Number and Operations Routines

To be successful in mathematics, first graders must develop understanding and skills related to number and operations. Many lessons in the program specifically focus on number and operations. To deepen understandings and practice skills over time, we have also included number and operations routines.

You can use the routines at any time: while students are waiting or walking to other activities, during transitions, at the beginning of the day, during circle time, or even before or after a specific lesson. In most cases, they do not require many materials and you can complete them with students in a short time period.

The content reinforced by each routine falls into one or more of the following categories.

1 Counting
- Counting to find how many
- Counting up/on from any number
- Counting down/back from any number
- Counting by 1s, 5s, 10s

2 Addition and Subtraction Basic Facts
- Commutativity
- Doubles
- Counting on to add
- Counting back to subtract
- Counting up to subtract
- Fact families
- Making 10
- Thinking addition to subtract
- Adding/subtracting on a number line

3 Addition and Subtraction Computation
- Making the next 10
- Breaking apart numbers
- Adding/subtracting on a number line

4 Place Value
- Identifying and representing numbers by place value
- Comparing 2-digit numbers

5 Estimation
- Estimating tens
- Estimating more or less

ADD IT UP!

Toss two number cubes. Write an equation in the following form:

$$\text{greater number} - \text{lesser number} = ?$$

Students solve the equation by "thinking addition," that is, beginning with the lesser number and counting up to get to the greater number.

Example:

$15 - 9 = ?$

Begin with 9; count 10, 11, 12, 13, 14, 15. So, $15 - 9 = 6$.

Materials 2 number cubes (one marked 5, 6, 7, 8, 9, 10; the other marked 11, 12, 13, 14, 15, 16)

Teaching Notes Start with number cubes marked with lesser numbers.

Suggested Use Lesson 2-7 and on, especially Lesson 4-5

BALANCE THE EQUATION

Begin with an equation with 2 addends on one side and the sum on the other. "Break apart" the sum and rewrite the equation so that there are 2 addends on one side and 2 addends on the other. Break apart one addend again so there are 3 addends on one side and 2 addends on the other. Break apart one addend a final time so that there are 3 addends on one side and 3 addends on the other side.

Example:

$$3 + 6 \;=\; 9$$
$$3 + 6 \;=\; 4 + 5$$
$$3 + 2 + 4 \;=\; 4 + 5$$
$$3 + 2 + 4 \;=\; 1 + 3 + 5$$

Materials Math balances (optional)

Teaching Notes After the first "break apart" and several experiences with this routine, students will be able to manage several addends on each side.

Suggested Use Lesson 5-4 and on

CLIMB THE LADDER

Students "climb" a ladder of 2 ten-frames by tossing one number cube and filling the frame(s) with the tossed quantity of counters. After each toss, students tell how many counters are on the ladder and how many more counters they need to fill the ladder. Then, students can "come down" the ladder by subtracting the quantity shown on a tossed number cube. This can be a partner routine activity or a class routine. For fun, time the class or teams to see how quickly students can count out the counters, answer the questions, and reach the top (or bottom) of the ladder.
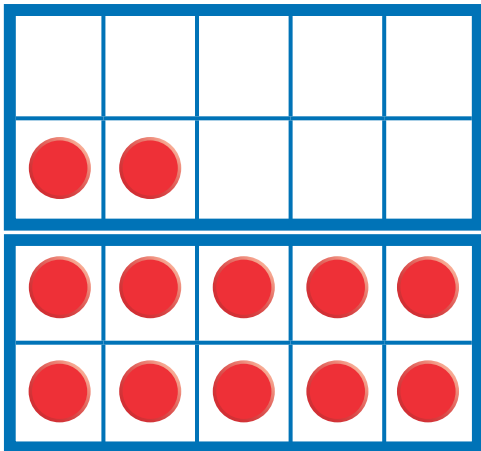

Materials 2 number cubes, one marked 0–5, the other marked 5–10; ladders of 2 ten-frames (Teaching Tool 16); counters (or Teaching Tool 6)

Teaching Notes Begin with the 0–5 number cube and later use the 5–10 number cube. Also, progress to a ladder of 5 or 6 five-frames.

