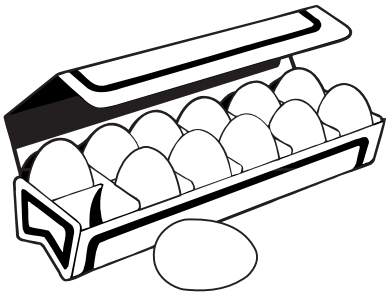
EXPLORATIONS™

Unit 11

Let Me Count the Ways



Concepts

- Addition
- Algebraic thinking
- Recognizing patterns
- Problem solving

Materials

- TI-10
- Book: *12 Ways to Get to 11*
- Grid paper
- Scissors
- Glue or paste
- Crayons or markers
- Color tiles or connecting cubes
- 5” x 8” index cards or tag board (at least 7 per student)
- Yarn or string
- Overhead tiles

Calculator Connections

- 2-line display
- Scrolling
- Problem Solving

Suggested Age/Grade Level

- Ages 6-7
- First grade

Overview

After viewing the cover of *12 Ways to Get to 11* written by Eve Merriam and illustrated by Bernie Karlin (Aladdin Paperbacks, 1996), students will make predictions about the number of ways to make 11 with two or more addends. The problem solving feature (manual mode) of the TI-10 and manipulatives will help students investigate patterns with these addends.

Assessment

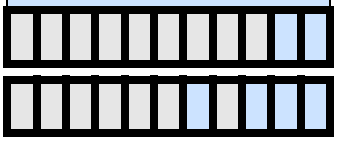
Assessment should be done through student work samples and teacher observation. The following items should be considered.

Throughout the activities, questions are included for formative assessment. Student flip books should be used as a check for understanding and may also be used for homework review.

New Vocabulary:
Addend
Addition
Pattern
Stairstep
Sum
Symbol
T-table

Example:
Trains are created by keeping like colors together to create the addends.

Sample Trains:



Activity A: Connecting Literature and Mathematics

Before showing the cover of *12 Ways to Get to 11* to the class, hide the number 12 with a sticky note or small piece of paper. Encourage students to make predictions about the title from looking at the illustrations on the cover.

1. Pass out color tiles or connecting cubes to students.
2. Open the book to the page showing nine pinecones and two acorns. Place nine overhead tiles of one color and two overhead tiles of another color on the overhead projector to create a train. Ask students how this train shows one way of making nine.
3. Open the book to the page showing six bites, a core, a stem, and three apple seeds. Place overhead tiles on the overhead projector to represent these numbers, and then make another train.
4. Have students use their cubes or tiles to represent other ways to make eleven. (Students may use more than two addends.)
5. Ask students to share their responses with a partner or in small groups.

Activity B: Creating Patterns with Combination Trains

1. Explain to students that when solving a problem, it is sometimes helpful to start with smaller numbers (making it simpler).
2. Tell students to choose only two colors of tiles or cubes. Ask students how they might use only those colors to make a new train that represents the number 5. Remind them that they must keep like colors together.

Questions to ask:

- How did you make a train to show the five?
- How is your train like another train in the class?
- How is it different?

3. Ask students to volunteer to show their train on the overhead projector with the overhead tiles.
4. Continue to ask for volunteers until the students see all of the combinations for five that can be made with two colors.

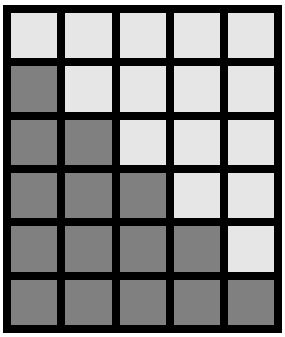
Questions to ask:

- How many different trains were made?
- How might we place these trains to show a pattern?

5. Ask students to work in pairs to make all the combinations for the number five using their two different colors of tiles or cubes. Encourage them to explore arranging the trains in a stairstep pattern. Volunteers may show their arrangements on the overhead projector using the previously placed files.

Teaching Tip:
Modeling student responses on the overhead projector will be helpful for students. It may be helpful to guide students by moving only two trains on the overhead projector to show a pattern.

Teaching Tip:
Additional guidance may be needed to refer to the pattern as a stairstep. A sample stairstep pattern is pictured below.



Activity C: Exploring T-tables

Explain to students that making a table is another helpful strategy in problem solving. Tell students that one kind of table is called a T-table because it is shaped like the letter T.

1. Draw a large T on the board or overhead projector and label the sides of the table with the colors of overhead tiles being used to create the trains.

Questions to ask:

- How many of each color were used to make the first train in the stairstep pattern?
- How many of each color were used to make the second train, and so forth?
- How many trains were made?

