Diagnostic Tasks

Instructions and Line Masters

https://www.pearsoncanadaschool.com/pd/products/steps-professional-resources.html

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Diagnostic Tasks

WHOLE AND DECIMAL NUMBERS

Counting

More, *K–Grade 1* 166
Get Me Task, *K–Grade 2* 167
Counting Principles, *K–Grade 2* 167
Ice Cream (Equal Sets), *Grades 1–3* 169
Skip Counting, *Grades 1–4* 170
1–9 Repeating Sequence, *K–Grade 4* 171
Up To and Over 100; Up To and Through the Hundreds, *Grades 2–7* 171
Saying the Number Sequence by Ones and Tens, *Grades 4–7* 174

Partitioning

Subitizing, *K–Grade 1* 175
Animals, *Grades 2–4* 176
How Did You Do It? *Grades 3–7* 177
What's Next? *Grades 4–7* 178

Place Value

Dinosaurs, *Grades 2–7* 180
52 Candies, *Grades 3–7* 182
43 Candies, *Grades 3–7* 184
116 Candies, *Grades 3–7* 186
Read, Write, and Say Numbers, *Grades 3–7* 188
Circle the Biggest, *Grades 6 and up* 190
Flexible Numbers, *Grades 6–9* 192
800 Game, *Grades 5–7* 195
Decimals, *Grades 5–9* 197
Numbers, *Grades 5–9* 201
Money, *Grades 5–9* 203

OPERATIONS

Addition and Subtraction

Change Task, *Grades 1–7* 205
How Much Taller? *Grades 4–7* 208
Empty Boxes, *Grades 5–7* 210

Multiplication and Division

Story Problems, *K–Grade 4* 212
Finding Factors, *Grades 5–7* 215
Calculator Number Sentences, *Grades 4–7* 217

COMPUTATIONS

Hide the Jelly Beans, *K–Grade 1* 219
How Many Want Jelly Beans? *Grades 1–3* 220
Find the Solutions, *Grades 3–7* 223
Buying Apples, *Grades 4–7* 227

Think Boards 229
Planning Masters 231

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Using the Whole and Decimal Numbers Tasks

If you teach Kindergarten through to Grade 2 students, start with Get Me Task and follow up with Counting Principles and Subtizing. If students have trouble with these tasks, then try the More task. If they succeed on the Get Me task, then try the Ice Cream task, the Animals task, and the Skip Counting task.

If you teach Grade 2 through to Grade 4 students, start with the Ice Cream task, the Skip Counting task, and the Animals task. If students struggle with these tasks, try the tasks suggested for K–2 students above.

COUNTING



DIAGNOSTIC TASK: More

Whole and Decimal Numbers
KU 2 for K–Grade 1 (ages 4–6)

Purpose

To assess students' ability to compare small collections and say which is bigger without using numbers

Materials

- Cards with 1–6 dots on each

Instructions

This task is a card game for two players. Distribute all the cards to the players. Players hold their cards face down in a pile. Both players turn over a card at the same time. They look at the cards. The player with the most dots is the winner and gets both cards.

Ask: "Who has the most dots?" or "Which card has more dots?"

If the same number of dots is turned up, then a match is declared and both players turn up another card simultaneously. If one is larger, the winner takes both pairs of cards.

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DIAGNOSTIC TASK: Get Me Task

Whole and Decimal Numbers
KU 1 for K–Grade 2 (ages 4–7)

Purpose

To see if the student chooses to use counting when asked to get a number of items

Materials

- General classroom equipment

Instructions

1. Tell the student that you need some blocks to make a house.
   Ask: "Can you get me 7 blocks?"
   Observe: Does the student
   - choose to use counting to help find the right amount?
   - take a handful, ignoring the amount requested?

2. Use all 7 blocks to build a house.

3. Ask: "Can you get me 12 counters so I can make a path to my house, please?"
   Observe the student again using the above criteria.

4. Set out the path around the house and engage the student in a short playtime.



DIAGNOSTIC TASK: Counting Principles

Whole and Decimal Numbers
KU 1 for K– Grade 2 (ages 4–7)

Purpose

To assess student understanding of the principles of counting

Materials

- General classroom equipment

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Instructions

1. *Counting Principles 1, 2, and 3(a)*: Show a student a scattered collection of 8 items.
   Ask: "Can you tell me how many [e.g., animals] are here?"
   Observe: Does the student
   - include each item only once?
   - say the number names in the right order?
   - move the items or keeps track of her/his starting point?

2. *Counting Principle 5*: When the student has completed the count, notice whether she/he emphasizes the last number. Even if it has been emphasized, ask the next question.

   Ask: "How many [e.g., animals] are there?"
   Observe: Does the student
   - recount from the start?
   - repeat the last number word?
   - look at you as though the question doesn't make sense?

3. *Counting Principle 4*: Place the items in a line.

   Ask: "How many [animals] are there?"
   Observe: Does the student
   - recount from the start?
   - restate the number without counting?
   - get the same number as she/he did with the first count?

