Video [ST5\\_Reasoning\\_3a\\_IsItTrue.mp4](#) (optional)
- Reasoning Prompt Cards or Poster (see Teachers' Guide [ST5\\_Reasoning\\_TeachersGuide.docx](#))
- [Assessment Sheet](#) (1 per student)

We value your feedback after these tasks via <https://www.surveymonkey.com/r/RJC6FPC>



# Is It True: The Lesson

## Introducing the Reasoning Task

Explain that in much of mathematics we try to find the easiest, most efficient way to answer questions - part of which involves noticing relationships in numbers and explaining our thinking. It might help to use terms such as *patterns* and *relationships* and key language such as *efficiency*, *partitioning*, *regrouping*, and *renaming*.

If desired, [Student Sheet 1 - Is it true? Number Task](#) can be used to present the task.

## Reasoning Task

$27 + 34 = 511$   
Is it true?  
Why or why not?

The idea is that students check the calculation mentally, but explain their reasoning in writing.

The video [ST5 Reasoning 3a IsItTrue.mp4](#) shows a student justifying her thinking in two ways: first by subtracting 34 directly from 511, and second by finding the difference between 511 and 34 assisted by a number line. The video shows how listening to students helps us appreciate the depth of their thinking.

## Reasoning Prompts

For more prompts in the context of this task, see this [table](#)

- What do you notice? (**Analysing**)
- Tell me what is wrong with [the answer]? (**Justifying**)
- How do you know [it is not true]...? (**Justifying**)
- How could we show that it is [not] true? (**Justifying**)
- True or false? Why? Let's justify. (**Justifying**)

What do you notice...?	Tell me what is wrong with...	How do you know?	How could we show or prove that it is true?	True or false? Why? Let's justify.
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## Enabling Prompts

- For students who cannot decide if the calculation is correct,
  - suggest that they model the numbers using materials such as MAB or
  - look at patterns for step by step calculation e.g. What is  $27 + 30$ , then  $27 + 31$  then  $27 + 32$  then  $27 + 33$ , then  $27 + 34$ ? What pattern do you notice?

## Extending Prompts

- Justify your thinking in at least two different ways. One way might use estimation.
- Explain why someone might mistakenly think this answer is correct. Why did the person make this mistake? Explain how you might help a friend to overcome this error.
- Alter one of the numbers to make this addition problem equal 511.

## Summary Phase

Invite students to share their solutions in order of complexity to develop a whole class mathematical discussion. The Formative Assessment [Table](#) shows the likely variation in responses. You might:

- Encourage students to explain each other's thinking.
- Possibly use the video [ST5 Reasoning 3a IsItTrue.mp4](#) to discuss the response of a student who is not in the class, or show other possibilities.
- Ask "What is one thing you know now about justifying your thinking that you did not know before?"
- Draw out the content knowledge that you wished to be the focus of the reasoning in the lesson.

## Further Activities

Having listened to a range of students' strategies in the initial task, students can apply those strategies to follow-up tasks as shown below.

For middle primary:      For upper primary:

$270 + 340 = 511$        $2.7 + 3.4 = 5.11$

$97 + 34 = 1211$        $4.65 + 2.87 = 6.152$

$511 - 34 = 27$        $5.271 + 3.814 = 8.1085$

$34 - 27 = 13$

[Student Sheet 2 - Is it True? Bakery Task](#)

(adapted from the reSolve 'Bakery' task focusing on multiplication and arrays).

$$\begin{array}{r} 40 \\ \times 24 \\ \hline 160 \\ 80 \\ \hline 240 \end{array}$$

## Formative Assessment

The following table shows some responses that students commonly give to this problem. These responses demonstrate the variety of levels for each reasoning action. Studying these sample responses can prepare the teacher for identifying their students' reasoning during the lesson. Suitable prompts are suggested to support or extend such students' reasoning.

Many of the possible responses in the table are linked to full work samples from students. Each work sample has been annotated by the teacher using the Rubric. A copy of the teachers' assessment sheet shows what the teacher recorded about reasoning during and after the lesson, and the recommendations the teacher made about how to further that student's reasoning.

