Building Computational Fluency
Grade 1

SAMPLE PAGES

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Building Computational Fluency, Grade 1
A Math Learning Center Publication

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illustrated by Tyson Smith

Bridges Breakout Units
Building Computational Fluency, Grades 5 & 6
Building Computational Fluency, Grade 4
Building Computational Fluency, Grade 3
Building Computational Fluency, Grade 2
Bridge Design & Construction: Data Collection & Analysis
Bugs Across the Curriculum
Crossing the Pond: A Probability Game
Exploring Money: Adding, Counting, Sorting and Patterning
Exploring Time: Hours, Minutes and Paper Clocks
Frogs Across the Curriculum
Geometry: Pattern Blocks, Polydrons and Paper Quilts (Grade 1)
Geometry: Shapes, Symmetry, Area and Number (Grade 2)
Math Buckets: Sorting and Patterning
Math with a Sock: Probability and Fractions
My Little Farm: Money, Place Value and Mapping
Penguins: Measuring, Sorting, Computation and More
Sea Creatures Across the Curriculum

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# Building Computational Fluency, Grade 1

## Section 1, Assessment & Support

<p>| Building Computational Fluency, Grade 1 Overview | 1 |
| Assessment &amp; Support 1 | 7 |
| Individual Interview | 7 |
| Numbers &amp; Ten-Frames Bingo | 9 |
| Coin Names &amp; Coin Values Bingo | 10 |
| Assessment &amp; Support 2 | 11 |
| Individual Interview | 11 |
| Ten &amp; More Bingo | 12 |
| Ten &amp; More | 13 |
| Ten &amp; More A Match Game | 15 |
| Writing Numerals &amp; Number Sentences | 16 |
| Ten &amp; More How Many Bugs? | 17 |
| Assessment &amp; Support 3 | 19 |
| Interview 1 Addition | 19 |
| Interview 2 Subtraction | 21 |
| Seeing Doubles &amp; Neighbors | 24 |
| Doubles &amp; Neighbors A Match Game | 27 |
| Bugs Doubles &amp; Neighbors Worksheets &amp; Flashcards | 28 |
| People Problems | 29 |
| Assessment &amp; Support 4 | 33 |
| Check-Up | 33 |
| Clocks &amp; Time Cards A Match Game | 34 |
| Tally Match Game | 35 |
| Doubles &amp; Neighbors Match Game | 36 |
| Assessment &amp; Support 5 | 37 |
| Check-Up | 37 |
| One Turn to Win | 40 |
| Two Turns to Win | 41 |
| Place Value Match Game | 42 |
| Assessment &amp; Support 6 | 43 |
| Check-Up | 43 |
| Coins on Board | 44 |
| Assessment &amp; Support 7 | 47 |
| Assessment 7 Check-Up | 47 |
| Seeing Addition &amp; Subtraction with Doubles | 50 |
| Adding &amp; Subtracting Doubles A Worksheet | 52 |
| One More, One Less | 53 |
| Two More, Two Less | 54 |</p>
<table>
<thead>
<tr>
<th>Assessment &amp; Support 8</th>
<th>57</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual Interview</td>
<td>57</td>
</tr>
<tr>
<td>Place Value Building &amp; Adding 2-Digit Numbers</td>
<td>58</td>
</tr>
<tr>
<td>Adding &amp; Subtracting Doubles &amp; Neighbors</td>
<td>60</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assessment &amp; Support 9</th>
<th>63</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check-Up</td>
<td>63</td>
</tr>
<tr>
<td>Two to Make Ten</td>
<td>65</td>
</tr>
<tr>
<td>Subtract from Ten</td>
<td>67</td>
</tr>
<tr>
<td>Add &amp; Subtract with Ten</td>
<td>69</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assessment &amp; Support 10</th>
<th>71</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check-Up</td>
<td>71</td>
</tr>
<tr>
<td>Counting Mixed Coins</td>
<td>72</td>
</tr>
<tr>
<td>Counting by 2's A Worksheet</td>
<td>73</td>
</tr>
<tr>
<td>Unifix Cube 2's</td>
<td>74</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assessment &amp; Support 11</th>
<th>77</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check-Up</td>
<td>77</td>
</tr>
<tr>
<td>Counting Mixed Coins</td>
<td>78</td>
</tr>
<tr>
<td>Place Value Puzzles</td>
<td>79</td>
</tr>
<tr>
<td>Ten-Frames Counting by 5's</td>
<td>80</td>
</tr>
<tr>
<td>Penguin Pairs Counting by 2's</td>
<td>81</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assessment &amp; Support 12</th>
<th>83</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual Interview</td>
<td>83</td>
</tr>
<tr>
<td>Practice the Facts Adding Doubles &amp; Neighbors</td>
<td>85</td>
</tr>
<tr>
<td>Doubles &amp; Neighbors A Match Game of Facts to 20</td>
<td>86</td>
</tr>
<tr>
<td>Practice the Facts Adding Doubles &amp; Neighbors</td>
<td>87</td>
</tr>
<tr>
<td>Subtracting Doubles &amp; Neighbors</td>
<td>88</td>
</tr>
<tr>
<td>Ten &amp; More with Unifix Cubes</td>
<td>89</td>
</tr>
<tr>
<td>Ten &amp; More Addition and Subtraction Double Bingo</td>
<td>90</td>
</tr>
</tbody>
</table>