   If the student finishes the count with a different number from the original count, say: "When you counted them before you said there were [say number] and now you say there are [say number]."

   Ask: "So, are there [the first number student said] or are there [the second number student said]?"
   Observe: Does the student know that he/she should have the same number for both counts?

4. *Counting Principle 3(b)*: Take a new collection of items. Place them in a line and ask the student to count the items starting in the middle. Point to an item in the middle.
   Ask: "How many [blocks] do we have? When you count the [blocks], begin with this one [pointing to the middle item]. It is number one."

   Observe: Does the student
   - count from the middle item. and includes all of the items in the count?
   - count from the middle moving from left to right to the end of the row, omitting the first few items in the row?

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DIAGNOSTIC TASK: Ice Cream (Equal Sets)

Whole and Decimal Numbers
KU 1 for Grades 1–3 (ages 6–8)

Purpose

To see if the student chooses to use counting in order to make an equivalent set

Materials

- A box filled with cut-out pictures of ice cream cones
- A picture of 6 children scattered around the page
- A picture of 10 children standing close together in a line
- A picture of 14 children scattered around the page

Instructions

1. Show the box of ice cream cones, place it on a desk some distance away from the student, and say it is an ice cream parlour.

2. Say to the student, "You are the [Mom/Dad] of this group of children [shown on a page in front of them] and they all want ice cream. Will you go to the ice cream parlour and get an ice cream cone for each of the children?"

3. Repeat the instruction for each of the different-sized groups.

   Observe: Does the student
   - count the starting group?
   - use the count of the starting group to count the number of ice cream cones?
   - just grab a handful of ice cream cones?
   - choose to give out one ice cream cone at a time, with no counting?

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DIAGNOSTIC TASK: Skip Counting

Whole and Decimal Numbers
KU 1 for Grades 1–4 (ages 6–9)

Purpose

To find out if the student knows that counting in groups gives the same result as counting by ones

Materials

- Any collection of 15 small items (e.g., beads)
- Any collection of 50 small items (e.g., popsicle sticks)

Instructions

This task may be carried out during lessons while a student is involved in making and counting collections.

1. Give a student 15 small things, such as beads.

   Ask: "How many beads have I given you? How did you decide that?"
   Observe: If the student counts to 14 accurately by twos, then adds the one, stop the interview here.
   If the student counts by ones, go on to step 2.

2. Ask: "Will you get the same answer if you count by twos? Count by twos to find out."
   Observe: Notice how the student keeps track of the "twos" and what he/she does when he/she reaches the remaining single bead.

   At the end of the count, notice if the student calls the single bead the next number in the "twos" sequence, even though there is only one there. For example, does the student point and say "12, 14, 16?" or "12, 14, 15" (arriving at 15 for the answer)?

   If by now you are sure the student knows that counting by twos gives the same result as counting by ones, stop the task. If you are still unsure, continue with step 3.

3. Empty out a container that holds more than 50 objects, e.g., craft sticks.

   Ask: "How many craft sticks do you think are there? How could you know exactly how many are there?"
   Observe: Watch to see if the student begins and then continues to count the whole collection by ones. If he/she does, ask: "How many craft sticks will there be if you count by fives?"

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DIAGNOSTIC TASK: 1–9 Repeating Sequence

Whole and Decimal Numbers
KU 4 for K–Grade 4 (ages 4–9)

Purpose

To find out how far the student knows the sequence of numbers used when counting

Instructions

Interview (ages 4–7): Listen to the student say the counting numbers as far as she/he can go. Help the student with the decade names if necessary.

Interview (ages 7–9): Listen to the student say the counting numbers from 80 to over 100. Say you want her/him to take over the counting where you leave off. Begin the count with "80, 81, 82, 83, 84, 85, …" having student continue to, say, 140.



DIAGNOSTIC TASK: Up To and Over 100; Up To and Through the Hundreds

Whole and Decimal Numbers
KU 4 for Grades 2–7 (ages 7–12+)

Purpose

To see if students know the pattern in the way we say numbers up to and over 100

Materials

- Line Master: Up To and Over 100
- Up To and Through the Hundreds

Instructionshttps://www.pearsoncanadaschool.com/pd/products/steps-professional-r

esources.html

1. Provide each student with a blank 10 × 20 grid and ask them to fill it in, counting by ones, beginning at one.

2. Interview individual students when:
   - the student writes an incorrect number or writes a number incorrectly. Ask him/her to "say" that part of the sequence so that you are able to hear what the student actually thinks the pattern is.
   - the student generally experiences difficulty when working with numbers.

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Name: _____

Grade: _____ **Date:** _____

Line Master **Up To and Over 100**

Write the numbers to the end of the boxes.
Begin with one and count by ones to the end of the boxes.