ANALYSING		
Possible Student Response	Level	Suggested Prompts
"Yes, it is true."	Not Evident	Offer enabling prompt.
Uses concrete materials to explore place value. E.g. "Here are 2 tens, this means 20."	Beginning	What do you notice about the tens and the ones?
The student notices the role of place value such as 2 in 27 means 20 and 3 in 34 means 30, therefore $20 + 30 = 50$ not 500.	Developing	What stays the same and what changes? Is it true? Why or why not?
The student experiments with alternate possibilities to explain the answer. (See <a href="#">Annotated Work Sample 1</a> )	Consolidating	Explain how estimation might help you to decide if this calculation is correct, using a real-life example.
Identifies place value of the digits and then uses addition to estimate. (See <a href="#">Annotated Work Sample 2</a> )	Consolidating	Is there another way you can prove this is not true?
Shows two different strategies to explain why it equals 61 (See <a href="#">Annotated Work Sample 3</a> )	Extending	How might you alter one of the numbers to make this addition problem equal 511?

JUSTIFYING		
Possible Student Response	Level	Suggested Prompts
"Yes, it is true."	Not Evident	Offer enabling prompt.
$2 + 3 = 5$ , $7 + 4 = 11$ , $5 + 11 = 511$	Beginning	Is this true? Why, why not?
Uses concrete materials to model	Beginning	Explain your thinking. Can you show this using number sentences?
No because $20 + 30 = 50$ , $7 + 4 = 11$ , $50 + 11 = 61$ Split 11 into 10 and 1	Developing	Convince me/your partner you are correct.
Estimation: The two numbers are close to 30. 2 lots of 30 are 60.	Consolidating	Can you show your thinking in another way?
No because $20 + 30 = 50$ , $7 + 4 = 11$ , $50 + 11 = 61$ (See <a href="#">Annotated Work Sample 1</a> )	Consolidating	How might you model this problem in another way for your friend to help them?
"If the total of any numbers we add together in a column is bigger than nine then we need to regroup. So, when you add 7 and 4, it makes 11 ones, which is the same as 1 ten and 1 one. So, we now have 2 tens, plus 3 tens, plus 1 ten."	Consolidating	How might you alter one of the numbers to make this addition problem equal 511?
The highest two-digit number equation you can make is $99+99=198$ - therefore it cannot be correct. (See <a href="#">Annotated Work Sample 3</a> )	Extending	Offer extending prompts.

# Annotated Work Sample 1

$$27 + 34 = 511$$

Is this true?

not true

Why or why not?

$$27 + 483 = 511$$

$$27 + 34 = 61$$

no work  
near 511

$$\begin{array}{r} 27 \\ 483 - 422 = 61 \\ \hline 83 - 22 \\ \hline 60 - 2 \\ \hline 63 - 2 \\ \hline 61 \end{array}$$

$$\begin{array}{r} 20 + 30 = 50 \\ 7 + 4 = 11 \\ \hline 50 + 11 = 61 \end{array}$$

$$\underline{11 + 50 = 511}$$

**JUSTIFYING: Refutes** a claim

*Provides an example to make a true number sentence.*

**ANALYSING: Recalls** and **repeats** patterns using numerical structure or spatial structure.

*The student experiments with alternate possibilities to explain the answer.*

**JUSTIFYING: Verifies** truth of statements by using a common property, rule or known facts that confirms each case. May also use materials and informal methods.

*Displays knowledge of place value*

**JUSTIFYING: Starting** statements in a **logical argument** are correct and accepted by the classroom.

*Explores partitioning and place value to predict why the student might have got an incorrect answer. That is,  $2+3 = 5$  and  $7+4 = 11$  therefore it equals 511*

**ANALYSING: Consolidating**

**JUSTIFYING: Consolidating**

**Teacher Prompt**

*Explain how estimation might help you with this problem using a real-life example.*

*Explain your thinking.*



Student Name: Work Sample 1 Reasoning Task: Is it True? Date: \_\_\_\_\_

**Observation of student's reasoning:**

Proved thinking in 3 different ways & explored why answer incorrect with an example

