INSTITUTE for LEARNING

SOAR: Intervention Survey

GRADES 1 to 3

Number and Operations in Base Ten: Place Value

Number and Operations in Base Ten: Place Value Survey
Grades 1 to 3

The Number and Operations in Base Ten Survey for Place Value is an informal survey for students in Grades 1 through 3. It is designed to be used with students who show an indication, based on the universal screener, of not understanding the base ten number system, including place value and magnitude of number. Because of the nature of the concepts, the survey may also be used with older students who show signs of not understanding place value and/or magnitude of whole numbers. The survey focuses on understanding of and operating with whole numbers within a thousand, and allows the user to view student performance through the lens of recognizing and making use of the structure of numbers and providing explanations and viable arguments.

Survey Categories

  I: Understanding, Reasoning with, and Using Numbers Within a Hundred

  II: Understanding, Reasoning with, and Using Numbers Within a Thousand

Two Mathematical Practices

The lens of two mathematical practices can be used to determine an understanding of number and the ability to reason about and operate with numbers using place value and magnitude. These include

- making use of the structure of mathematics, specifically place value and magnitude and
- providing valid explanations for and constructing viable arguments about mathematical ideas and relationships.

Note: This survey has not been designed to measure a student's ability to compute, though computation is required by the survey. It is suggested that either the universal screener or a separate computation assessment be used to measure computational skills.

Materials Needed

To administer this survey, in addition to this document, you will need

- Place Value Checklist to record your observations about student performance,
- Place Value Student Prompt Book that contains each of the survey items in print, and
- scrap paper for students to use, as needed.

Additional materials include:

- Category I: a hundreds chart, a number line, and a selection of manipulatives, including base ten blocks (tens and ones), two color counters, connecting cubes or bundles of popsicle sticks (bundles of 10), and scratch paper
- Category II: a selection of manipulatives, including base ten blocks (hundreds, tens, and ones), two color counters, connecting cubes or bundles of popsicle sticks (bundles of 10), and scratch paper

Administration of the Survey

The survey can be completed as a one-on-one interview (approximately 20 minutes for each section). The survey can be given to a small group of students as well. If the survey is used with a small group of students, it will be important to vary the students who are called on first as to minimize the influence other students' responses have on the results. This will help ensure you get an actual measure of each student's understanding of and operating within the base ten number system. Students in Grade 1 whose performance on the universal screener suggests a need for additional support will need to complete all of Category I.

➢ Students in Grade 2 whose performance on the universal screener suggests a need for additional support will need to complete all of Category I and most of Category II.

➢ Students in Grade 3 whose performance on the universal screener suggests a need for additional support may need to complete all of Category I and Category II, depending on the entry level of the student.

➢ Students in grades higher that Grade 3 whose performance on the universal screener suggests a need for additional support may need to complete Categories I and II, depending on the entry level of the student.

Before starting the survey, fill out the information on the top of the checklist, including the date on which you are giving the survey. As previously noted, a copy of each survey item is provided in the Student Prompt Book which should be used during the survey. The teacher is encouraged to read the survey items to the students since this is not a test of a student's reading ability.

Start the survey by saying, *"I like to learn about how my students are thinking about numbers. This is why we are meeting. I want you to talk out loud about your strategy so I know how you are thinking about the item. If you need an item repeated, please ask me to repeat it."* If needed, repeat this statement to them throughout the survey.

This survey is a tool designed to find out where students are in their learning; therefore, the interview questions provided on the next several pages are limited and reflect only those questions that probe for student understanding.