1	**2**	**3**							

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Name:_____

Grade: _____ **Date:** _____

Line Master **Up To and Through the Hundreds**

1. Write the numbers to the end of the boxes.
   Begin at 91 and count by ones to the end of the boxes.

91	**92**	**93**							

2. Write the numbers to the end of the boxes.
   Begin at 491 and count by ones to the end of the boxes.

491	**492**	**493**							

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DIAGNOSTIC TASK: Saying the Number Sequence by Ones and Tens

Whole and Decimal Numbers
KU 4 and KU 6 for Grades 4–7 (ages 9–12+)

Purpose

To see if students can use the patterns in the way we say numbers to count on and back by tens from any starting point. The counting by ones gives information about KU 4. The counting by tens aspect of this task gives us information about KU 6.

Instructions

Interview: Ask the student to take over saying the number sequence where you leave off. For example, say "74, 75, 76, 77, 78, …" Repeat this process for each of the examples below.

1. Say the number sequence going forward by ones
   a) starting from 79
   b) starting from 985

2. Say the number sequence going backwards by ones
   a) starting from 75
   b) starting from 1010

3. Say the number sequence going forward by tens
   a) starting from 180
   b) starting from 34

4. Say the number sequence going backwards by tens
   a) starting from 520
   b) starting from 146

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DIAGNOSTIC TASK: Subitizing

Whole and Decimal Numbers
KU 2 for K–Grade 1 (ages 4–6)

Purpose

To assess student ability to subitize quantities up to six

Materials

- Six blocks (two-centimetre cubes)
- An ice-cream tub or similar container

Instructions

1. Place two blocks in a container.
2. Show it briefly to the student. Ask: "How many blocks are there?"
3. Add blocks or remove blocks to show the following numbers: 2, 3, 1, 5, 4, and 6, asking the student to tell you how many each time.

Note: Remember to give the student only a brief look so that she/he is forced to use subitizing rather than counting.

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DIAGNOSTIC TASK: Animals

Whole and Decimal Numbers
KU 2 for Grades 2–4 (ages 6–9)

Purpose

To find out if the student can partition using materials or with numbers

Materials

- Sheet of paper
- Collections of countable objects if necessary
- Children's picture book about groups of animals (e.g., rabbits in or out of a garden patch)

Instructions

Have the student create partitions in response to the story about animals, using the same number of animals as appeared in the story. Ask the student to show all the different ways she/he could put (e.g., 12) animals in two places (e.g., garden or cage). At first limit the student to paper and pen. If the student struggles, suggest using some materials to help.

Observe: Does the student

- use numbers alone, moving "one" from this number to that number?
- draw lines, dots, or other symbols and count, and then record her/his partitioning?
- use materials to count and then record his/her partitioning?

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DIAGNOSTIC TASK: How Did You Do It?

Whole and Decimal Numbers
KU 5 and KU 6 for Grades 3–7 (ages 8–12+)

Purpose

To see if student needs to count to solve a computation mentally, or can use partitioning based on place value or his/her own written methods

Instructions

This lesson enables students to share the strategies they use to carry out a mental computation. The lesson needs to be modelled a number of times with simple computation examples to give students practice in thinking about and recording their mental strategies.

Listen to and record student responses on the board including counting strategies if students mention them.

If the students cannot do the computation mentally, they should find an answer by using pencil and paper. Students should indicate on their page whether they worked it out mentally or used pencil and paper or materials.

Present students with either the Grades 3–5 or 5–8 Sample Learning Activity from Whole and Decimal Numbers KU 6.

Grades 3–5: Math Method (*Number Sense* Resource Book, p. 79)	**Grades 5–8: Different Strategies** (*Number Sense* Resource Book, p. 79)
62 – 23 26 + 37	Your grandpa is 84 but you only have 67 candles for his birthday cake. How many more candles do you need?

Students write the problem on their page, solve it mentally, and then record their strategy. If students cannot solve the problem mentally, tell them to work it out on the paper in a way that makes sense to them, or to use materials if they need to.

Note: Record what the students actually say and do. This will help you to reflect on what they are thinking rather than what you *assume* they are thinking.

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DIAGNOSTIC TASK: What's Next?

Whole and Decimal Numbers
KU 4 and KU 5 for Grades 4–7 (ages 9–12+)

Purpose

To see to what extent the student understands the number sequence (to be used with those students who show that they know the sequence of numbers to 200)

Materials

- Line Master: What's Next?

Instructions

Direct students to complete the set of questions by writing in the next number.

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Name: _____

Grade: _____ **Date:** _____

Line Master **What's Next?**

The turnstiles at the stadium gates count the people as they go through one by one. What will be the number on each of the gates when one more person goes through?

489 _____	999_____
1 099_____	2 999 _____
4 909_____	9 999 _____
10 999_____	13 999 _____
199 999_____	1 099 999_____

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DIAGNOSTIC TASK: Dinosaurs

Whole and Decimal Numbers
KU 5 for Grades 2–7 (ages 7–12+)

Purpose

To examine student understanding of the meaning of the individual digits in a two-digit number

Materials

- Line Master: Dinosaurs
- Pencils or pens in two different colours, e.g., green and red

Note: If your students' work is being examined in a group, it is essential that the entire group uses the same colours for this task.