	Analysing	Generalising	Justifying
Not Evident	<ul style="list-style-type: none"> <li>Does not notice common property or pattern.</li> </ul>	<ul style="list-style-type: none"> <li>Does not communicate a common property or rule (conjecture).</li> </ul>	<ul style="list-style-type: none"> <li>Does not justify.</li> </ul>
Beginning	<ul style="list-style-type: none"> <li>Recalls random known facts or attempts to sort examples or repeats patterns.</li> </ul>	<ul style="list-style-type: none"> <li>Attempts to communicate a common property or rule for the pattern.</li> </ul>	<ul style="list-style-type: none"> <li>Describes what they did and recognises what is correct or incorrect.</li> <li>Argument is not coherent or does not include all steps.</li> </ul>
Developing	<ul style="list-style-type: none"> <li>Notifies a common property, or sorts and orders cases, or repeats and extends patterns.</li> <li>Describes the property or pattern.</li> </ul>	<ul style="list-style-type: none"> <li>Generalises: communicates a rule (conjecture) using mathematical terms and records other cases or examples.</li> </ul>	<ul style="list-style-type: none"> <li>Attempts to verify by testing cases and detects and corrects errors or inconsistencies.</li> <li>Starting statements in a logical argument are correct.</li> </ul>
Consolidating	<ul style="list-style-type: none"> <li>Systematically searches for examples, extends pattern or analyses structure to form a conjecture.</li> <li>Makes predictions about other cases.</li> </ul>	<ul style="list-style-type: none"> <li>Generalises: communicates a rule using mathematical symbols and explains what the rule means or explains how the rule works using examples.</li> </ul>	<ul style="list-style-type: none"> <li>Verifies truth of statements by confirming all cases or refutes a claim by using a counter example.</li> <li>Uses a correct logical argument.</li> </ul>
Extending	<ul style="list-style-type: none"> <li>Notifies and explores relationships between properties.</li> </ul>	<ul style="list-style-type: none"> <li>Generalises cases, patterns or properties using mathematical symbols (including algebraic symbols) and applies the rule.</li> <li>Compares different expressions for the same pattern or property to show equivalence.</li> </ul>	<ul style="list-style-type: none"> <li>Uses a watertight logical argument.</li> <li>Verifies that the generalisation holds for all cases using logical argument.</li> </ul>

**Comments (feedback, reasoning prompts for further development):**

\* Need to develop watertight argument  
 \* What is 'role' of place value?  
 \* Extending prompt and/or follow up task

## Annotated Work Sample 2

$$27 + 34 = 511$$

Is this true?

Why or why not?

Not true

means the 2 and the 3  
30 = 50 and 30 20 20 and  
and 50 is it is here 50  
here 500 no were

Explain why someone might mistakenly think this problem is true.

Because the 7 and the 4 =  
11 and 511 has 11

**ANALYSING:** Notices more than one common property.

Identifies place value of the digits and then uses addition to estimate.

**ANALYSING:** Consolidating

**JUSTIFYING:** Consolidating

**Teacher Prompt**

*Is there another way you can prove that this is not right?*

*How might you model this problem in another way for your friend to help them?*

**JUSTIFYING:** Uses a correct **logical argument** that has a complete chain of reasoning

Uses estimation to justify their thinking and uses language such as 'so'.

**JUSTIFYING:** Extends the **generalisation** using logical argument.

Explores partitioning and place value to predict why the 'student' might have got an incorrect answer. That is,  $2+3 = 5$  and  $7+4 = 11$  therefore it equals 511.



Student Name: Work Sample 2 Reasoning Task: Is it True? Date: \_\_\_\_\_

**Observation of student's reasoning:**

Explains reasons for 'not true' using place value & some estimation – identified misconception

	Analysing	Generalising	Justifying
Not Evident	<ul style="list-style-type: none"> <li>Does not notice common property or pattern.</li> </ul>	<ul style="list-style-type: none"> <li>Does not communicate a common property or rule (conjecture).</li> </ul>	<ul style="list-style-type: none"> <li>Does not justify.</li> </ul>
Beginning	<ul style="list-style-type: none"> <li>Recalls random known facts or attempts to sort examples or repeats patterns.</li> </ul>	<ul style="list-style-type: none"> <li>Attempts to communicate a common property or rule for the pattern.</li> </ul>	<ul style="list-style-type: none"> <li>Describes what they did and recognises what is correct or incorrect.</li> <li>Argument is not coherent or does not include all steps.</li> </ul>
Developing	<ul style="list-style-type: none"> <li>Notices a common property, or sorts and orders cases, or repeats and extends patterns.</li> <li>Describes the property or pattern.</li> </ul>	<ul style="list-style-type: none"> <li>Generalises: communicates a rule (conjecture) using mathematical terms and records other cases or examples.</li> </ul>	<ul style="list-style-type: none"> <li>Attempts to verify by testing cases and detects and corrects errors or inconsistencies.</li> <li>Starting statements in a logical argument are correct.</li> </ul>
Consolidating	<ul style="list-style-type: none"> <li>Systematically searches for examples, extends pattern or analyses structure to form a conjecture.</li> <li>Makes predictions about other cases.</li> </ul>	<ul style="list-style-type: none"> <li>Generalises: communicates a rule using mathematical symbols and explains what the rule means or explains how the rule works using examples.</li> </ul>	<ul style="list-style-type: none"> <li>Verifies truth of statements by confirming all cases or refutes a claim by using a counter example.</li> <li>Uses a correct logical argument.</li> </ul>
Extending	<ul style="list-style-type: none"> <li>Notices and explores relationships between properties.</li> </ul>	<ul style="list-style-type: none"> <li>Generalises cases, patterns or properties using mathematical symbols (including algebraic symbols) and applies the rule.</li> <li>Compares different expressions for the same pattern or property to show equivalence.</li> </ul>	<ul style="list-style-type: none"> <li>Uses a watertight logical argument.</li> <li>Verifies that the generalisation holds for all cases using logical argument.</li> </ul>