Suggested Use Lesson 3-5 and on for addition; Lesson 4-3 and on for subtraction

CONTIG

Student partners choose and randomly write 9 numbers between 10 and 20 inside their own 3 × 3 grids, one number per square. Partners each toss a number cube. They add the numbers on the two faces, and each partner covers that sum with a counter if it is on his or her grid. When one partner covers three numbers in a row, column, or diagonal, he or she calls "Contig" (for "contiguous," meaning "touching") and wins the game.
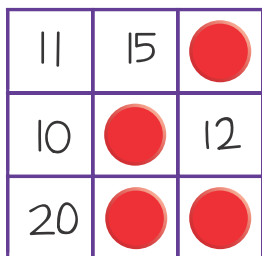
Materials 2 number cubes (both marked 5, 6, 7, 8, 9, 10), 1 empty 3 × 3 grid per student, counters to cover squares (or Teaching Tool 6)

Teaching Notes Begin by having students use numbers 0–10 for their grids and two number cubes with faces marked 0, 1, 2, 3, 4, 5.

Suggested Use Lesson 3-7 and on, especially Lesson 4-6

DANCE THE NUMBER BY TENS AND ONES

Students dance a 2-digit number using arm or leg movements to indicate the digit in the tens place and finger movements to indicate the digit in the ones place. For example, students could dance 64 with 6 circular arm movements and 4 finger circles, or 6 back-and-forth leg movements and 4 open-and-close finger movements.

Suggested Use Lesson 8-1 and on, especially Lesson 9-3

DIGIT PLACE

Secretly write a 2-digit number for students to guess. Students describe (using tens and ones vocabulary) and record a series of guesses using reasoning based on clues you give them. For each guess, respond with one of two clues: an arrow that signifies that a digit is correct but in the wrong place, or a star that signifies that a digit is correct and in the correct place. Do not label the specific digit that is correct or incorrect; write the symbols to the side of the guesses as shown below.

Example: The secret number is 54.

Guess	Clues
35	←——→
13	
51	☆
56	☆
54	☆ ☆

Suggested Use Lesson 8-4 and on, especially Lesson 9-6

DOMINO SUMS AND DIFFERENCES

Place dominoes facedown. Each student selects a domino and finds the sum of the dots on both sides. Students line themselves up in the order of their sums, from 0 to 18. For fun, have teams compete to see which team can line up in the correct order first.
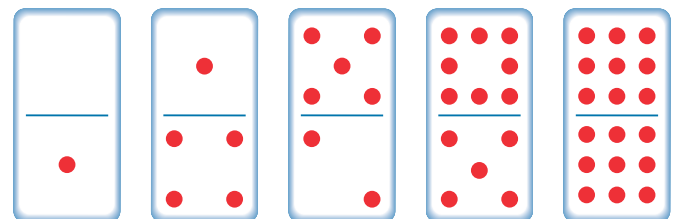

Materials Double-nine dominoes

Teaching Notes Start with addition, then have students subtract and use the differences to make the class line.
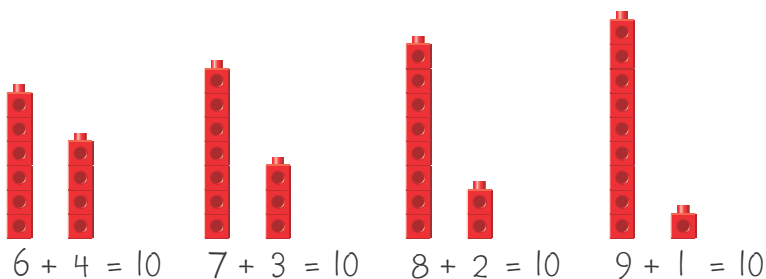
Suggested Use Lesson 3-2 and on for addition; Lesson 4-1 and on for subtraction, especially Lesson 9-5