Instructions

1. Ask students to work out how many dinosaurs there are on the page. Students write how many in the space provided.

2. Talk about the number of dinosaurs until everyone agrees there are 35. Write the number 35 on the board.

3. Point to the 5 and say "Use a green pencil and put a circle around what this part of the number means in the set of dinosaurs." Do not say the word "five."

4. Point to the 3 and say "Use a red pencil and put a circle around what this part of the number means in the set of dinosaurs." Do not say the word "three."

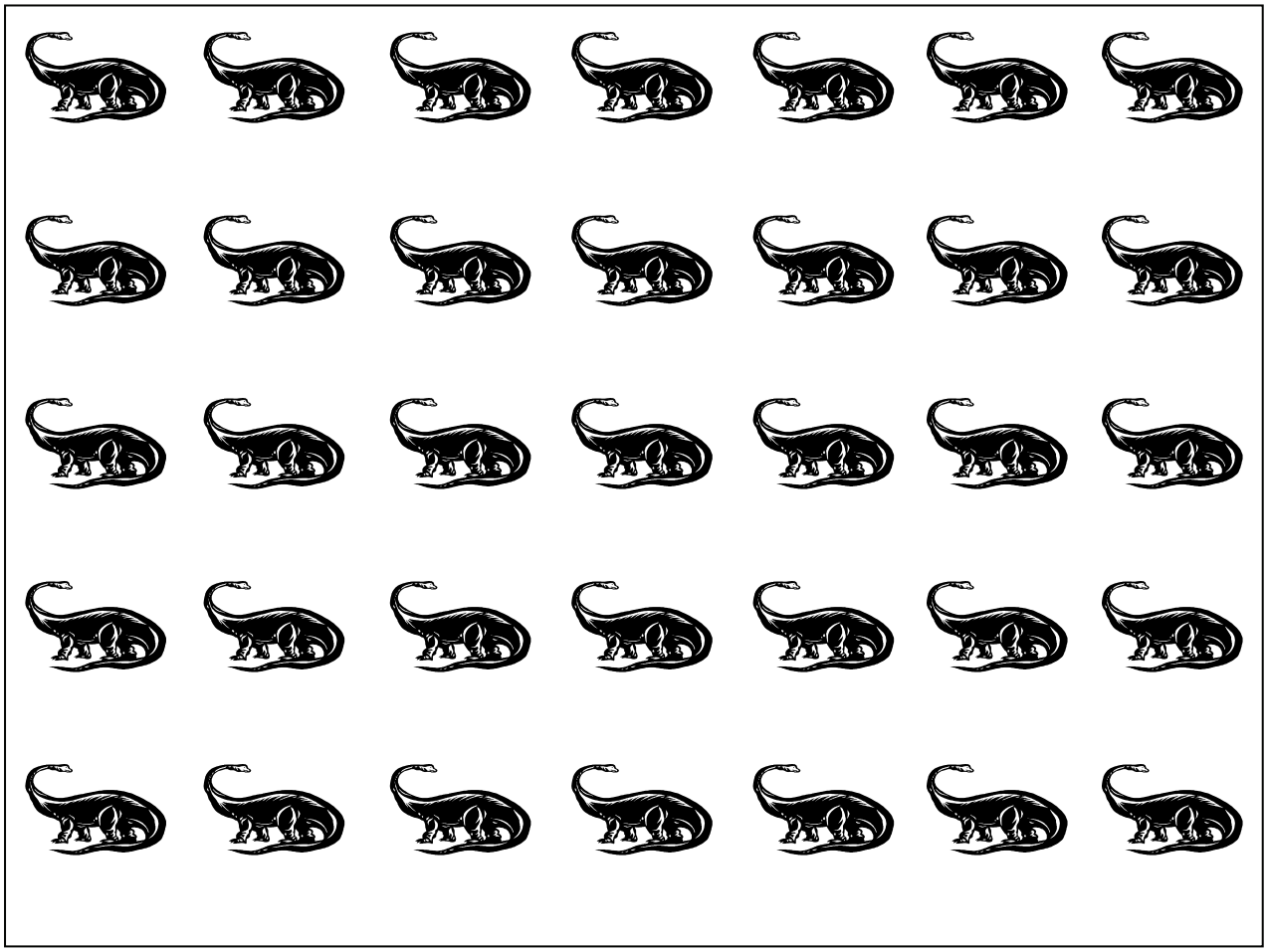
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Name:_____

Grade: _____ **Date:** _____

Line Master **Dinosaurs**

How many dinosaurs are here?_____



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DIAGNOSTIC TASK: 52 Candies

Whole and Decimal Numbers
KU 5 for Grades 3–7 (ages 8–12+)

Purpose

To explore student understanding of the meaning of the individual digits in a two-digit number when confronted by both standard and non-standard groupings of objects

Materials

- Line Master: Candies (Set A)
- Pencils or pens in red and blue

Instructions

1. Provide each student with a copy of the line master for this task.

2. Read the introductory sentence with them to make sure that students understand that these candies can be bought as single candies or in rolls of ten.