**Comments (feedback, reasoning prompts for further development):**

Have student show thinking / model in another way.

Try a follow-up task to transfer thinking



# Annotated Work Sample 3

$$27 + 34 = 511$$

Is this true? False

Strategy 1

$$\begin{array}{r} 27 \\ + 34 \\ \hline 61 \end{array}$$

Strategy 2

$$\begin{array}{l} 27 + 34 = \\ \swarrow \quad \searrow \\ 20 + 30 = 50 \quad 7 + 4 = 11 \\ \swarrow \quad \searrow \\ 50 + 11 = 61 \end{array}$$

Why or why not?

Reason 1

The highest 2 digit numbers which are 99+99 only equal 198. That is nowhere near 500

Reason 2

If you try any strategy you would get 61

**ANALYSING:** Notices and explores relationships between: common properties, numerical structures of patterns

**JUSTIFYING:** Verifies truth of statements by using a common property, rule, or known facts that confirms each case.

Shows two different strategies to explain why it equals 61.

**JUSTIFYING:** Uses a watertight logical argument.

Identifies the largest possible number to make with 2-digit and 2-digit addition.

**ANALYSING:** Extending

**JUSTIFYING:** Extending

**Teacher Prompt**

How might you alter one of the numbers to make this addition problem equal 511?

Tell me what is wrong with the answer of 511. (Justifying)

**JUSTIFYING:** Starting statements in a **logical argument** are correct and accepted by the classroom.

# Work Sample 3 Rubric

Student Name: Work Sample 3 Reasoning Task: Is it True? Date: \_\_\_\_\_

**Observation of students' reasoning:**

explained his thinking about the 2 different strategies to get to 61 & looked at highest combination (99+99) but didn't explain misconception.

	Analysing	Generalising	Justifying
Not Evident	<ul style="list-style-type: none"> <li>Does not notice common property or pattern.</li> </ul>	<ul style="list-style-type: none"> <li>Does not communicate a common property or rule (conjecture).</li> </ul>	<ul style="list-style-type: none"> <li>Does not justify.</li> </ul>
Beginning	<ul style="list-style-type: none"> <li>Recalls random known facts or attempts to sort examples or repeats patterns.</li> </ul>	<ul style="list-style-type: none"> <li>Attempts to communicate a common property or rule for the pattern.</li> </ul>	<ul style="list-style-type: none"> <li>Describes what they did and recognises what is correct or incorrect.</li> <li>Argument is not coherent or does not include all steps.</li> </ul>
Developing	<ul style="list-style-type: none"> <li>Notices a common property, or sorts and orders cases, or repeats and extends patterns.</li> <li>Describes the property or pattern.</li> </ul>	<ul style="list-style-type: none"> <li>Generalises: communicates a rule (conjecture) using mathematical terms and records other cases or examples.</li> </ul>	<ul style="list-style-type: none"> <li>Attempts to verify by testing cases and detects and corrects errors or inconsistencies.</li> <li>Starting statements in a logical argument are correct.</li> </ul>
Consolidating	<ul style="list-style-type: none"> <li>Systematically searches for examples, extends pattern or analyses structure to form a conjecture.</li> <li>Makes predictions about other cases.</li> </ul>	<ul style="list-style-type: none"> <li>Generalises: communicates a rule using mathematical symbols and explains what the rule means or explains how the rule works using examples.</li> </ul>	<ul style="list-style-type: none"> <li>Verifies truth of statements by confirming all cases or refutes a claim by using a counter example.</li> <li>Uses a correct logical argument.</li> </ul>
Extending	<ul style="list-style-type: none"> <li>Notices and explores relationships between properties.</li> </ul>	<ul style="list-style-type: none"> <li>Generalises cases, patterns or properties using mathematical symbols (including algebraic symbols) and applies the rule.</li> <li>Compares different expressions for the same pattern or property to show equivalence.</li> </ul>	<p>99+99</p> <ul style="list-style-type: none"> <li>Uses a watertight logical argument.</li> <li>Verifies that the generalisation holds for all cases using logical argument.</li> </ul>