Category I: Understanding, Reasoning with, and Using Numbers Within a Hundred

Recognizes Numbers and Understands Magnitude of Number

1. Tell me about the number you see below. 27	**Recognizes and Makes Use of Structure of Number**	**Names and models multi-digit numbers.** • *What is this number? Tell me how you know the number is _____.* • *Show 27 using the blocks, counters, or the pen and paper.* • *Tell me how the model (diagram, blocks, counters) shows the number.*
	Provides Explanation	**Explains the magnitude of a digit based on its place value position.** • *What does the 7 in 27 tell us?* • *What does the 2 in 27 tell us?*

2. Tell me what you know about these numbers. 43 34	**Recognizes and Makes Use of Structure of Number**	**Names and models multi-digit numbers.** • *What are these numbers? Tell me about these numbers.* • *In which of the numbers does the 4 represent more?*
	Provides Explanation	**Explains the magnitude of a digit based on its place value position.** • *How do you know the 4 in _____ represents more?*

Recognizes Patterns and Relationships

3. Study how the numbers are organized in the table below.	Recognizes and Makes Use of Structure of Number	**Names patterns.** • *Tell me what you notice about the way the numbers are organized in this table.* • *What patterns do you see in the numbers in this table?*
	Provides Explanation	**Explains the pattern.** • *You told me about the _____ pattern. Why do you think this is happening?* • *Why does the digit in the ones place change as we move across the table?* • *Why does the digit in the tens place change as we move down a column?*

Table for item 3:

20	21	22	23	24	25	26	27	28	29
30	31	32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47	48	49
50	51	52	53	54	55	56	57	58	59

| 4. Study the numbers below and tell me what you notice. 33, 43, 53, 63	Recognizes and Makes Use of Structure of Number	**Names and extends a pattern.** • *Tell me what you notice about how the numbers are changing.* • *If this pattern were continued, what number comes before 33?* • *If this pattern were continued, what number comes after 63?*
	Provides Explanation	**Explains the pattern and justifies how the pattern can be extended.** • *Why are the numbers changing this way?* • *How do you know ___ comes before 33 in this series of numbers?* • *How do you know ___ comes after 63 in this series of numbers?*
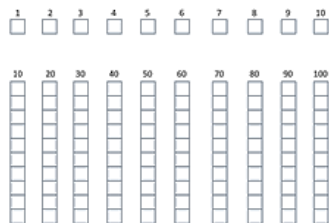
5. Study the diagram below. What does the diagram show?	Recognizes and Makes Use of Structure of Number	**Names the relationship between two quantities.** • *Study the diagram below. What does the diagram show?*
	Provides Explanation	**Explains units of 10.** • *Why can I say that both of these [point to the 10 ones and the 10 tens] show 10?*

Reasoning About Place Value and Magnitude of Numbers

<table>
<tr>
<td>6. We are going to be using the diagrams on this page to answer several questions about numbers.

A ? 20 — 30

B ? 30 — 40

C 15 10 — 20

D 38 30 — 40

E 45 ? — ?</td>
<td>Recognizes and Makes Use of Structure of Number</td>
<td>**Reasons about the magnitude of number based on place value.**

Identify a number between two benchmark numbers

- *Look at the numbers 20 and 30. Tell me a number that falls between these two numbers. How do you know?*
- *Look at the numbers 30 and 40. Tell me a number that falls between these two numbers. How do you know?*

Identify relative location of a point given two benchmark numbers

- *Where would you put 15 on this number line? How do you know?*
- *Where would you put 38 on this number line? How do you know?*

Identify two benchmark numbers

- *Look at the number 45. Tell me the two tens that 45 comes between. How do you know?*</td>
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<tr>
<td></td>
<td>**Provides Explanation**</td>
<td>*Explanation questions are embedded above.*</td>
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<table>
<tr>
<td>7. Put the numbers below in order from least to greatest.

75, 45, 8, 72</td>
<td>Recognizes and Makes Use of Structure of Number</td>
<td>**Compares/orders numbers.**

- *Put these numbers in order from least to greatest.*</td>
</tr>
<tr>
<td></td>
<td>**Provides Explanation**</td>
<td>**Explains how the order of the numbers was determined.**

- *Tell me how you figured out the order of the numbers.*</td>
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<tr>
<td>8. Solve each equation in your head.