### Section 2, Assessment & Support Blacklines

<table>
<thead>
<tr>
<th>Assessment &amp; Support 1</th>
<th>1.1 – 1.6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment &amp; Support 2</td>
<td>2.1 – 2.2.9</td>
</tr>
<tr>
<td>Assessment &amp; Support 3</td>
<td>3.1 – 3.14</td>
</tr>
<tr>
<td>Assessment &amp; Support 4</td>
<td>4.1 – 4.8</td>
</tr>
<tr>
<td>Assessment &amp; Support 5</td>
<td>5.1 – 5.8</td>
</tr>
<tr>
<td>Assessment &amp; Support 6</td>
<td>6.1 – 6.4</td>
</tr>
<tr>
<td>Assessment &amp; Support 7</td>
<td>7.1 – 7.9</td>
</tr>
<tr>
<td>Assessment &amp; Support 8</td>
<td>8.1 – 8.7</td>
</tr>
<tr>
<td>Assessment &amp; Support 9</td>
<td>9.1 – 9.8</td>
</tr>
<tr>
<td>Assessment &amp; Support 10</td>
<td>10.1 – 10.6</td>
</tr>
<tr>
<td>Assessment &amp; Support 11</td>
<td>11.1 – 11.8</td>
</tr>
<tr>
<td>Assessment &amp; Support 12</td>
<td>12.1 – 12.22</td>
</tr>
</tbody>
</table>
Building Computational Fluency, Grade 1 Overview

Building Computational Fluency, Grade 1 is a supplement designed to provide you with powerful and flexible tools to assess and support first grade students in developing key computational skills and concepts. Organized into twelve sections, this supplement enables you to assess some or all of your students on computational skills throughout the school year and provide support to students who need extra help in key areas, including:

- counting to 100
- reading and writing numerals
- understanding the operations of addition and subtraction
- developing strategies for adding and subtracting numbers to 20
- developing fluency with addition facts to 20 and subtraction facts to 10
- counting by 2’s, 5’s, and 10’s
- counting by 10’s and 1’s
- developing strategies for adding 2-digit numbers
- telling time and counting money

The materials in the Building Computational Fluency packet are intended to complement and strengthen any first grade math program. These materials may also be useful to resource room teachers and others working with students on a pull-out basis, as well as teachers working with second graders who are below grade level.