3. Ask: "How many candies are represented altogether?"

4. Talk with the students about their answers until all students agree that there are 52 candies. Observe students as they record 52 on their pages.

5. Write 52 on the board in view of all students. When giving the following instructions it is important that you do not say the words "five" or "fifty" or "two."
   a) Point to the 2 in 52 and say, "Use a blue pen to colour in what this part of the 52 means in the drawing."
   b) Point to the 5 in the 52 on the board and say, "Use a red pen to colour in what this part of the 52 means in the drawing."

Based on ideas by Sharon Ross (1989)

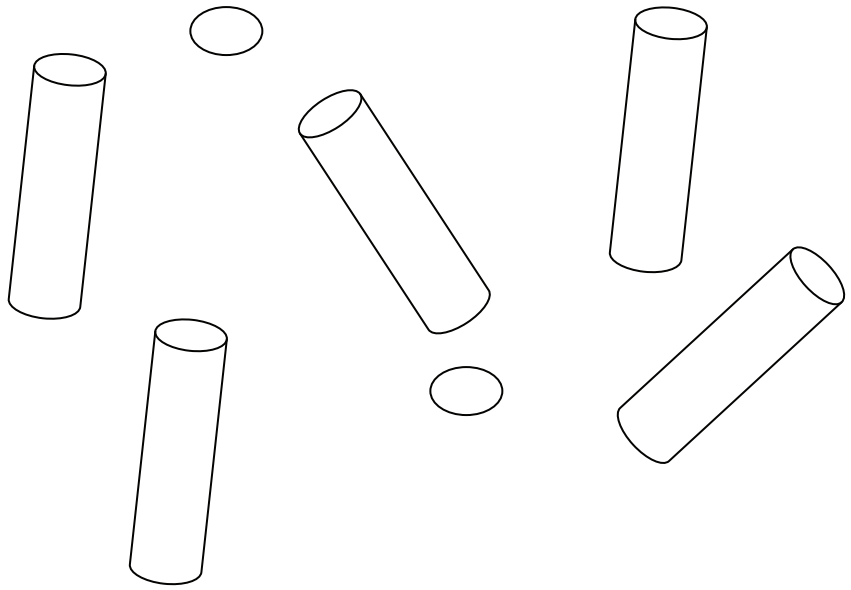
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Name: _____

Grade: _____ **Date:** _____

Line Master **Candies (Set A)**

Candies can be bought as single candies or in rolls of ten as shown here.



How many candies are shown here?_____

Task based on ideas by Sharon Ross. *Arithmetic Teacher, 1989*

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DIAGNOSTIC TASK: 43 Candies

Whole and Decimal Numbers
KU 5 for Grades 3–7 (ages 8–12+)

Purpose

To explore student understanding of the meaning of the individual digits in a two-digit number when confronted by both standard and non-standard groupings of objects

Materials

- Line Master: Candies (Set B)
- Pencils or pens in red and blue

Instructions

1. Provide each student with copies of the line master for this task.

2. Introduce as for 52 Candies.

3. Ask: "How many candies are represented altogether?"

4. Talk with the students about their answers until all students agree that there are 43 candies. Observe students as they record 43 on their pages.

5. Write 43 on the board in view of all students. When giving the following instructions it is important that you do not say the words "four" or "forty" or "three."
   a) Point to the 3 in 43 and say, "Use a blue pen to colour in what this part of the 43 means in the drawing."
   b) Point to the 4 in the 43 on the board and say, "Use a red pen to colour in what this part of 43 means in the drawing."

Based on ideas by Sharon Ross (1989)

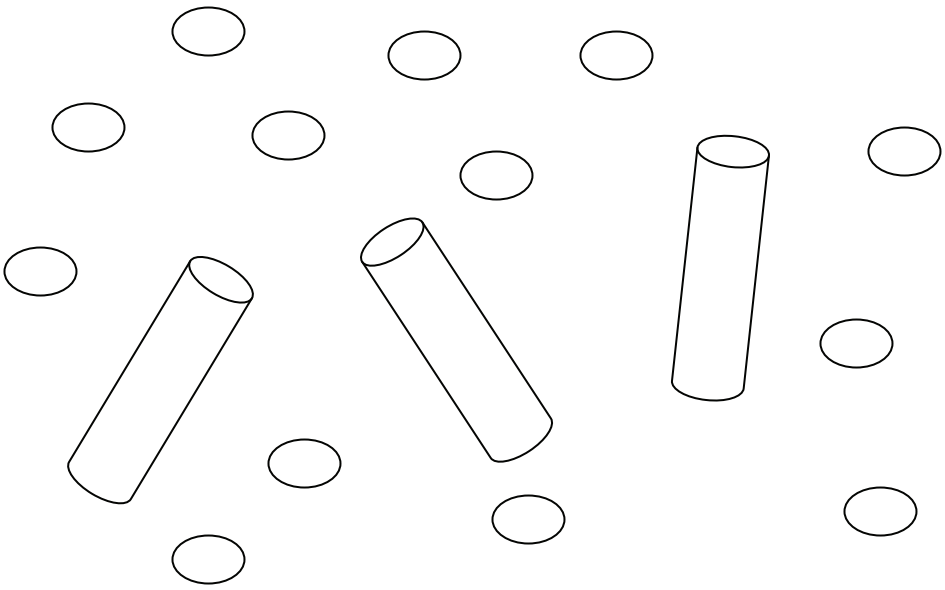
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Name:_____

Grade: _____ **Date:** _____

Line Master **Candies (Set B)**

Candies can be bought as single candies or in rolls of ten as shown here.