25 + 9 = _____
32 + 60 = _____
21 + 49 = _____

9. Solve each equation in your head.

70 – 10 = _____
50 – 20 = _____
80 – 50 = _____</td>
<td>Recognizes and Makes Use of Structure of Number</td>
<td>**Calculates the solution to equations using mental math.**

- *Tell me the solution to the equation quickly without writing anything down.*
- *Tell me how you figured out the solution.*</td>
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<td></td>
<td>**Provides Explanation**</td>
<td>*Explanation question is embedded above and student responses will reveal if an understanding of the structure of number and/or magnitude of number was used (or not used) to calculate solutions.*</td>
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</table>

Category II: Understanding, Reasoning with, and Using Numbers Within a Thousand

Recognizes Numbers and Understands Magnitude of Number

<table>
<tr>
<td colspan="2">10. What is this number?

145</td>
</tr>
</table>

Recognizes and Makes Use of Structure of Number	**Names and models multi-digit numbers.** • *What is this number?* • *Tell me how you know the number is _____?.* • *Show 145 using the blocks, counters, or the pen and paper.* • *Tell me how the model (diagram, blocks, counters) shows the number.*
Provides Explanation	**Explains the magnitude of a digit based on its place value position.** • *What does the 1 in 145 mean?* • *What does the 4 in 145 mean?* • *What does the 5 in 145 mean?* • *What do the blocks (or diagram) tell us about the 1, 4, and 5 in 145?*

<table>
<tr>
<td colspan="2">11. Tell me what you know about these numbers.

435   543   354</td>
</tr>
</table>

Recognizes and Makes Use of Structure of Number	**Names and models multi-digit numbers.** • *What are these numbers?* • *Tell me about these numbers.* • *Which of these numbers is the greatest? How do you know?*
Provides Explanation	**Explains the magnitude of a digit based on its place value position.** • *How does the value of the 3 change in each of the numbers?*

Recognizes Patterns and Relationships

12. Study the table. Tell me what you notice about how the numbers are organized in this table.	Recognizes and Makes Use of Structure of Number	**Names patterns.** • *Tell me what you notice about the way the numbers are organized in this table.* • *What patterns do you see in the numbers in this table?*
	Provides Explanation	**Explains the pattern.** • *You told me about the _____ pattern. Why do you think this is happening?* • *Why does the digit in the ones place change as we move across the table?* • *Why does the digit in the ones place stay the same as we move down a column?* • *Why does the digit in the tens place stay the same as we move across the table, but the tens place changes as we move down a column?*

The table for item 12:

270	271	272	273	274	275	276	277	278	279
280	281	282	283	284	285	286	287	288	289
290	291	292	293	294	295	296	297	298	299
300	301	302	303	304	305	306	307	308	309

13. There are two sets of numbers below. We are going to talk about each set of numbers. Study the first set of numbers. A. 233, 243, 253, 263 B. 342, 442, 542, 642	Recognizes and Makes Use of Structure of Number	**Names and extends a pattern.** Number series 233, 243, 253, 263 • *Look at the first set of numbers. Tell me what you notice about the numbers.* • *What is changing? Why is this changing?* • *If this pattern were continued, what number comes before 233? How do you know ___ would come before 233?* • *If this pattern were continued, then what number comes after 263? How do you know ___ would come after 263?* Number series 342, 442, 542, 642 • *Look at the second set of numbers. Tell me what you notice about the numbers.* • *What is changing? Why is this changing?* • *If this pattern were continued, what number comes before 342? How do you know ___ would come before 342?* • *If this pattern were continued, then what number comes after 642? How do you know ___ would come after 642?*
	Provides Explanation	*No additional explanations are necessary*

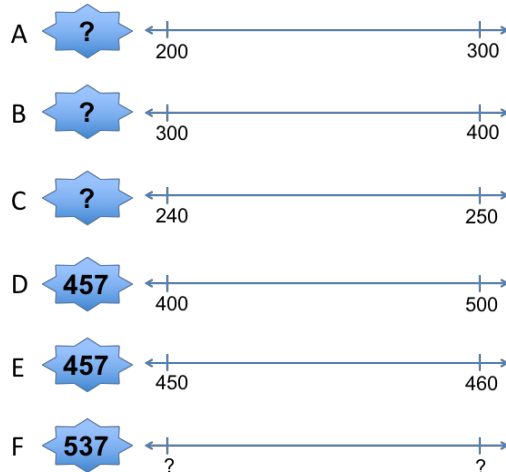| 14. Study the numbers below and think about how the numbers are related. $$1$$ $$10$$ $$100$$	Recognizes and Makes Use of Structure of Number	**Names the relationship.** • *Tell me how these numbers are related.* • *What can you tell me about the meaning of the 1 in each of these numbers 1, 10, and 100?*
	Provides Explanation	**Explains the relationship.** • *Tell me about 1 and 10, how are these two amounts related?* • *How many ones are needed to make a 10?* • *Tell me about 10 and 100, how are these two amounts related?* • *How many tens are needed to make a 100?*