Assessments

Each of the twelve sections in this packet includes an assessment and a set of activities designed to help students who indicate needs in the specific areas assessed. The assessments are designed to be administered at the rate of one or two per month, starting at the end of September, but may also be used at any other time of the year, depending on the needs of your students and your instructional schedule. The first three assessments are individual interviews, which are more developmentally appropriate for incoming first-graders and more likely to yield useful information about their skills. There are two other individual interviews for use later in the year, but the rest are written check-ups that can be administered to your whole class at the same time. You may elect to conduct the interviews with selected individuals rather than every child in your classroom, especially later in the year when many students’ skills are already well-known to you.
Support Activities
Following each assessment, you’ll find a collection of Support Activities designed to help students who indicate needs in the specific areas assessed. These activities include games, short activities, and worksheets. They consistently involve the use of concrete and visual models, as well as fact strategies, and will help students develop solid conceptual understandings as well as proficiency. Although these activities have been designed to provide remedial help to students targeted by the assessments, you may find that some of the games and worksheets provide valuable instructional resources for your entire class. The Support Activities can also be conducted with small groups of targeted students by educational assistants, parent volunteers, resource or title teachers, and some of them are specifically designed to be taken home by students for extra practice with their families.

Materials
Each section in the Building Computational Fluency packet includes instructions for conducting an assessment of basic computational skills and teaching the related Support Activities. You’ll find blacklines for all written assessments and activity worksheets, as well as blacklines for making any needed game components and instructional materials in a section of their own at the back of the packet. The manipulatives and tools required to conduct the assessments and teach the games and activities are fairly minimal and found in many first grade classrooms: Unifix cubes or other linking cubes, clear round plastic game markers or other counters, plastic or real coins, a pocket chart, and individual chalkboards or whiteboards.

Using a Fact Strategy Approach
If asked to solve an addition combination they don’t already know “by heart”, first graders will generally respond in one of the following ways:

- by representing each quantity with counters or their fingers and then counting each object one by one, starting with 1.
- by counting on to find the total (i.e., to solve 4 + 5, counting “four, 5, 6, 7, 8, 9”).
- by working from a previously learned fact (i.e., to solve 4 + 5, recalling that 4 + 4 = 8 so 4 + 5 must be 9).

The first method, often referred to as “direct modeling” is the most common among young first graders. The second, counting on, is less common, but something first grade teachers work hard to teach their students. The third is the most efficient, short of just knowing the answer, and is often referred to as a “derived fact method” because the answer is derived from another fact the student already knows.

There is a considerable body of research to support the idea that teaching basic fact strategies helps students move from less to more efficient methods.
and is more effective than asking children to memorize facts by rote. In a seminal article written for *Teaching Children Mathematics* magazine (Vol.5 Number 9, May 1999, p.508 – 515) researchers Andrew C. Isaacs and William M. Carroll suggest that teachers propose and model basic fact strategies as well as asking students to share their own. Teachers are also encouraged to supplement class discussions with games and exercises designed to facilitate more sophisticated strategies.

The materials in this packet are designed to help you do just that. The assessments and Support Activities are built around the following strategies for addition and subtraction facts:

- adding and subtracting 0’s
- adding and subtracting 1’s and 2’s using a counting on or counting back strategy
- adding doubles (4 + 4, 5 + 5, etc.) and subtracting halves (8 – 4, 10 – 5, etc.)
- using doubles to solve “neighbors” (3 + 3 = 6 so 3 + 4 must be 7)
- adding and subtracting complements of 10 (6 + 4, 7 + 3, 10 – 2, 10 – 4, etc.)
- adding numbers to 10 (“fast 10’s” such as 10 + 2, 10 + 3, etc.)
- subtracting 10’s or 1’s from teen numbers (15 – 10 = 5, 15 – 5 = 10, etc.)

Once children have started to use the strategies listed above, there aren’t many facts left to learn. If you examine all the addition facts for numbers through 12, for instance, you’ll find that there are only 14 combinations that aren’t covered by one of these strategies, and 7 of them are reverse of the others (3 + 5, 3 + 6, 3 = 8, 3 + 9, 4 + 7, 4 = 8, 5 + 7, and their reverses). The picture is slightly more complex for subtraction, but the strategies above cover many of facts and also help students understand the relationship between addition and subtraction.
**A List of the Assessments and Support Activities in Building Computational Fluency, Grade 1**

