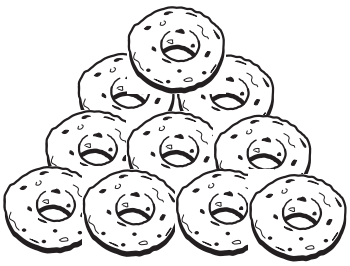
EXPLORATIONS™

Unit 3

Crunching Numbers



Concepts

- Connecting number words and numerals
- Part-whole relationships
- Place value notation
- Place value (interpreting 2-digit numbers)
- Place value (addition of 2-digit numbers)
- Creating addition procedures (algorithms)

Materials

- TI-10
- Book: *The Cheerios Counting Book*
- Cheerios® or similar cereal
- 2-ounce (50 ml) condiment cups
- Wooden tongue depressors
- Glue
- Place value mats (made from 12” x 18” construction paper)

Calculator Connections

- 2-Line display
- Scrolling
- Operations
- Problem solving
- Place value

Suggested Age/Grade Level

- Ages 6-8
- First through second grade

Overview

After listening to *The Cheerios Counting Book*, written by Barbara Barbieri McGrath and illustrated by Rob Bolster and Frank Mazzola, Jr. (Scholastic, Inc., 1998), students are given the opportunity to build two-digit numbers with Cheerios®. Students will explore those numbers and two-digit addition with place value mats and the TI-10 Place Value feature. This lesson will provide transition from grouping by tens and ones to creating addition algorithms with regrouping.

Assessment

Assessment should be done through student work samples and teacher observation. Place Value Transition Mats should be used for formative assessment.

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New Vocabulary:
Base ten

Prerequisites:
Concepts from Unit 2
Counting to 100
Grouping by ones
Grouping by tens

Directions:
To make a Place Value Transition Mat, start with a 12”x18” sheet of construction paper. Divide the paper into two columns. The first column should be 6” wide and the second column should be 18” wide. Each column should then be divided into sections of 2”, 8”, 4” and 4”. The top columns should be labeled Tens and Ones.

Activity A: Connecting Literature and Mathematics

Read or revisit *The Cheerios Counting Book*.

Activity B: Adding Two-Digit Numbers

Tell students that they will explore adding two-digit numbers.

1. Pass out 100 Cheerios®, cups, and transition place value mats to pairs of students.

These mats may be made by the teacher or students from construction paper of two colors. Directions can be found to the left.

Sample of Place Value Transition Mat

Tens	Ones
addends	
decision area	
answer area	

2. Call out a number for students to make on their transition mat. For this example, the number 34 is called out.

Questions to ask:

- What number did you hear?
- How might you show that number with your Cheerios and cups?
- How might you count that number?

Explain that the mat has two large places for the number. Help to demonstrate the section of the mat that will be used for tens and the section of the mat to be used for ones.

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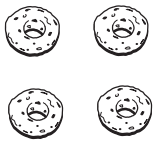
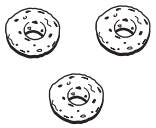
Questions to ask:

- In which space will you place your cups of ten Cheerios®?
- Why did you choose that space?
- In which space might you place your extra Cheerios?
- Why did you choose that space?
- Suppose you had 34 Cheerios and one of your friends gave you twenty-three more. How would you find the total number of Cheerios?

Encourage students to discuss ways of finding this information.

- How might you show 34 on the transition mat?
- Where might you place the cups and extra Cheerios of 23?

Sample of Place Value Transition Mat

Tens	Ones
	
	

decision area

answer area

- How might you use the decision area to help find the total?

Observe students as they work and encourage them to think about how they might show the action of putting together or adding.

Teaching Tip:
Before beginning this part of the activity, it is important that students have had sufficient exploration time making 1-digit and 2-digit numbers with Cheerios® and cups. It is also important to provide an atmosphere for students to develop their own addition algorithms.

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If using the overhead projector, the teacher moves the cups to the decision area as an example. If no projector is available, you can model the action on student mats.