T-Table Example:

RED	BLUE
0	5
1	4
2	3
3	2
4	1
5	0

2. Fill in the T-table with the students' responses. When completed, it should look like the sample to the left.
3. Pass out the one inch grid paper located in Appendix A.
4. Have students choose any two colors of markers or crayons to create a stairstep pattern for the number 5 on the sheet of grid paper.
5. Instruct students to draw their own T-table and enter the grid colors they chose and combinations for five.

Activity D: Scrolling with the TI-10

1. Have students place the TI-10 next to their colored grid and T-table.

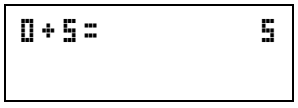
Questions to ask:

- What number represents no tiles of a color?
- How might you write the number sentence zero plus five equals five?
- How might you write the number sentence for the top with the TI-10?
- How did the class record the combination on the first row of the T-table?

Example:
No red tiles and five blue tiles make five tiles altogether.

2. Press ON to begin.
3. Press AC to clear anything previously stored in the memory.
4. Press Clear. The screen is blank (except for the cursor), the memory is clear, and you are ready to get started.
5. Press 0 + 5 =.

The TI-10 displays:

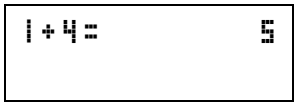


Questions to ask:

- How did you record the second grid row combination on your T-table?
- How might you show a number sentence for this combination with the TI-10?

6. Press 1 + 4 =.

The TI-10 displays:



7. Ask students to continue to enter each number sentence on the TI-10 as before.

When students have completed each of the six number sentences, ask them to scroll ◁▷ for pattern review.

Tell students they will be using their index cards to make a flip book that shows their combination trains.

8. Pass out blank index cards.
9. Have the students cut out each grid row and glue on a separate index card.

Encourage the students to use their TI-10 display screen as a model to help them write the appropriate number sentence on each index card.

Students can use the scrolling feature (◁ and ▷) to help them arrange their index cards in sequence.

To create a flip book, add a cover and secure with yarn or string.

Teaching Tip:
It is helpful to have the index cards pre-punched with two holes at the top.

Sample Card:

3 + 2 = 5

Teaching Tip:
Students can make a cover for their flip book with a blank index card. A sample title could be: How Many ways to 5?

Activity E: Exploring Patterns with the TI-10

How might the TI-10 show us all of the two-addend number sentences for 5 in another way?

1. Reset the TI-10.
2. Press the problem solving key ◈ and Auto to take a shortcut to manual problem solving.
3. Press ? + ? = 5 Enter.

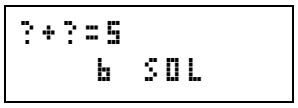
Resetting the TI-10:
Press On to wake it up if it has turned off.

Press AC if you need to clear the memory.

Press Clear to clear the display.

Teaching Tip:
It is important to introduce another way of showing the number sentence on the TI-10 by pressing [5] [=] [?] [+] [?] [Enter]. Discuss the similarities and differences between the two number sentences.

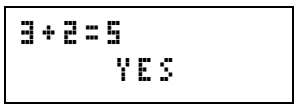
The TI-10 displays:



This means that there are six solutions or number sentences for this problem. How many solutions did you find with your tiles or cubes for five? How many did you record on the T-table? How many difference number sentences did you make in your flip book for five?

4. Press an addend that you think belongs in this number sentence.

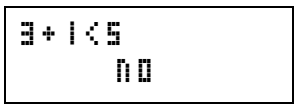
If you pressed [3] [Enter] and [2] [Enter], the TI-10 displays:



5. Write this number sentence on paper and try another set of addends.

Teaching Tip:
Students may respond by saying that "there is always one more way or solution than the sum itself." Some students may be able to show this amount as 5+1, 6+1, or any number plus one. You may want to introduce the concept of *n* (any number) + 1 at this time.

If you pressed [3] [Enter] and [1] [Enter], the TI-10 displays:



This means that 3 and 1 make a number that is smaller than 5. Try again with new addends.

Encourage students to explore all six solutions with their TI-10 and record them on paper. When ready, they should explore two addend solutions for other sums.

Questions to ask:

- What can you say about the target sums you used (5, 6, *n*) and the number of two-addend solutions for each sum?
- How might you say or show that?

Conclusion

Show the cover of *12 Ways to Get to 11* with the *12* still hidden.

Questions to ask:

- What might be a good title for this book?
- Why do you think that?
- What title do you think the author chose?

Extension

- Eve Merriam, the author of *12 Ways to Get to 11*, also provides combinations for 11 that are more than two addends. Read the book and show the other combinations.
- When students are ready, encourage them to explore 3, 4, 5, 6, and 7 addend combinations and patterns.