<table>
<thead>
<tr>
<th>Section</th>
<th>Type of Assessment</th>
<th>Recommended Timing</th>
<th>Skills Addressed</th>
<th>Support Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment &amp; Support 1</td>
<td>Individual Interview</td>
<td>September</td>
<td>• counting quantities to 10 • recognizing numerals to 10 • recognizing coin names &amp; values</td>
<td>1A Numbers &amp;Ten-Frames Bingo 1B Coin Names &amp; Coin Values Bingo</td>
</tr>
<tr>
<td>Assessment &amp; Support 2</td>
<td>Individual Interview</td>
<td>September</td>
<td>• reading, writing, and understanding numbers between 10 and 20 • reading and writing addition sentences • adding numbers to 10 (i.e., 10 + 2, 10 + 3, and so on)</td>
<td>2A Ten &amp; More Bingo 2B Ten &amp; More 2C Ten &amp; More: A Match Game 2D Writing Numerals &amp; Number Sentences 2E Ten &amp; More: How Many Bugs?</td>
</tr>
<tr>
<td>Assessment &amp; Support 3</td>
<td>Individual Interview</td>
<td>October</td>
<td>• addition combinations to 10 • subtraction combinations to 5 • addition &amp; subtraction strategies</td>
<td>3A Seeing Doubles &amp; Neighbors 3B Doubles &amp; Neighbors: A Match Game 3C Bugs Doubles &amp; Neighbors Worksheets &amp; Flashcards 3D People Problems</td>
</tr>
<tr>
<td>Assessment &amp; Support 4</td>
<td>Written Check-Up</td>
<td>October</td>
<td>• telling time to the hour • counting by 5’s • adding doubles &amp; neighbors • writing number sentences</td>
<td>4A Clocks &amp; Time Cards: A Match Game 4B Tally Match Game 4C Doubles &amp; Neighbors Match Game</td>
</tr>
<tr>
<td>Assessment &amp; Support 5</td>
<td>Written Check-Up</td>
<td>November</td>
<td>• understanding place value • writing numerals • recognizing number patterns • adding coin values</td>
<td>5A One Turn to Win 5B Two Turns to Win 5C Place Value Match</td>
</tr>
<tr>
<td>Assessment &amp; Support 6</td>
<td>Written Check-Up</td>
<td>January</td>
<td>• counting mixed coins • place value</td>
<td>6 Coins on Board</td>
</tr>
<tr>
<td>Assessment &amp; Support 7</td>
<td>Written Check-Up</td>
<td>January</td>
<td>• addition and subtraction strategies • writing number sentences</td>
<td>7A Seeing Addition &amp; Subtraction with Doubles 7B Adding &amp; Subtracting Doubles: A Worksheet 7C One More, One Less 7D Two More, Two Less</td>
</tr>
<tr>
<td>Section</td>
<td>Type of Assessment</td>
<td>Recommended Timing</td>
<td>Skills Addressed</td>
<td>Support Activities</td>
</tr>
<tr>
<td>--------------------------</td>
<td>--------------------</td>
<td>--------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Assessment &amp; Support 8</td>
<td>Individual Interview</td>
<td>February</td>
<td>• counting by 5’s&lt;br&gt;• adding 2-digit numbers&lt;br&gt;• adding &amp; subtracting doubles &amp; neighbors&lt;br&gt;• writing number sentences</td>
<td>8A Place Value Building &amp; Adding 2-Digit Numbers&lt;br&gt;8B Adding &amp; Subtracting Doubles &amp; Neighbors</td>
</tr>
<tr>
<td>Assessment &amp; Support 9</td>
<td>Written Check-up</td>
<td>March</td>
<td>• adding &amp; subtracting doubles&lt;br&gt;• adding neighbors&lt;br&gt;• solving 10’s facts&lt;br&gt;• problem solving</td>
<td>9A Two to Make 10&lt;br&gt;9B Subtract from 10&lt;br&gt;9C Add &amp; Subtract with 10</td>
</tr>
<tr>
<td>Assessment &amp; Support 10</td>
<td>Written Check-Up</td>
<td>April</td>
<td>• counting &amp; adding mixed coins&lt;br&gt;• counting by 2’s</td>
<td>10A Counting Mixed Coins: 50¢ or Bust!&lt;br&gt;10B Counting by 2’s A Worksheet&lt;br&gt;10C Unifix Cube 2’s</td>
</tr>
<tr>
<td>Assessment &amp; Support 11</td>
<td>Written Check-Up</td>
<td>May</td>
<td>• counting and adding mixed coins&lt;br&gt;• counting by 10’s and 1’s&lt;br&gt;• counting by 2’s &amp; 5’s</td>
<td>11A Counting Mixed Coins Bingo&lt;br&gt;11B Place Value Puzzles&lt;br&gt;11C Ten-Frames: Counting by 5’s&lt;br&gt;11D Penguin Pairs: Counting by 2’s</td>
</tr>
</tbody>
</table>
Assessment & Support 3