DOUBLE IT AND MOVE

Given a number less than 10, each student makes a cube tower. The whole class can get the same number or groups can get different numbers. Students can work with a partner to double their quantity (without joining the two towers). Each pair writes an equation to show the sum their towers represent.

$$5 + 5 = 10$$
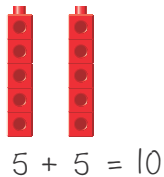
Partners then move 1 cube from one tower to the other tower and write that equation. The process continues until one tower has just one cube.

$$6 + 4 = 10 \qquad 7 + 3 = 10 \qquad 8 + 2 = 10 \qquad 9 + 1 = 10$$

Materials Connecting cubes (or Teaching Tool 7)

Suggested Use Lesson 2-2 and on, especially Lesson 3-3

DRAW A PICTURE

Display an addition or a subtraction equation. Each student draws a simple picture to illustrate the equation and writes the equation on the back of the picture. When students share their pictures, their peers can compare the drawing with the equation. Focus the discussion on understanding the operation.

$$9 - 3 = 6$$
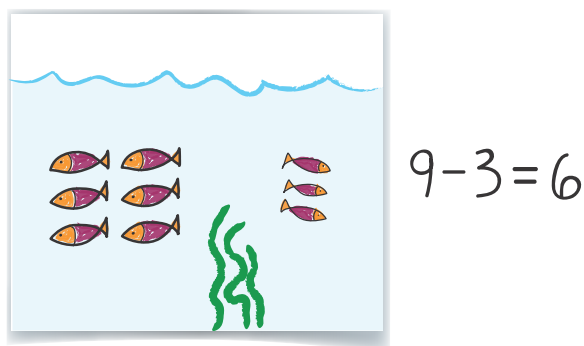
Materials Crayons or markers

Teaching Notes Begin with addition and subtraction equations within 10, and then progress to addition and subtraction equations within 20.

Suggested Use Lesson 5-1 and on, especially Lessons 10-9 and 11-7

FOUR AND GONE!

Secretly write an equation. Then write the equation on the board using only the symbols (= and either + or −) and lines for the individual digits in the equation. Students guess a single digit. If the guessed digit appears in your equation, write that digit in each corresponding blank. If the guessed digit does not appear in your equation, write nothing in the blanks and record a letter from the word GONE. Students try to solve the equation before they are GONE!

Example: The secret equation is $65 + 10 = 75$.

$$\underline{}\,\underline{} + \underline{}\,\underline{} = \underline{}\,\underline{}$$

Guess	Clues
3	G
5	___ 5 + ___ ___ = ___ 5
0	___ 5 + ___ 0 = ___ 5
2	GO
1	___ 5 + 10 = ___ 5
4	GON
6	65 + 10 = ___ 5
7	65 + 10 = 75

Teaching Notes Use different forms of equations with 1- and 2-digit numbers throughout the year. Include these forms:

$$4 + 5 = 9 \qquad\qquad 24 + 12 = 36$$
$$9 = 4 + 5 \qquad\qquad 36 = 24 + 12$$
$$9 - 4 = 5 \qquad\qquad 24 + 10 = 34$$
$$4 + 5 = 3 + 6 \qquad 34 = 24 + 10$$
$$9 + 5 = 14 \qquad\qquad 24 = 34 - 10$$
$$14 = 9 + 5 \qquad\qquad 34 - 10 = 24$$

Suggested Use Lesson 5-3 and on, especially Lesson 10-2

HOW MANY DAYS?

Students use the school calendar to count and record the number of days they have been in school and the number of days left in the school year. They show the numbers with manipulatives and record the numbers daily.

Example: The picture shows what the display looks like on Day 3. (180 school days are shown, as this is a common length for an academic year.)

