3:14 Fluency within 1000 (Add/Subtract)

Teacher Notes

Central math concepts

Task 3:14 focuses on fluency with procedures. For the mental calculations in the task, students can use place value, properties of operations, and the relationship between addition and subtraction as computation strategies. For the pencil-and-paper calculations in the task, there are various possibilities for efficient, accurate, and generalizable strategies and algorithms that handle the given problems.

Computation strategies and computation algorithms are usefully distinguished (CCSS, pp. 85; see figure). Strategies are "purposeful manipulations that may be chosen for specific problems, may not have a fixed order, and may be aimed at converting one problem into another." Mental calculation often uses such strategies. For example, we could begin calculating 612 - 13 mentally by thinking that the answer will be 1 less than 612 - 12, because subtracting 12 "takes away 1 too few" compared to the given problem. Alternatively, we could think of 612 - 13 as 1 less than 613 - 13, because "we added 1 compared to the given problem." Flexible procedural fluency based on place value, properties of operations, relationships between operations, and ideas of equivalence is valuable both in practical terms and also as a way of doing arithmetic that prefigures algebra. In algebra, strategies are the most common way of working.

> **Computation algorithm**. A set of predefined steps applicable to a class of problems that gives the correct result in every case when the steps are carried out correctly. See also: computation strategy.
>
> **Computation strategy**. Purposeful manipulations that may be chosen for specific problems, may not have a fixed order, and may be aimed at converting one problem into another. See also: computation algorithm.

Algorithms are inflexible by definition. One step follows another in the prescribed order. Some algorithms are much simpler to execute than others. The standard multi-digit addition algorithm is less complex than the standard multi-digit subtraction algorithm. The standard algorithm for dividing fractions is less complex than the standard algorithm for dividing multi-digit numbers.

Sometimes even an efficient general-purpose algorithm wouldn't be an efficient approach to a particular instance of a calculation, as in the addition problem 999 + 1. On the other hand, when faced with a calculation there may be times when we don't find ourselves readily inventing a flexible mental procedure on the spot, so it is valuable to know and be proficient with an algorithm.

The standard multi-digit addition algorithm and the standard multi-digit subtraction algorithm aren't required in grade 3 (CCSS 3.NBT.A.2), although students are expected to use algorithms for addition and subtraction (not just use opportunistic methods), and the standard algorithms can be among those students learn to use. Practice with calculating multi-digit sums and differences can promote confidence while offering opportunities to debug procedures, reinforce ideas, and strengthen recall of single-digit sums and related differences.

3:14 Write the sums and differences.

With pencil and paper

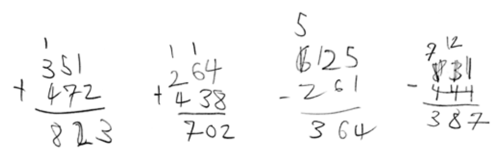
351	264	625	831
+ 472	+ 438	– 261	– 444

Mentally

800 – 300
240 + 540
365 – 165
612 – 13

Answer

For the written calculations, 823, 702, 364, and 387. (See the first figure; students might use different strategies and/or algorithms than the ones shown in the example.) For the mental calculations, 500, 780, 200, and 599. (Some potential thought processes leading to the results—not the only possible thought processes—are suggested in the second figure. Note that for the mental calculations, students could manage the mental load by using writing to jot down intermediate results along the way.)



800 - 300 = **(8 - 3) × 100 = 500**

240 + 540 = **(200 + 500) + (40 + 40) = 700 + 80 = 780**

365 - 165 = **300 - 100 + 0 = 200**

612 - 13 = **613 - 13 - 1 = 600 - 1 = 599**

Click here for a student-facing version of the task.

Refer to the Standards

3.NBT.A.2; MP.6, MP.7. Standards codes refer to www.corestandards.org. One purpose of the codes is that they may allow a task to shed light on the Standards cited for that task. Conversely, reading the cited Standards may suggest opportunities to extend a task or draw out its implications. Finally, Standards codes may also assist with locating relevant sections in curriculum materials, including materials aligned to comparable standards.

Relevant prior knowledge

The following mathematics knowledge may be activated, extended, and deepened while students work on the task: place value concepts; and single-digit sums and differences.

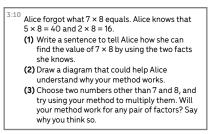
Extending the task

How might students drive the conversation further?

- Checking differences by adding can offer additional procedural practice and reinforce the relationship between addition and subtraction ($C - A$ is the unknown factor in $A + \square = C$).
- Students could make sense of their answers another way by making estimates of the values; for example, the difference 831 - 444 should be reasonably close to 800 - 400 = 400.

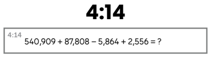
Related Math Milestones tasks

3:10

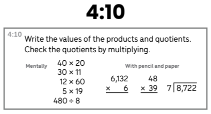

3:10 Alice forgot what 7 × 8 equals. Alice knows that 5 × 8 = 40 and 2 × 8 = 16.
(1) Write a sentence to tell Alice how she can find the value of 7 × 8 by using the two facts she knows.
(2) Draw a diagram that could help Alice understand why your method works.
(3) Choose two numbers other than 7 and 8, and try using your method to multiply them. Will your method work for any pair of factors? Say why you think so.