After moving the cups to the decision area and modeling counting by tens, move the extra Cheerios® to the decision area.

Questions to ask:

- How might you count these pieces?
- What kind of decisions might you make about grouping?

3. Once students have answered the questions listed above, the Cheerios and cups can be moved to the answer area on the transition mat.

Continue to call out additional numbers for students to add together.

Activity C: Adding Two-Digit Numbers with the TI-10

When the students have had sufficient experience with the Cheerios® and place value transition mats, ask them how the TI-10 might help when adding two-digit numbers.

1. Press (On/Off) to begin.
2. Press (AC) to clear anything previously stored in memory.
3. Press (Clear). The screen is blank (except for the cursor), the memory is clear, and you are ready to get started.
4. Press the problem solving key ◈ that looks like a puzzle maze.
5. Press the (Auto) toggle key to work in the manual mode.

Question to ask:

Teaching Tip:
If students are working in pairs, one partner may make the number while the other enters it on the TI-10.

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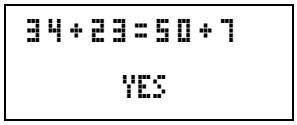
- Suppose that you have 34 Cheerios and your friend gives you 23 more. This time, how could you use the TI-10 to help find the total number of Cheerios?

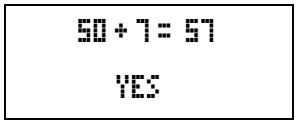
6. Show 34 with your Cheerios and cups on your mat.
7. Enter 34 on your TI-10 by pressing [3] [4].
8. Show 23 with your Cheerios and cups on your mat.
9. Press [+] [2] [3] [=].
10. Move your cups to the decision area.
11. Press [5] [0] to represent the total number of Cheerios in the cups.
12. Move your extra Cheerios to the decision area.
13. Press [+] [7] to represent the total number of extra Cheerios.
14. Press [Enter].

The TI-10 displays:



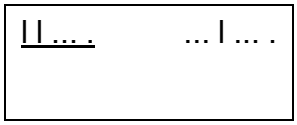
15. Now that you have discovered that 34+23 is the same as 50+7, move your cups and Cheerios to the answer area on your mat.
16. Press [5] [0] [+] [7] [=] [5] [7] [Enter].

The TI-10 displays:



17. Press [Mode].
18. Press [◆] to show two choices for working with place value.

The TI-10 displays:



Teaching Tip: Understanding 2-digit addition is aided when students are given meaningful situations for adding, such as in the Cheerios® example.

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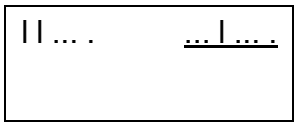
19. Press ◄► to underline ... I ... .

The TI-10 displays:



20. Press Enter.
21. Press Mode to exit the choice screen and return to the work screen.
22. Press 5 7 because this is the number that we will use.
23. Press ■I..
24. Press 10. to find out what digit is in the tens place.
25. The TI-10 displays:

Question to ask:

- What might you say about this digit?

26. Press 1. to find out what digit is in the ones place.

The TI-10 displays:

Question to ask:

- What might you say about this digit?

27. Press 7 to find the place value of that digit.

The TI-10 displays:

28. Press 5 to find the place value of that digit.

Example
Answer in place value language:

5 tens and 7 ones =
50 + 7 = 57

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The TI-10 displays:

This means that when you use tens and ones to make the number fifty-seven, you used five groups of ten and seven ones.

Questions to ask:

- How might you write your answer in place value language?

  How might you write the number sentence in place value language?

Continue to call out other two-digit numbers in meaningful situations for adding.

Activity D: Adding Two-Digit Numbers with Regrouping

Tell students that they will add some two-digit numbers that may require a different decision.

1. Call out a number. In this example, the number 57 is used.

Questions to ask:

- What number did you hear?
- How might you show that number with your Cheerios® and cups?
- How might you count that number?
- Your mat has two large spaces for this number. In which space might you place your cups?
- Why did you choose that space?
- In which space might you place your extra Cheerios?
- Why did you choose that space?