How many candies are shown here?_____

Task based on ideas by Sharon Ross. *Arithmetic Teacher, 1989*

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DIAGNOSTIC TASK: 116 Candies

Whole and Decimal Numbers
KU 2 and KU 6 for Grades 3–7 (ages 8–12+)

Purpose

To explore if and how students can produce standard and non-standard partitions of a quantity

Materials

- Line Master: 116 Candies

Instructions

Provide each student with a copy of the 116 Candies task. Read the introductory sentence to make sure all students understand that candies can be bought as single candies, in rolls of ten, or boxes of 100 (10 rolls of ten). Students complete the task independently.

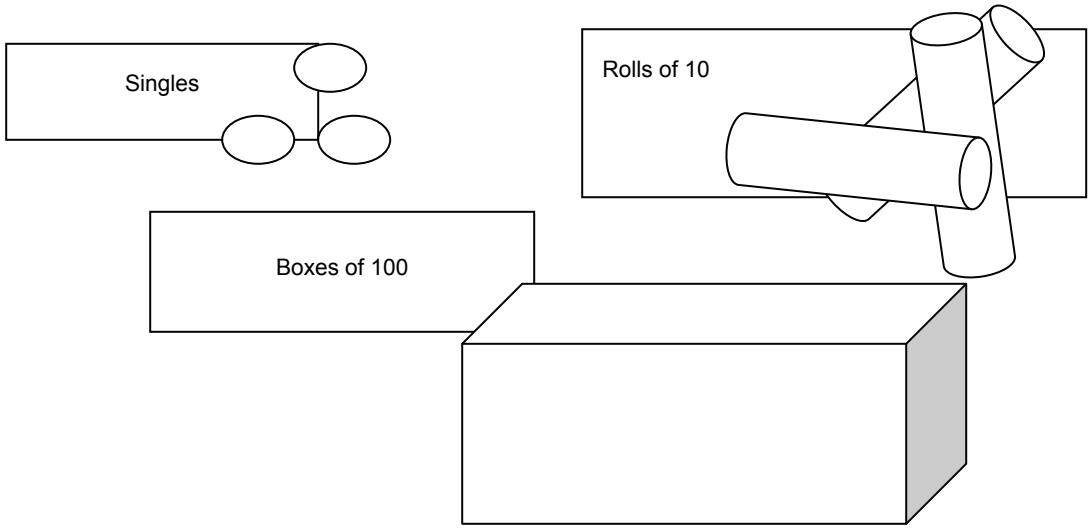
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Name: _____

Grade: _____ **Date:** _____

Line Master **116 Candies**

Candies can be bought as single candies, in rolls of ten, or in boxes of 100 as shown here.



How many different ways could you make up an order for 116 candies?

Draw or write your answer in this box.

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DIAGNOSTIC TASK: Read, Write, and Say Numbers

Whole and Decimal Numbers
KU 5 for Grades 3–7 (ages 8–12+)

Purpose

To explore the limits of students' writing of large numbers and to expose their personal rules or misconceptions when writing such numbers

Materials

- Line Master: Read, Write, and Say Numbers

Instructions

1. Provide each student with a copy of the line master for this task.

2. Call out the following numbers for students to write for questions 1–6:
   - sixty-three
   - one thousand twenty
   - twenty-six thousand fifteen
   - five hundred six thousand fifteen
   - one million five
   - five billion, thirty-six million, four hundred seven thousand four

3. Students complete the rest of the sheet independently.

4. Interview some individual students and ask them to explain how they knew to write the number in the way that they did. The purpose of the interview is to uncover any invented rules that students may be using.

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Name:_____

Grade: _____ **Date:** _____

Line Master **Read, Write, and Say Numbers**

Write the numbers the teacher says. Here is an example:

If the teacher says ***nineteen***, you write ***19***.

A._____ **D.** _____

B._____ **E.** _____

C._____ **F.** _____

Write these numbers in words.

G. 504

H. 1 768

I. 250 000

J. 13 648

K. 6 003

L. 13 806 009

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DIAGNOSTIC TASK: Circle the Biggest

Whole and Decimal Numbers
KU 5 for Grades 6 and up (ages 11+)

Purpose

To see if students are able to compare numbers using multiplicative relationships

Materials

- Line Master: Circle the Biggest

Instructions

1. Distribute the line master for this task.
2. Ask students to write a full explanation of the reasoning behind each choice. You may need to conduct some individual interviews if students' reasoning is not clear from the written explanation.