Interview 1 Addition

Overview
This Assessment allows you to look closely at children’s current computational strategies. Do they understand what happens when 0 is added? What about 1? Do they know any of the doubles facts to 10 yet? How do they handle the facts they don’t already know?

Timing
★ Throughout October or anytime of the year appropriate for your students

You’ll need
★ Assessment 3A Addition (Blackline 3.1, run a class set back-to-back with Assessment 3B Subtraction on Blackline 3.2 and write students’ names on the sheets ahead of time so you can easily see who still needs to be interviewed)
★ Unifix cubes

Skills & Concepts
★ using such addition strategies as counting all, counting on, using known facts
★ addition combinations to 10

In order to conduct this interview and the subtraction interview on pages 21, try to find time in your day when routines are going smoothly and meet with students individually. We keep our clipboard handy with the assessment sheets attached so that when spare moments arise throughout the day, we can interview a student or two.

Each of the addition problems on the first interview sheet is to be presented in random order. Point to various problems on the sheet and read each aloud. How do children solve the problem? Are they able to answer quickly? If so, loop the problem.
If they take some time to figure each one out, how do they go about it? Can they read the problem aloud themselves? You’ll want to make some notes at the bottom of the page about how students handle the addition facts they don’t already know in the comments section. Here are three types of strategies you’re likely to see as children work with these addition combinations:

- **Direct Modeling.** The child will use her fingers or cubes to set out both quantities and then count all of the objects one by one to determine the total. If, after checking a student on ten to twelve of the facts on the sheet, including some that involve adding 0 or 1, it becomes clear that this is her main or only strategy, it’s not necessary to go through all the rest of the combinations.

```
5 + 4
1 2 3 4 5 1 2 3 4

“1, 2, 3, 4, 5, 6, 7, 8, 9—the answer is 9”
```

- **Using a Counting Strategy.** The child may use fingers or cubes or work mentally to count on from one number to the other. This is a more abstract method, in that the child can hold one quantity in her head and work from
there as opposed to counting out each set and determining the total by counting one at a time from 1.

\[ 5 + 4 \]

\[
\begin{array}{c}
\text{5}
\end{array}
\quad \begin{array}{c}
\text{6} \quad \text{7} \quad \text{8} \quad \text{9}
\end{array}
\]

"5—6, 7, 8, 9—the answer is 9"

• Using Derived Number Facts. The child will use a number fact that she already knows to solve one that is less familiar. This is the most abstract strategy of the three, and certainly the most efficient. While you're more likely to see first graders using direct modeling or counting strategies at this point in the year, you may be surprised to discover that a fair number of your students make use of facts they already know to solve some addition combinations.

“I know that 4 + 4 = 8, so 5 + 4 must be 9—it’s just 1 more.”

**ASSESSMENT 3B**

**Interview 2 Subtraction**

**Overview**

The Subtraction Assessment also allows you to look closely at children's current computational strategies. Do they understand what happens when 0 is subtracted? What about 1? Do they know any of the doubles facts to 10 yet? How do they handle subtraction facts they don’t already know?

**Skills & Concepts**

★ using such subtraction strategies as counting what’s left after one quantity is removed, counting backwards, using known facts

**You’ll need**

★ Assessment 3B Subtraction
  (Blackline 3.2, run a class set back to back with Blackline 3.1)

★ Unifix cubes

**Timing**

★ Throughout October or anytime of the year appropriate for your students
Repeat the assessment process with the subtraction sheet. How are students dealing with subtraction? Do they understand subtracting zero? How about subtracting one? Are they able to subtract the doubles (1 − 1, 2 − 2, 3 − 3, etc.)? What strategies do they use? How do they feel about subtraction? Does it help them to think about a hungry shark eating fish or some other scenario? (You may find that children who don’t appear to understand subtraction when they look at it in written form, e.g., 5 − 4, understand the process itself when you or they tell a story about it.)