2. Say another number. In this example, the number 26 is used.

Examples

Number sentence in place value language:

3 tens and 4 ones =
30 + 4 = 34
+ 2 tens and 3 ones =
20 + 3 = 23
= 5 tens and 7 ones =
50 + 7 = 57

OR

3 tens and 4 ones
+ 2 tens and 3 ones
= 50 tens and 7 ones
= 50 + 7 = 57

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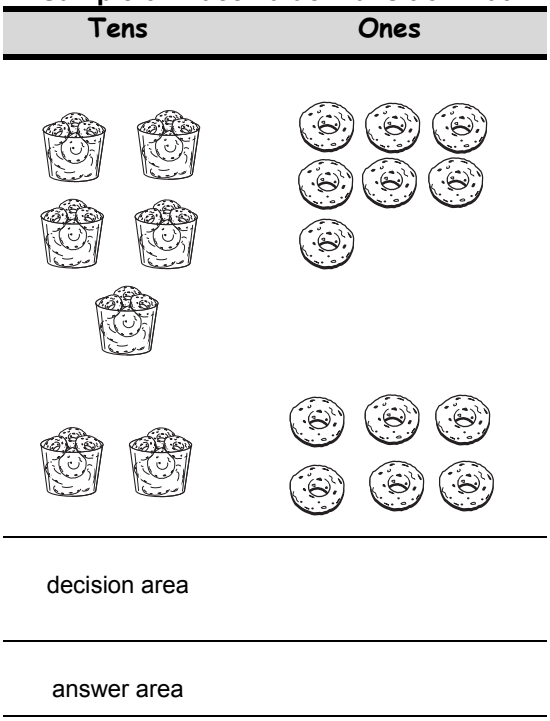
Questions to ask:

- What number did you hear?
- How might you show that number with your Cheerios® and cups?
- How might you count that number?
- Suppose you had 57 trading cards in a collection, and one of your friends gave you 26 more. How might you find the total number of trading cards?
- How might you show 57 on the transition mat?
- Where might you place the cups and extra Cheerios for 26?

Sample of Place Value Transition Mat



- How might you use the decision area to help find the total?

Observe students as they work.

3. If using an overhead projector, move the cups to the decision area as an example. If an overhead projector is unavailable, find another way of modeling this action.

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Question to ask:

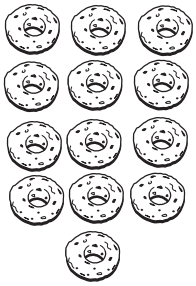
- How might you count these cups?

4. Move the extra Cheerios® on the ones side to the decision area.

Questions to ask:

- How might you count these?
- What did you observe about your counting?
- What decisions might you make about your groups of tens? How might the extra Cheerios be grouped or regrouped?
- What might the answer look like after you make your decision? Why?

Sample of Place Value Transition Mat

Tens	Ones
addends	
	
answer area	

Sample of Place Value Transition Mat

Tens	Ones
addends	
decision area	

Teaching Tip:
It is important that you guide students to the fact that a new group of ten can be made.

Teaching Tip:
It is important for students to understand that regrouping is another term for reorganizing their Cheerios® into their original groups of tens. It is helpful to teach multi-digit addition with and without regrouping at the same time by using manipulatives and relating this process to realistic situations. When manipulatives are used, it is easy to demonstrate when regrouping is needed, so there is no need to teach regrouping as a separate algorithm.

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

Press (AC) if you need to clear the memory.

Press (Clear) to clear the display.

Activity E: Adding Two-Digit Numbers with Regrouping with the TI-10

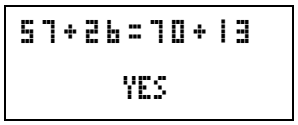
1. Reset the TI-10.
2. Press the problem solving key ◈ that looks like a puzzle maze.
3. Press the (Auto) toggle to take the shortcut to manual problem solving.