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Name: _____

Grade: _____ **Date:** _____

Line Master **Circle the Biggest**

1. Circle the bigger number.

37 **370**

How do you know it is bigger?

How many times bigger is it?

2. Circle the smaller number.

647 **6470**

How do you know it is smaller?

How many times smaller is it?

3. Circle the bigger number.

0.37 **0.0037**

How do you know it is bigger?

How many times bigger is it?

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DIAGNOSTIC TASK: Flexible Numbers

Whole and Decimal Numbers
KU 2 and KU 6 for Grades 6–9 (ages 11–14)

Purpose

To explore students' understanding that numbers can be partitioned in many ways (KU 2), and to find out if students can produce non-standard partitions of a number (KU 6)

Materials

- Line Master: Flexible Numbers (1)
- Line Master: Flexible Numbers (2)
- Scissors

Instructions

Have students complete the task individually. Interview some individual students, asking them to explain how they knew to make the number in the way that they did.

1. Have students cut the Flexible Numbers (2) page into separate cards and use the cards to make each of these numbers in as many ways as they can: 312, 400, 454, 401, 204, 61.

2. Direct students to record the ways they made each number on the worksheet, then put the cards back into the centre to make the other numbers.

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Name:_____

Grade: _____ **Date:** _____

Line Master **Flexible Numbers (1)**

Use the cards on the Flexible Numbers (2) Line Master to make each number in as many ways as you can. Record the different ways as you go.
Put the cards back into a pile to use for the next number.

For example, you can make up the number **532** using these cards:

5 hundreds	**3 tens**	**2 ones**

Now put the number cards in these boxes to make up the numbers shown.

61

312

454

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Name: _____

Grade: _____ **Date:** _____

Line Master **Flexible Numbers (2)**

NUMBER CARDS Cut-Out Sheet

14 ones	**1 one**	**4 ones**
2 ones	**4 hundred**	**10 ones**
11 ones	**12 ones**	**3 tens**
4 tens	**5 tens**	**40 tens**
41 tens	**42 tens**	**1 ten**
45 tens	**6 tens**	**3 hundreds**
31 tens	**2 hundreds**	**11 tens**

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DIAGNOSTIC TASK: 800 Game

Whole and Decimal Numbers
KU 5 for Grades 5–7 (age 10–12+)

Purpose

To see the extent of students' understanding of the relationship between the places. For example, do the students know that 8 is ten times greater than 0.8 and ten times smaller than 80?

Materials

- Line Master: 800 Game
- Scissors
- Calculators

Instructions

Copy and cut out cards; distribute one set (3 zeros, one decimal point, and one 8) to each student. Students should work with partners.

Observe students as they play and talk.
Record what they understand about the multiplicative relationship between the places.

Instructions for players:

1. Make a number with your cards.

2. Decide how you could change the value of your number so that it is equal to the value of your partner's number.

3. Use a calculator to test your suggestion.

4. Try some more examples.

5. Talk to other players.
   a) Are they doing it the same way as you?
   b) How do you account for any differences?

Notes:
- To make the game easier, use only two zeros and omit the decimal point.
- See the description in the *Number Sense* Resource Book, page 70, for additional ideas about how to bring out the mathematics and extend this Diagnostic Task into a learning activity.

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Name:_____

Grade: _____ **Date:** _____

Line Master **800 Game**

0	0	0	•	8
0	0	0	•	8
0	0	0	•	8
0	0	0	•	8
0	0	0	•	8
0	0	0	•	8
0	0	0	•	8
0	0	0	•	8
0	0	0	•	8

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DIAGNOSTIC TASK: Decimals

Whole and Decimal Numbers
KU 7 for Grades 5–9 (ages 10–14)

Purpose

To see the extent of students' understanding of decimals and to uncover preconceptions and misconceptions

Materials

- Line Masters: Decimals (Sets A–H)

Instructions

Have students complete the questions individually. You may need to conduct some individual interviews where students' reasoning is not clear from the written explanation.

Note: Students usually find some questions easier than others. Therefore, you may choose to break up the worksheets and present sections one at a time.

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Name: _____

Grade: _____ **Date:** _____

Line Master **Decimals (Sets A–D)**

A Compare and Order

Circle the biggest number in each group of three.

i) 5 436 or 547 or 56

ii) 6.78 or 45.6 or 345

iii) 3.521 or 3.6 or 3.75

iv) 15.4 or 15.56 or 15.327

v) 4.09 or 4.7 or 4.008

Swan, M. (1983)

B Money

i) When James used his calculator to see how much his shopping came to it showed 14.5.
How much is that in dollars and cents?

_____

ii) Rachel purchased 4 balls.
She worked out the price for one ball on the calculator.
The result was 6.125. How much is that in dollars and cents?

_____

C Renaming Decimals as Fractions

Write these numbers as fractions.

i) 0.67 _____

ii) 0.341 _____

iii) 0.2 _____

D Naming Digits after the Decimal Point

i) What does the 3 mean in 0.236?