Number of days in school so far this school year

Number of days left in this school year
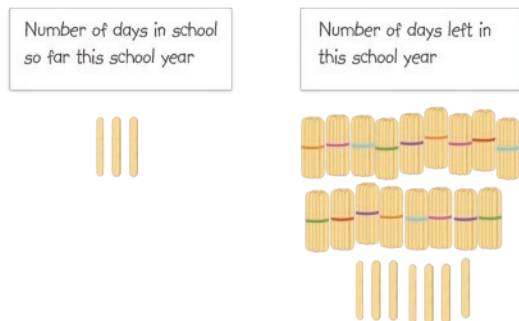
Materials Craft sticks bound in groups of 10

Teaching Notes This is an all-year routine activity. Initially, students count only the number of days in school so far. With the class, subtract the sticks to add to the number of days, modeling counting and the "break apart a group of ten" procedures. As the year progresses, students make groups of ten with the sticks. After 60 days, students can begin counting the number of days left in the school year as well. Students may need assistance working with numbers greater than 120.

Suggested Use Lesson 1-1 and on, especially Lesson 7-1

HOW MANY TENS?

Fill a clear container (that can be marked) with 20–120 small manipulatives, such as cubes. Mark the container to show the level when it is full. Count ten objects out of the container and mark the remaining level. Using that information, students estimate the number of manipulatives in the total container using the following decade categories: *about 20, about 30, about 40* through *about 120*. Student volunteers can then count out the remaining manipulatives and report the number of tens in the total container, for example, *about 50* or *about 5 tens*. Students may count the exact number of manipulatives, but the important concept is the estimate for the number of tens, which can have more than one acceptable answer.

Materials Clear container with 20–120 manipulatives; cubes or paper for students to record their estimates

Teaching Notes Students are best able to reason about their estimate (rather than guess) when they can fluently count by tens mentally.

Suggested Use Lesson 7-4 and on, especially Lesson 8-2

HOW MANY WAYS?

Students toss 11–18 two-color counters and record all the ways they can write true equations to represent the relationship between the two quantities.

Example: Toss 13 counters.
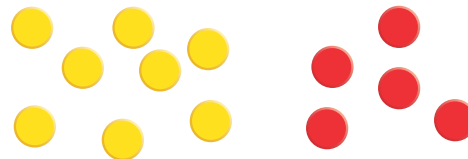
$$8 + 5 = 13$$
$$5 + 8 = 13$$
$$13 = 8 + 5$$
$$13 = 5 + 8$$
$$13 - 5 = 8$$
$$13 - 8 = 5$$
$$8 = 13 - 5$$
$$5 = 13 - 8$$

Materials Two-color counters (or Teaching Tool 6)

Teaching Notes Begin with 5–10 counters and progress to 11–18. Write sums first and then differences.

Suggested Use Lesson 4-4 and on, especially Lesson 5-3

IN AND OUT

Make a 2-column chart. Record a number in the IN column, then perform a "secret" operation on the IN number to get the OUT number. Write another IN number and ask students to determine the OUT number. Do at least three rows using the same operation. Invite students to perform the secret operation on their own IN numbers.

Examples:

IN	OUT	IN	OUT
4	7	8	2
10	13	16	10
52	55	66	60

Teaching Notes Begin with simple counting-on strategies and progress to addition and subtraction strategies using one operation (such as "doubles plus one").

Suggested Use Lesson 2-1 and on, especially Lessons 3-1 and 4-1

JUMP ON, JUMP BACK, AND JUMP UP

Write an equation with a symbol for an unknown number. Students solve the equation by jumping on a floor number line or by placing a counter on their own number line.

Examples:

Equation is $5 + 4 = ?$.
Student stands on the number 5 and jumps ON to 6, 7, 8, 9.
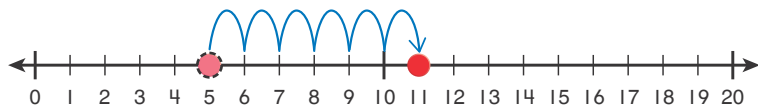The solution is 9.