Question to ask:

- Suppose that you have 57 trading cards and your friend gives you 26 more. How might you use the TI-10 to find the total number of trading cards?

4. Show 57 with your Cheerios® and cups on your mat.
5. Enter 57 on your TI-10 by pressing [5] [7].
6. Show 26 with your Cheerios and cups on your mat.
7. Press [+] [2] [6] [=].
8. Move your cups to the decision area.
9. Press [7] [0] to represent the total number of Cheerios in the cups.
10. Move your extra Cheerios to the decision area.
11. Press [+] [1] [3] to represent the extra Cheerios.
12. Press [Enter].

The TI-10 displays:



Now that you have discovered that 57+26 is the same as 70+13, make a decision about your grouping before moving your Cheerios to the answer area.

13. Press [7] [0] [+] [1] [3] [=] [8] [0] [+] [3] [Enter].

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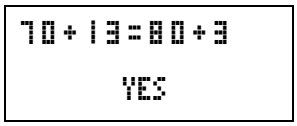
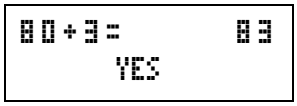
The TI-10 displays:



14. 8 0 + 3 = 8 3 Enter.

The TI-10 displays:



15. Press 8 3.

16. Press ■.

17. Press 10. to find out what digit is in the tens place.

The TI-10 displays:

Question to ask:

- What might you say about this digit?

18. Press 1. to find out what digit is in the ones place.

The TI-10 displays:

Question to ask:

- What might you say about this digit?

19. Press 3 to find the place value of that digit.

The TI-10 displays:

20. Press 8 to find the place value of that digit.

Teaching Tip:
It is important for students to understand that regrouping is another term for reorganizing their cereal bits into groups of ten. It is helpful to teach multi-digit addition with and without regrouping simultaneously, using manipulatives, and relating this process to realistic situations. When manipulatives are used, it is easy to demonstrate when regrouping is needed; and then there is no need to teach regrouping as a separate algorithm.

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Example
Answer in place value language:

8 tens and 3 ones =
80 + 3 = 83

Examples
Number sentence in expanded notation:

5 tens and 7 ones =
50 + 7 = 57
+ 2 tens and 6 ones =
20 + 6 = 26
= 7 tens and 13 ones
= 7 + 13 = 13
= 8 tens and 3 ones =
80 + 3 = 83

OR

5 tens and 7 ones
+ 2 tens and 6 ones
= 7 tens and 13 ones
= 8 tens and 3 ones
= 80 + 3 = 83

Teaching Tip:
Concrete materials such as the Cheerios® allow students to construct groupings. Experiences with these stress one-to-one correspondence between the number and the material it represents. Cheerios sticks are fixed materials. They provide a ready made manipulative and require more abstract thinking.

The TI-10 displays:

This means that when you use tens and ones to make the number eighty-three, you used eight groups of ten and three ones.

Questions to ask:

- How would you write your answer in place value language?
- How might you write the number sentence in place value language?

Provide similar experiences for students with multi-digit addition in situational problems using the TI-10 and cereal cups.

Extension

- Provide the opportunity for sufficient experience with the Cheerios® and cups before making the transition to fixed materials that are representational. When students are ready, pass out tongue depressors, Cheerios, and glue.
- Tell students that they will make Cheerios sticks that hold exactly ten Cheerios. The sticks are made by applying a line of glue down the center from one end of the tongue depressor to the other. Ten Cheerios are then placed in a row on the stick and a second line of glue can be applied on top of the Cheerios to provide an air tight seal. The sticks will need to dry overnight.
- Present the same types of addition problems and questions to students and ask them to use their Cheerios sticks, transitions mat, and TI-10 to solve.
- Ask students to record their problems and solutions.
- Encourage students to create their own situation problems as well as explore and other possible addition algorithms.

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