**Comments (feedback, reasoning prompts for further development):**

#95  
~~\* Needs watertight argument / use language~~ ✓  
~~\* Extending prompt /~~ of if so, then...  
 Follow-up tasks

$$27 + 34 = 511$$

Is it true?

Why or why not?



One tray of cakes contains 24 cakes

Charlie tried to work out the total number of cakes that he would make from 40 trays.

Here is Charlie's working out

Is it correct?

Why or why not?

Justify your thinking in at least two different ways.

Charlie's working out

$$\begin{array}{r} 40 \\ \times 24 \\ \hline 160 \\ 80 \\ \hline 240 \end{array}$$



Student Name:

Reasoning Task:

Date:

Observation of student's reasoning:

	ANALYSING	GENERALISING	JUSTIFYING
NOT EVIDENT	<ul style="list-style-type: none"> <li>Does not notice common property or pattern.</li> </ul>	<ul style="list-style-type: none"> <li>Does not communicate a common property or rule (conjecture) for a pattern.</li> </ul>	<ul style="list-style-type: none"> <li>Does not justify.</li> </ul>
BEGINNING	<ul style="list-style-type: none"> <li>Recalls random known facts or <b>attempts to sort</b> examples or <b>repeats</b> patterns.</li> </ul>	<ul style="list-style-type: none"> <li><b>Attempts to communicate</b> a common property or rule (conjecture) for a pattern.</li> </ul>	<ul style="list-style-type: none"> <li><b>Describes</b> what they did and <b>recognises</b> what is correct or incorrect.</li> <li><b>Argument</b> is not coherent or does not include all steps.</li> </ul>
DEVELOPING	<ul style="list-style-type: none"> <li><b>Notices</b> a common property, or <b>sorts and orders</b> cases, or <b>repeats and extends</b> patterns.</li> <li><b>Describes</b> the property or pattern.</li> </ul>	<ul style="list-style-type: none"> <li><b>Generalises:</b> <b>communicates</b> a rule (conjecture) using mathematical terms, and records other cases or examples.</li> </ul>	<ul style="list-style-type: none"> <li><b>Attempts to verify</b> by testing cases, and <b>detects and corrects</b> errors or inconsistencies.</li> <li>Starting statements in a <b>logical argument</b> are correct.</li> </ul>
CONSOLIDATING	<ul style="list-style-type: none"> <li><b>Systematically searches</b> for examples, extends patterns, or analyses structures, to form a conjecture.</li> <li>Makes <b>predictions</b> about other cases.</li> </ul>	<ul style="list-style-type: none"> <li><b>Generalises:</b> <b>communicates</b> a rule (conjecture) using mathematical symbols and <b>explains what</b> the rule means or <b>explains how</b> the rule works using examples.</li> </ul>	<ul style="list-style-type: none"> <li><b>Verifies</b> truth of statements by confirming all cases or <b>refutes</b> a claim by using a counter example.</li> <li>Uses a correct <b>logical argument</b>.</li> </ul>
EXTENDING	<ul style="list-style-type: none"> <li><b>Notices and explores</b> relationships between properties.</li> </ul>	<ul style="list-style-type: none"> <li><b>Generalises</b> cases, patterns or properties using mathematical symbols and <b>applies</b> the rule.</li> <li><b>Compares</b> different expressions for the same pattern or property to show equivalence.</li> </ul>	<ul style="list-style-type: none"> <li>Uses a <b>watertight logical argument</b>.</li> <li><b>Verifies</b> that the generalisation holds for <i>all</i> cases using logical argument.</li> </ul>

Comments (feedback, reasoning prompts for further development):