Many children may not be able to respond quickly to the examples shown on the sheet, but will have some strategies for solving subtraction problems. Here are the three types of strategies you’re likely to see as children work with these subtraction combinations:

- **Direct Modeling.** The child will use his fingers or cubes to set out the first quantity. Then he’ll remove the quantity being subtracted and count how many are left, working one by one throughout the process. If, after checking a student on ten to twelve of the facts on the sheet, including some that involve subtracting 0 or 1, it becomes clear that this is his main or only strategy, it’s not necessary to go through all the rest of the combinations.
Using a Counting Strategy. The child may use fingers or cubes or work mentally to count backwards from the initial quantity. This method is quite abstract, in that the child has to make a double count, keeping track of counting backwards while remembering how many times he's “hopped” back.

Using Derived Number Facts. The child will use a number fact that he already knows to solve one that is less familiar. This is the most abstract strategy of the three, the most efficient, but the least likely you are to see at this point in the year.

“I know that 4 – 3 is 1, so 5 minus 3 must be 1 more. The answer is 2.”
SUPPORT ACTIVITY 3A

Seeing Doubles & Neighbors

Overview
In this activity, the teacher introduces a new set of cards in which bugs are organized into ten-frames to illustrate the addition combinations we often call “doubles” (1 + 1, 2 + 2, 3 + 3, and so on), along with a set in which the bugs have been placed to show neighbors, or doubles plus or minus one (2 + 1, 3 + 2, 4 + 3, and so on). Once all the cards have been set out in the pocket chart, children scan them to locate the doubles. After making some observations about these cards, they locate the neighbor for each double. The teacher then guides them in verbalizing and writing a number sentence for each card.

You’ll need
★ Doubles & Neighbors cards (Blacklines 3.3-3.7)
★ pocket chart
★ student chalkboards, chalk, and erasers or white boards and pens

Begin the activity by posting all of the doubles and neighbors bug cards in your pocket chart. Ask the children to search out the cards that picture doubles, 1 + 1, 2 + 2, 3 + 3, 4 + 4, and 5 + 5. Arrange these cards in a column and ask children to share observations about each.

**Teacher**  What do you notice about the doubles card at the top of the column?

**Children**  It’s 5 praying mantises and 5 beetles. It’s 5 + 5. That makes 10.
Once they've examined all the doubles, ask children to find the neighbor card for each one, that is, the card that pictures one less bug. (We define neighbors as one more or one less than the double.)
Help children generate a number sentence for each of the neighbor cards, working from the top row to the bottom each time, as you point.

Finally, show one bug card at a time and ask children to write a number sentence to match the card on their chalkboards.
Doubles & Neighbors  A Match Game

Overview
In this lesson, the teacher distributes a collection of number sentences and asks children to find the doubles or neighbors bug card to match each sentence. Children then practice reading and answering each number sentence.

You’ll need
★ Doubles & Neighbors cards (Blacklines 3.3-3.7)
★ Doubles & Neighbors number sentences (Blacklines 3.7-3.12)
★ pocket chart

Hand out the bug cards, one per student, and ask these children to stand in a line facing the class. Then hand out the number sentence cards to some of the children who are still seated. Call on one youngster at a time to find his or her match. Ask the class to help as needed. Display that pair of cards in the pocket chart, and call on another child to find his or her match. Continue until all the cards have been matched and posted.

Finally, take all the number sentence cards out of the pocket chart and show them to the children one by one. Ask everyone to read the number sentences together as you show them. Shuffle these cards and hand them out. Ask students to take turns reading them to the group in question form, that is, “2 plus 3 equals?” Have children respond with the answer and then ask the student reader to turn the card to the group to confirm.
Assessment & Support 3 (cont.)