Equation is $5 + ? = 11$.
Student puts a counter on 11 and jumps BACK 10, 9, 8, 7, 6, 5;

OR

Student puts a counter on 5 and jumps it UP to 6, 7, 8, 9, 10, 11.
The solution is 6.

Materials Number lines (Teaching Tool 19) and counters (or Teaching Tool 6) OR floor number lines (Consider making large number lines with chalk or paint on pavement.)

Teaching Notes Begin with facts to 10, finding sums by counting ON, and then progress to unknown-addend problems with facts to 10. Later in the year, progress to facts to 20.

Suggested Use Lesson 2-1 and on, especially Lessons 3-1 and 4-1

MAKE 30

Partners take turns adding either 1 or 2 counters to a shared set of 3 ten-frames. Partners try to be the first to place the 30th counter on the ten-frames. After each play, the partner must say how many counters are on the board and how many more are needed to "make 30." (After lots of playing, students will discover a way to always win if the other player starts!)
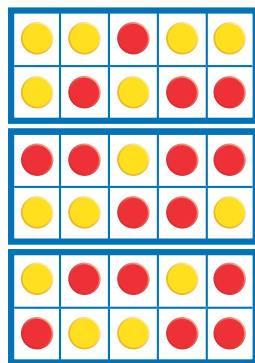
Materials For each pair, a set of 3 ten-frames (Teaching Tool 14) and 30 two-color counters (or Teaching Tool 6)

Teaching Notes Reasoning develops as students experiment.

Suggested Use Lesson 10-5 and on

MORE OR LESS THAN 120

Place a clear bag of small objects where it can only be seen and not touched or moved. Students make estimates and vote if the bag contains more or less than 120. The Counters of the Day count the objects in groups of ten and report the exact quantity to the class. If (by chance) the bag contains exactly 120, it is neither more nor less, so all estimates would be incorrect.

More or Less than 120?

Materials 12 ten-frames for counting (Teaching Tool 17) or 12 egg cartons with two sections cut off; clear bag; small objects for the bag, such as beans, plastic jewels, 1-inch tiles, connecting cubes, unit cubes

Teaching Notes Begin with estimating more or less than 50, then 100, and then 120. Progress to two bags of different materials and ask students to estimate and count the total of the two bags.

Suggested Use Lesson 1-8 and on, especially Lesson 7-2

MYSTERY NUMBER

Students guess a mystery number using given clues to eliminate possibilities on a chart or number line. Give students three types of clues:

Comparing clues (for example, the number is less than 97; the number is greater than 85; the number is between 100 and 120.)

Place-value clues (for example, the digit in the tens place is greater than 3; the number has the same number of tens and ones.)

Addition/subtraction clues (for example, the number is greater than the sum of 5 and 6; the number is less than the difference between 50 and 30; the number is 9 more than 37; when the digits of this number are added together, the sum is 8.)

Materials Number lines or 100 and 120 charts (Teaching Tools 21 and 23)

Teaching Notes Give comparing clues for numbers 1–20, 1–50, 1–100, 1–120; place-value clues for 2-digit numbers; addition and subtraction clues with 1- and 2-digit numbers.

Suggested Use Lesson 9-2 and on

NUMBER CHAIN

Give three single digits and two operations in a "chain." Ask students to show the final answer with their fingers. (Answers greater than 10 require the method described in the "Pat and Show" routine.) Because no materials are needed, this is an ideal routine to do while students are waiting in line.

Examples:

- "5; 8 more; 4 less" [9]
- "5; add 2; add 8" [15]
- "6; subtract 6; add 2" [2]
- "10; add 10; add 5" [25]

Teaching Notes Begin with the addition of three numbers. Then use 3 numbers, which include two subtractions. Finally, include chains of 3 numbers and mixed operations. By the end of the year, some students will be doing chains of 4 and even 5 numbers.

