

Supporting Mathematical Thinking through Formative Assessment Flexible Strategies for Addition and Subtraction

Synopsis: We want our students to develop a rich mathematical understanding that allows them to work flexibly and efficiently with numbers. In this video, students demonstrate a number of flexible strategies for addition and subtraction.



Questions for Discussion and Reflection:

As you watch this video, keep these questions in mind. You may wish to pause the video for discussion.

- What strategies do you see being used by the students in this video?
- Would you consider these strategies to be accurate, reliable and efficient? Why or why not?
- What can you learn about each student’s understanding of mathematical concepts through their strategies and explanations?

Key Ideas:

Students in Alberta investigate a number of different strategies for addition and subtraction. It is expected that they will develop facility with **at least 1 appropriate and efficient strategy that they understand**.

Students investigate strategies as they work with basic addition and subtraction facts. They will build upon these strategies as they begin to work with larger numbers.

- Think about how some common strategies for basic number combinations connect to this video’s big ideas of decomposition, compensation and using multiples of 10 as “landmark numbers”:

Add in Parts
(decomposition,
landmark of 10)

$$8 + 6 = ?$$

$$\begin{array}{r} / \backslash \\ 2 + 4 \end{array}$$

$$8 + 2 = 10$$

$$10 + 4 = \underline{14}$$

Subtract in Parts
(decomposition,
landmark of 10)

$$12 - 5 = ?$$

$$\begin{array}{r} / \backslash \\ 2 + 3 \end{array}$$

$$12 - 2 = 10$$

$$10 - 3 = \underline{7}$$

Near Doubles
(compensation)

$$6 + 7 = ?$$

$$\begin{array}{r} -1 \\ 6 + 6 = 12 \\ +1 \end{array}$$

$$12 + 1 = \underline{13}$$

**Move Some to
Make a Ten**
(compensation,
landmark of 10)

$$9 + 6 = ?$$

$$\begin{array}{r} +1 \quad -1 \\ 10 + 5 = \underline{15} \end{array}$$

Students, beginning in Kindergarten, learn to **decompose**, or take numbers apart, in a variety of ways and to understand that this does not affect the quantity. The ability to flexibly decompose numbers is key to many strategies for operations.

- Here are three examples where students have decomposed numbers to assist with calculations:

$$\begin{aligned} \underline{23} + \underline{48} &= \\ 3 + 8 &= 11 \\ 40 + 20 &= 60 \\ 60 + 11 &= 71 \end{aligned}$$

$$\begin{aligned} 51 - 18 &= \\ 10 + 8 &= 18 \\ 41 - 1 &= 40 \\ 40 - 8 &= 32 \end{aligned}$$

Work Space

$$\begin{aligned} 80 - 12 &= 68 \\ \text{Mrs A-k's class needs} \\ &68 \text{ more dollars to} \\ &\text{get a pizza party.} \\ 80 - 10 &= 70 \\ 70 - 2 &= 68 \end{aligned}$$

Students may chose to make changes to a term in an equation in order to make the calculations easier, and then **compensate** for those changes by either...

... adjusting the other term
before calculating the answer...

$$\begin{aligned} 48 + 25 \\ +2 \quad -2 \\ \hline 50 + 23 = 73 \end{aligned}$$

... or adjusting the
solution afterward.

$$\begin{aligned} 48 + 2 &= 50 \\ 23 + 50 &= 73 \\ 73 - 2 &= 71 \end{aligned}$$

Often, as shown in these two examples, students make use of multiples of 10 or 100 as “landmark numbers” to act as a bridge during calculations.

$$99 + 47 = 146$$

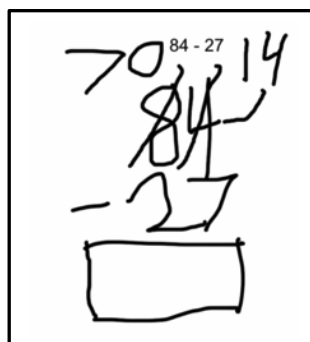
$$80 - 68 = 12$$

Flexible strategies like these depend on a sound understanding of place value. Students need to be able to:

- decompose numbers in a variety of ways
- identify combinations that equal 10 (e.g. 7 and 3 more is 10; 4 less than 10 is 6)
- understand how to add or subtract groups of 10 to or from another number

Traditional algorithms still have a place in the mathematics curriculum. It is important that students are able to explain the strategy and relate it to the place value meaning of the digits

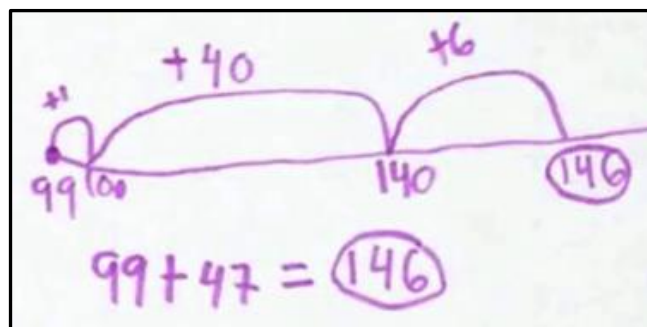
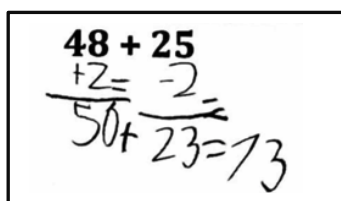
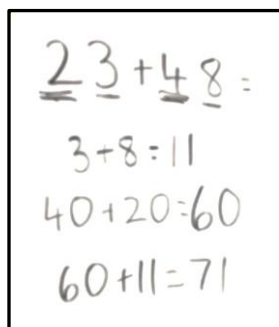
- Notice how this student has demonstrated a rich understanding of place value and the mathematics embedded in the algorithm through his oral explanation and written recording.



Next Steps:

Sit down with a colleague and try your hand at solving the following questions, using any combination of techniques highlighted in this video:

decomposition, compensation and landmark numbers.



$25 + 9 = ?$

$37 + 48 = ?$

$54 - 8 = ?$

$70 - 45 = ?$

Can you...

- ... explain your thinking orally?
- ... represent your strategy using an open numberline?
- ... use equations to represent your strategy symbolically?
- ... find a second strategy to solve each question? How are your two strategies different? How are they the same? Which would you consider the “better” of the two strategies, and why?