SUPPORT ACTIVITY 3C

Bugs  Doubles & Neighbors Worksheets & Flashcards

Overview
Students match doubles and neighbors pictures and number sentences in their Student Books and then cut out sets of doubles and neighbors flashcards so they can practice these facts with their classmates.

You’ll need
- Bugs Doubles & Neighbors Student Worksheet (Blackline 3.13, run 1 per student)
- Bugs Doubles & Neighbors Flashcards (Blackline 3.114, run on cardstock and cut apart)
- scissors and glue
- envelopes

Hand out the Doubles & Neighbors worksheet first. Explain that they’ll need to cut around the number sentence boxes at the bottom of the sheet and glue them below the appropriate bug cards at the top of the sheet. Remind students to cut all the way around the entire collection of number sentences first and then cut the individual boxes apart.
As children finish the worksheet, have them cut apart the flash cards on their second sheets. They should use these cards to practice the doubles and neighbors facts with someone else who is finished. (You might want to model how to practice number facts with another person if your students haven't done this sort of thing before.) Send the flash cards home in an envelope, along with the completed worksheets, for children to share with their families.

**Support Activity 3D**

**People Problems**

You’ll need
- An individual chalkboard or whiteboard for each student
- Chalk or marker for each student
- Eraser

*Note* Paper and pencil can be used in place of the materials listed if necessary.
Instructions for People Problems

1. Ask a group of 4-5 children to stand in front of the group. Divide them into two smaller groups by some easily seen attribute, such as long sleeves and short sleeves.

2. Engage students in a conversation about the 2 small groups standing in front of them. Use sketches, words, and numbers to record an addition statement about the 2 groups.

   **Teacher** Everyone in this group has tops but some have short sleeves and some have long. Let’s count how many have short sleeves.

   **Students** 1, 2, 3.

   **Teacher** And let’s count how many have long sleeves.

   **Students** 1, 2.

   **Teacher** How many tops is that in all?

   **Students** It’s 3 and 2.

   There are five – 3 with short and 2 with long.

   **Teacher** We can say (points to each group) $3 + 2 = 5$. I can draw a picture about these children’s tops on the board and write words about them too.

   ![Sketch of children’s tops]

   Three kids have short sleeves and two kids have long sleeves. Five kids have tops.

   **Teacher** There is also a short-cut way to tell that story with numbers and symbols instead of words, like this (writes $3 + 2$ on the board).
3. Have the 2 groups join hands so they're all standing together. Ask students to reconfirm the number standing in line (5). Then ask the students to drop hands and have the group with short sleeves sit down right where they are. Ask students the following:

- How many children just sat down?
- How many are left standing?
- How many children used to be standing?

Then have all 5 students stand again. On another section of your whiteboard, redraw the 5 tops and use sketches, words, and numbers to represent the subtraction process.

Teacher I'll draw another picture about these children on the whiteboard. There were 5 children standing (redraws the 5 tops). The three with short sleeves sat down so I'll need to cross them out. How many tops are left?

4. Have the group return to their seats. Write a quick story under the shirts as the students tell you the events. Then show them how the story can be recorded with a number sentence as well.
Five kids have tops. The three with short sleeves sat down. Two were left standing.

\[ 5 - 3 = 2 \]

5. Repeat the entire process again, with a different group of 4 or 5 students or a different attribute if you're doing this activity with a very small group. Work with more input from the students to write short “stories” and number sentences this time.

6. Distribute individual boards and markers (or paper and pencil). Repeat the process once or twice more and ask students to practice writing the number sentences along with you as you go.
Assessment & Support 4

Check-Up

Overview
A check-up given to all your students helps assess their facility with the skills listed below. The 3 match games included help students who need to strengthen these skills.

Timing
During the month of October or any-time of year appropriate for your students.

You'll need
★ Assessment 4 check-up (Blacklines 4.1-4.2, run a class set)
★ a hard writing surface and a pencil for each child

Skills & Concepts
★ telling time to the hour
★ recognizing groups of 5
★ counting in chunks
★ recognizing and adding doubles and neighbors
★ writing number sentences

When you've worked for weeks to establish a community of learners who help one another, a written test may feel threatening to some children. We explain to our students that we want them to complete this check-up by themselves. This lets us know if they need more help with a particular skill. After explaining the two sheets, spread the children out in the room. Make sure each student has a hard writing surface.