Reasoning About Place Value and Magnitude of Numbers

15. We are going to be using the diagrams on this page to answer several questions about numbers. A **?** 200 — 300 B **?** 300 — 400 C **?** 240 — 250 D **457** 400 — 500 E **457** 450 — 460 F **537** ? — ?	Recognizes and Makes Use of Structure of Number	**Reasons about the magnitude of number based on place value.** Identify a number between two benchmark numbers (Items A-C) • *Look at the numbers 200 and 300. Tell me a number that falls between these two numbers. How do you know?* • *Look at the numbers 300 and 400. Tell me a number that falls between these two numbers. How do you know?* • *Look at the numbers 240 and 250. Tell me a number that falls between these two numbers. How do you know?* Identify relative location of a point given two benchmark numbers (Items D-E) • *Where would you put 457 on this number line? How do you know?* • *Where would you put 457 on this number line? How do you know?* Identify two benchmark numbers (Items F) • *Look at the number 537. Tell me the two hundreds that 537 comes between. How do you know?* • *Now tell me the two tens that 537 comes between. How do you know?*
	Provides Explanation	*No additional explanations are necessary*

| 16. Put the numbers below in order from least to greatest.

827, 943, 95, 842, 845 | Recognizes and Makes Use of Structure of Number | **Compares/orders numbers.**

• *Put the numbers in order from least to greatest.* |
| | Provides Explanation | **Explains how the order of the numbers was determined.**

• *Tell me how you figured out the order of the numbers.* |

| 17. Solve the equations as quickly as you can and explain how you arrived at the solutions.

$240 + 45 \ =$ _____
$420 + 170 =$ _____
$380 + 550 =$ _____

18. Solve the equations as quickly as you can and explain how you arrived at the solutions.

$459 - 28 \ =$ _____
$652 - 210 =$ _____
$478 - 80 \ =$ _____
$587 - 490 =$ _____ | Recognizes and Makes Use of Structure of Number | **Calculates the solution to equations quickly.**

• *Tell me the solution to the equation as quickly as you can.*
• *Tell me how you figured out the solution.* |
| | Provides Explanation | *Explanation question is embedded above and student responses will reveal if an understanding of the structure of number and/or magnitude of number was used (or not used) to calculate solutions.* |

Only ask if the student is in Grade 3 or higher, if student is in Grade 2 end the survey before asking 19.	**Recognizes and Makes Use of Structure of Number**	**Estimates and then solves for the solution to the equation.** Both Addition and Subtraction Equation • *What would you estimate the solution to be?* • *What did you do to estimate the solution (sum or difference)?* • *What is the solution to the equation?* • *How did you arrive at that solution?*
19. Estimate the sum for the equation, and then calculate to figure out the exact sum. 532 + 349 = _____ 20. Estimate the difference for the equation, and then calculate to figure out the exact difference. 792 – 349 = _____	**Provides Explanation**	*Explanation question is embedded above and student responses will reveal if an understanding of the structure of number and/or magnitude of number was used (or not used) to calculate solutions.*

21. Solve the equations below in your head. 2 x 40 = _____ 60 x 3 = _____ 9 x 70 = _____	**Recognizes and Makes Use of Structure of Number**	**Calculates the product of multiplication equations using mental math.** • *What is the solution to the multiplication equation?* • *Tell me how you figured out the solution.*
	Provides Explanation	*Explanation question is embedded above and student responses will reveal if an understanding of the structure of number and/or magnitude of number was used (or not used) to calculate solutions.*