Suggested Use Lesson 5-4 and on, especially Lessons 10-2 and 11-5

NUMBER OF THE DAY

Select a Number of the Day. Students work in small groups. Each group represents the number with a different manipulative. Groups must organize their creation so the manipulatives can be counted quickly to check for accuracy.
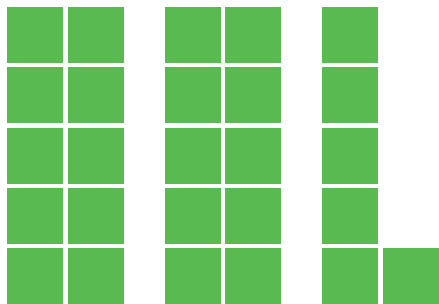
Number of the Day: 26

Materials Connecting cubes, place-value blocks, square tiles, sticks and rubber bands, counters in ten-frames, and more (or Teaching Tools 6, 7, 14, 27)

Teaching Notes Begin with numbers less than 10 and progress to numbers less than 20, 30, 40, 50, and so on to 120.

Suggested Use Lesson 1-1 and on, especially Lesson 8-6

NUMBER SCAVENGER HUNT

Assign two students to each bring a picture or drawing of a 2-digit number found somewhere in their home or outside. Each student writes his or her number and tells where it was found. The class then adds the two numbers or finds the difference between the two numbers. The class can then write a story about the number relationship, make the numbers using manipulatives, and/or write an equation using the two numbers.

Teaching Notes Begin with two 1-digit numbers, then a 1-digit number and a 2-digit number, and finally two 2-digit numbers.

Suggested Use Lesson 10-8 and on, especially Lesson 11-7

OOH! AND *AAH!*

Students count using a pattern. They begin counting with any number ending in 1, such as 61. They pat their legs for each number they count. They roll their hands and say "*Ooh!*" for every multiple of 5 (for example, they say "*Ooh!*" instead of 65). Students continue to count, patting their legs each time (for example: 66, 67, 68, 69, 70). For any decade number, they roll their hands and say "*Ooh!*" (because it is a multiple of 5) and then each hold both palms out with all ten fingers extended and say "*Aah!*" (for a decade number). They continue counting as high as 120, saying "*Ooh!*" and "*Aah!*" as appropriate.

Materials Counting charts to 120, if necessary (Teaching Tools 21, 23)

Teaching Notes Begin with counts to 50, then counts to 100, and then progress to 120.

Suggested Use Lesson 1-1 and on, especially Lesson 7-2

ORDER THE SUMS

Each student takes two number cards and states the sum. Students then take their cards and join other students to order themselves by their sums in a large number line from 2 to 20. Students with the same sums should stand behind one another at the same "point" on the number line. Teams can compete, each with their own deck, to see who can line up in the correct order first.

Example of the sums of three students (8, 12, and 15):

| 5 | 3 | | 3 | 9 | | 8 | 7 |

Materials Sets of number cards 1–10 (Teaching Tool 3); 2 cards per student

Teaching Notes Initially, have students play this as partners, with each student taking one card and the partners adding their cards together to get the sum and make the number line.

Suggested Use Lesson 3-7 and on, especially Lesson 9-5

PART-PART-WHOLE CARDS

Students make their own flash cards to practice fact families. They write the four equations of a fact family on the back of an index card. On the front, they write the numbers from the family to look like a part-part-whole model. In the example below, the dashed line shows where to fold the card and the thick black line shows where to cut the card.

```
        9
  - - - - - - - -
     4  |  5
```
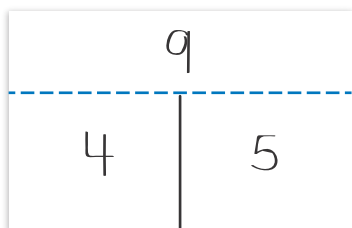
To practice addition facts (4 + 5 = ? or 5 + 4 = ?), they fold back the top number (9), or whole, so that they can only see the parts (4 and 5). To practice subtraction facts (9 – 4 = ? and 9 – 5 = ?), they fold back one part so that only the whole and the other part show.