NAME ___________________________ DATE ___________
Assessment 4 check-up

Time: What time is it?

_____ o'clock   _____ o'clock   _____ o'clock

Tallying: How many in each grouping?

Assessment 4 check-up (cont.)

Doubles & Neighbors: How do you see it? How many altogether?

___ + ___ = ___   ___ + ___ = ___   ___ + ___ = ___

___ + ___ = ___   ___ + ___ = ___   ___ + ___ = ___
Assessment & Support 4 (cont.)

Strategies To Watch For
If your students worked on time telling in kindergarten, recognizing time to the hour should be comfortable for many of them.

How are they doing with tally groups? Can they see groups of 5? Do they know that two groups of 5 make 10 or are they counting each group one by one? Keep an eye on the students whose skills you question.

How about the doubles and neighbors? Can they see the quantities in each row of the ten-frames? Can they add those quantities? Can they write an accurate number sentence for each of the pictured addition combinations?

Support for Targeted Children
You’ll find three match games pictured and described below to play at school with children who need more instruction in telling time to the hour, teen number tallying, and matching doubles and neighbors pictures to number sentences. In all of the games below, we have our targeted students cut up the playing cards and put them in an envelope. Send the games home once students know how to play the games well enough to teach their families. Once they’ve prepared a set of cards for a needed skill, we work with the children to be certain they understand the game. We often start with the easier version and have children work in pairs or alone matching the cards. That way, they become familiar with the sets of cards before playing the challenging version.

SUPPORT ACTIVITY 4A

Clocks & Time Cards  A Match Game

You’ll need for teaching the game
★ a set of Clocks Match Game clock cards and time cards borrowed from a student
★ scissors

Each targeted student takes home
★ Clocks Match Game clock cards (Blackline 4.3, run on cardstock, cut apart)
★ Clocks Match Game time cards (Blackline 4.4, run on cardstock, cut apart, and store in an envelope with Clock cards)
Assessment & Support 4 (cont.)

Easier version
Leave both sets of cards faceup and find the matching pairs.

Challenging version
Place all of the clock cards facedown. Place all of the time cards facedown beside the clock cards. Players alternate turning a card from each group faceup. When the cards match, keep the pair and take another turn.

Be sure to play the game a few times at school so children know how to play and can teach their families.

SUPPORT ACTIVITY 4B

Tally Match Game

You’ll need for teaching the game
★ a set of Tally Match Game tally cards and number cards borrowed from a student
★ scissors

Each targeted student takes home
★ Tally Match Game tally cards (Blackline 4.5, run on cardstock, cut apart)
★ Tally Match Game number cards (Blackline 4.6, run on cardstock, cut apart, and store in an envelope with the tally cards)

Easier Version
Leave all of the cards faceup and find each matching pair.

Challenging Version
Turn all the tally cards facedown. Place all the number cards facedown beside the tally cards. Players take turns turning a card from each group faceup. When
Assessment & Support 4 (cont.)

the cards match, keep the pair and take another turn. Be sure to play the game a few times at school so children know how to play and can teach their families. When your students are confident with the game, send it home.

**SUPPORT ACTIVITY 4C**

### Doubles & Neighbors Match Game

**You’ll need**
- Doubles & Neighbors Match Game ten-frame cards and number sentence cards borrowed from a student
- scissors

**Each targeted student takes home**
- Doubles & Neighbors Match Game ten-frame cards (Blackline 4.7, run on cardstock, cut apart)
- Doubles & Neighbors Match Game number sentence cards (Blackline 4.8, run on cardstock, cut apart, and store in an envelope with the Doubles & Neighbors cards)

**Easier Version**

Leave all of the cards faceup and see if you can find each matching pair.

**Challenging Version**

Place all of the ten-frame cards facedown. Place all of the number sentence cards facedown beside the ten-frame cards. Players alternate turning a card from each group faceup. When the cards match, you get to keep the pair and take another turn. Be sure to play the game a few times at school so children know how to play and can teach their families. When your students are confident with the game, send it home.