Fluency with two-digit sums and differences is an ingredient in the partial-products (distributive property) relationships in task **3:10 Alice's Multiplication Fact**.

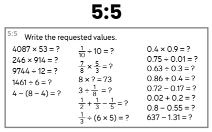
4:14


4:14 540,909 + 87,808 − 5,864 + 2,556 = ?

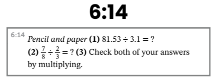
4:10


4:10 Write the values of the products and quotients. Check the quotients by multiplying.
Mentally: 40 × 20, 30 × 11, 12 × 60, 5 × 19, 480 ÷ 8
With pencil and paper: 6,132 × 6; 48 × 39; 8,722 ÷ 7

5:5

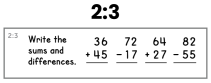

5:5 Write the requested values.
4087 × 53 = ?; 246 × 914 = ?; 9744 ÷ 12 = ?; 1461 ÷ 6 = ?; 4 − (8 − 4) = ?
$\frac{1}{10} \div 10 = ?$; $\frac{7}{8} \times \frac{5}{3} = ?$; $8 \times ? = 73$; $3 \div \frac{1}{8} = ?$; $\frac{1}{2} + \frac{1}{3} - \frac{1}{5} = ?$; $\frac{1}{3} \div (6 \times 5) = ?$
0.4 × 0.9 = ?; 0.75 ÷ 0.01 = ?; 0.63 ÷ 0.3 = ?; 0.86 + 0.4 = ?; 0.72 − 0.17 = ?; 0.02 + 0.2 = ?; 0.8 − 0.55 = ?; 637 − 1.31 = ?

6:14

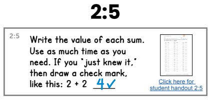

6:14 *Pencil and paper* **(1)** 81.53 ÷ 3.1 = ? **(2)** $\frac{7}{8} \div \frac{2}{3} = ?$ **(3)** Check both of your answers by multiplying.

In later grades, task **4:14 Fluency with Multi-Digit Sums and Differences** marks the culmination of the progression for multi-digit addition and subtraction. Task **4:10 Calculating Products and Quotients** involves grade-level procedures with multi-digit multiplication and division. Task **5:5 Calculating** continues procedures into larger numbers of digits and into fractions and decimals. Task **6:14 Dividing Decimals and Fractions** marks the culmination of algorithmic procedures with general fraction and decimal division.

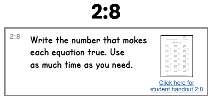
2:3


2:3 Write the sums and differences. 36 + 45; 72 − 17; 64 + 27; 82 − 55

2:5


2:5 Write the value of each sum. Use as much time as you need. If you "just knew it," then draw a check mark, like this: 2 + 2 4✓
Click here for student handout 2:5

2:8


2:8 Write the number that makes each equation true. Use as much time as you need.
Click here for student handout 2:8

In earlier grades, task **2:3 Fluency within 100 (Add/Subtract)** is the analogue of task 3:14 for two-digit sums and differences. Tasks **2:5 Sums of Single-Digit Numbers** and **2:8 Fluency within the Addition Table** involve the single-digit sums and related differences upon which multi-digit addition and subtraction algorithms are built.

Aspect(s) of rigor:

Procedural skill and fluency

Additional notes on the design of the task

The task does not require students to show their work, but looking at students' steps can show where they may have made a careless mistake.

Curriculum connection

1. In which unit of your curriculum would you expect to find tasks like 3:14? Locate 2-3 similar tasks in that unit. How are the tasks similar to each other, and to 3:14? In what specific ways do they differ from 3:14?
2. Thinking about the curriculum unit you identified, at what point in the unit might a task like 3:14 help students converge toward grade-level thinking about the important mathematics in the task? What factors would you consider in choosing when to use such a task in the unit?*

* Math Milestones™ tasks are not designed for summative assessment. Used formatively, the tasks can reveal and promote student thinking.

3:14 Fluency within 1000 (Add/Subtract)

Teacher Notes

Anticipating and responding to student thinking about the task

Imagine how students might think about the task, and what you might see and hear while they work.

On this page, you can write your thoughts on the following questions.

Solution Paths

- What solution paths might you expect to see?
- What representations might you see? What correspondences between those representations might be noticed by students (or be worth pointing out to students) and discussed by them?
- What misconceptions or partial understandings might be revealed as students work on the task? How could you respond to these positively and productively?

Language

- What might you expect to hear from students engaged with the task? What does that language reveal about their mathematical thinking, and how might you respond to different ways of thinking?
- If students are using early English or using multiple languages in an integrated communication system, how might you help their classmates see those mathematical ideas as valuable?
- Even when using nascent language, students are thinking and communicating their thinking. What might it look like to respond positively and productively to the mathematics in their thinking before giving feedback on the language used?

Identity, Agency, and Belonging

- How can you engage students' interests, experiences, or funds of knowledge?
- How can you build students' self-confidence as learners, thinkers, and doers of mathematics?
- What choices are there for a student to make in the task? How can you build students' agency to the point where they notice and make these choices to solve problems?
- How might one use feedback to build student agency? Where might there be opportunities to build students' self-confidence?