Materials Index cards, scissors, markers

Teaching Notes Students first create cards for fact families within 10, and then within 20.

Suggested Use Lesson 4-4 and on

PAT AND SHOW

Write or display a number that is greater than 10 and less than 20. Students show the quantity in two parts using their fingers. First, they pat their legs and then show one part with their extended fingers. Then they pat their legs again and show another part.

Example: Students could show 18 as "PAT, 10 fingers, PAT, 8 fingers" OR they could show 18 as "PAT, 9 fingers, PAT, 9 fingers."

Materials If not writing on a board, large number cards for display

Teaching Notes Begin by displaying the number as a ten and then some ones, then ask for other ways to display the number, and finally play "Pat, number, Pat, number, Pat, number" for numbers less than 30.

Suggested Use Lesson 2-1 and on, especially Lesson 4-7

TABLE PATTERNS

Students can make their own addition tables for facts 0 to 5, learn how to use them to show addition and subtraction, color in the facts they know from memory, observe and shade in patterns on a printed table, and/or use the table to check their answers.

+	0	1	2	3	4	5
0	0	1	2	3	4	5
1	1	2	3	4	5	6
2	2	3	4	5	6	7
3	3	4	5	6	7	8
4	4	5	6	7	8	9
5	5	6	7	8	9	10

Patterns may include: diagonals from top right to bottom left are all the same number; diagonals within any square have the same sum (for example, 5 + 7 = 12 and 6 + 6 = 12 is shown); 2 + 3 has the same sum as 3 + 2 or if you fold the square along the sums of doubles, the sums on each side of the fold match.

Materials Blank or completed table for facts 0 to 5 (for blank grid, use Teaching Tool 22), crayons to identify patterns

Teaching Notes Students can begin to create the addition table as they progress through the year. They can identify patterns throughout the year as they learn more about addends and sums and how to identify a square.

Suggested Use Lesson 2-9 and on, especially Lessons 3-3 and 4-4

TOSS AND COVER

Toss a number of counters and have students state the total. Cover some of the counters. Students count those they can see. Then students tell how many are covered. Students can do this routine with a partner.
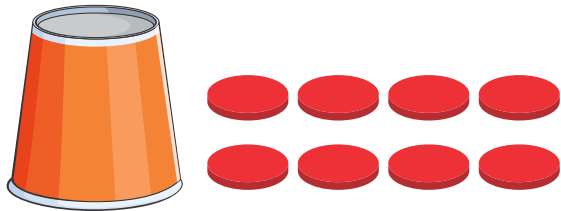
**Materials** 10–20 counters; materials to cover the counters, such as cups

Teaching Notes Begin with 10 counters, then progress to 15 or fewer, then 20 or fewer.

Suggested Use Lesson 2-7 and on, especially Lesson 4-7

UP AND DOWN

Students work in pairs; partners face each other. One partner shows a number of extended fingers with some fingers folded down so that they cannot be seen. The other partner states how many fingers he or she sees (the "Up" number) and then states how many fingers are folded down (the "Down" number). That partner then states the resulting equation as the "Up" number added to the "Down" number to make ten. Partners reverse roles.
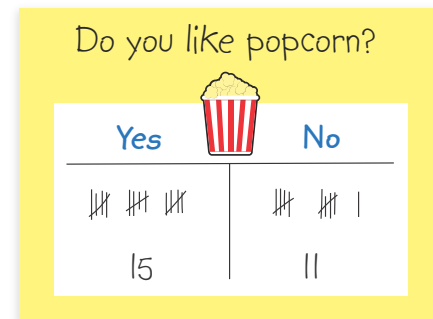
Example: For the partner's hands shown below, the other partner says "7 up and 3 down" and then gives the equation $7 + 3 = 10$.
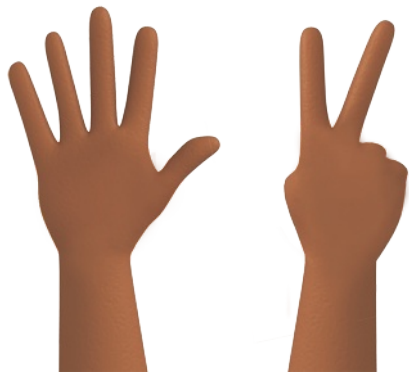
Suggested Use Lesson 3-5 and on

VOTING DATA

Write a Question of the Day and ask students to vote their answers using connecting cubes or their name cards. Represent the results using a tally chart or picture graph.

Example:

Question: Do you like popcorn? Yes or No

Each student selects a blue cube for "yes" or a red cube for "no." The Grapher of the Day then collects the cubes and makes a red tower and a blue tower. Students compare the two quantities and use statements to describe the results.

Materials Connecting cubes (or Teaching Tool 7), tally chart (Teaching Tool 28)

Suggested Use Lesson 6-4 and on

WHICH ONE IS FALSE?

Display four true equations and one false equation in any order. Give students one minute to find the false equation and rewrite it so that it is true.

Example:

$$35 = 29 + 6$$
$$54 + 10 = 55$$
$$12 + 5 = 17$$
$$50 = 50$$
$$17 = 12 + 5$$

Students would write $54 + 10 = 64$.

Teaching Notes Focus on the facts or strategies students are currently learning.

Suggested Use Lesson 5-2 and on, especially Lessons 10-8 and 11-6

NUMBER AND OPERATIONS ROUTINES

The chart suggests lessons where the routines may be introduced (cells in darker green).
It also suggests specific lessons where the routines may be practiced. Teachers may incorporate
these routines in a different sequence and with more frequency after introducing them.

Categories (left-to-right): Counting · Addition & Subtraction Basic Facts · Addition & Subtraction Computation · Place Value · Estimation

Counting	A&S Basic Facts	A&S Computation	Place Value	Estimation	ROUTINES	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15
								VOLUME 1					VOLUME 2							
•	•				Add it Up!		2-7		4-5											
	•	•			Balance the Equation					5-4										
•	•	•			Climb the Ladder			3-5	4-3											
	•	•			Contig			3-7	4-6											
			•		Dance the Number by Tens and Ones								8-1	9-3						
			•		Digit Place								8-4	9-6						
	•		•		Domino Sums and Differences			3-2	4-1					9-5						
	•				Double It and Move		2-2	3-3												
	•				Draw a Picture					5-1					10-9	11-7				
	•	•			Four and GONE!					5-3					10-2					
•			•		How Many Days?	1-1						7-1								
•				•	How Many Tens?							7-4	8-2							
•	•				How Many Ways?				4-4	5-3										
	•	•			In and Out		2-1	3-1	4-1											
•	•				Jump On, Jump Back, and Jump Up		2-1	3-1	4-1											
		•			Make 30										10-5					
•				•	More or Less Than 120	1-8						7-2								
			•		Mystery Number									9-2						
	•	•			Number Chain					5-4					10-2	11-5				
•			•		Number of the Day	1-1							8-6							
	•	•			Number Scavenger Hunt										10-8	11-7				
•			•		*Ooh* and *Aah!*	1-1						7-2								
	•		•		Order the Sums			3-7						9-5						
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	•	•			Pat and Show		2-1		4-7											
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	•				Toss and Cover		2-7		4-7											
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•	•	•			Voting Data						6-4									
	•	•			Which One is False?					5-2					10-8	11-6				