_____

ii) What does the 2 mean in 0.236?

_____

iii) What does the 6 mean in 0.236?

_____

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Name:_____

Grade: _____ **Date:** _____

Line Master **Decimals (Sets E–F)**

E Ordering

Sonya said, "When we put books on the library shelf we put 65.6 before 65.125 because 6 is less than 125," but Tao didn't agree.

Who is right? _____

Why do you think that?

Write your explanation in this box.

F Counting On and Back by Decimal Numbers

Write down the next 2 numbers in each sequence.

a) 0.2, 0.4, 0.6, _____, _____
(add 0.2 each time)

b) 0.3, 0.6, 0.9, _____, _____
(add 0.3 each time)

c) 0.92, 0.94, 0.96, 0.98,
_____, _____
(add 0.02 each time)

d) 1.13, 1.12, 1.11,
_____, _____
(take away 0.01 each time)

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Name: _____

Grade: _____ **Date:** _____

Line Master **Decimals (Sets G–H)**

G Quantity

Paper clips come in boxes of 1000. Abi counted the loose paper clips in a tray and said there were 1260. Jeremy said, “That's 1.26 boxes of paper clips.”
Could they both be right?

Yes ☐ No ☐

Why do you think that?

H Number Sequence

How would you use a calculator to generate this number sequence?

2.0, 0.2, 0.02, 0.002

_____

_____

_____

_____

_____

_____

_____

_____

_____

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DIAGNOSTIC TASK: Numbers

Operations
KU 7 for Grades 5–9 (ages 10–14)

Purpose

To see the extent of students' understanding of decimals and to uncover any possible preconceptions and misconceptions they may have

Materials

- Line Master: Numbers

Instructions

Have students complete the questions individually. You may need to conduct some individual interviews where students' reasoning is not clear from the written explanation.

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Name: _____

Grade: _____ **Date:** _____

Line Master **Numbers**

What do you think this number means? **85.6**

Explain how many apples you think you would have to give me if I asked for **85.6** apples.

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DIAGNOSTIC TASK: Money

Operations
KU 7 for Grades 5–9 (ages 10–14)

Purpose

To see the extent of students' understanding of decimals and to uncover any possible preconceptions and misconceptions they may have

Materials

- Line Master: Money

Instructions

Have students complete the questions individually. You may need to conduct some individual interviews where students' reasoning is not clear from the written explanation.

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Name: _____

Grade: _____ **Date:** _____

Line Master **Money**

Jacob had to share $33 among 8 people.

He used his calculator and pressed **33 ÷ 8 =** and this is what he saw on his calculator:

4.125

How much money should he give each person? _____

Explain how you decided.

Will there be any money left over? _____

If so, how much? _____

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Operations

ADDITION AND SUBTRACTION



DIAGNOSTIC TASK: Change Task

Operations
KU 2 for Grades 1–7 (ages 6–12+)

- Use Change Task 1 with Grades 1–5 (ages 6–10).
- Use Change Task 2 with Grades 5–7 (ages 10–12+).

Purpose

To see if students are able to use the inverse relationship between addition and subtraction when solving word problems with a calculator

Materials

- Line Master: Change Task 1
- Line Master: Change Task 2

Instructions

Begin with Change Task 1. If the students are successful on this task, then, at a later time, ask them to complete Change Task 2. Do **not** allow students to use calculators for this task.

1. Explain that students are to write what they would put into a calculator to solve the problem, not just to write the answer.

2. Read out all of the problems while the students follow on the sheet.

3. If you are using this as a whole-class task, follow up interviews may be necessary to clarify what some students are thinking.

Note: You might like to modify the contexts of these problems to make the stories more relevant to your students.

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Name:_____

Grade: _____ **Date:** _____

Line Master **Change Task 1**

Write the numbers and signs that you would use to solve each problem with a calculator. You do not have to solve them.

1. Anna had 7 trading cards and then her brother gave her 3.
   How many does she have now?

2. Anna has 6 jelly beans but would like to have 11.
   How many more does she need to get?

3. Anna had some marbles and then her brother gave her 4.
   Now she has 10. How many did she have at the start?

4. Anna had 12 trading cards and then she gave her brother 3.
   How many does she have now?

5. Anna had 13 jelly beans and then she gave her brother some.
   Now she has 7. How many did she give her brother?

6. Anna had some candies and gave her brother 3 of them.
   Now she has 8 left. How many did she have at the start?

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Name: _____

Grade: _____ **Date:** _____

Line Master **Change Task 2**

Write the numbers and signs that you would use to solve each problem with a calculator. You do not have to solve them.

1. Anna has 112 game trading cards and some sports trading cards.
   She has 87 more game trading cards than sports trading cards.
   How many sports cards does she have?

2. In the long jump final at the Olympic games, the Canadian athlete jumped 8.55 m, and the Australian athlete jumped 7.67 m. How much farther did the Canadian jump than the Australian?

3. Anna has 156 pearly marbles and some cat's-eye marbles.
   She has 89 fewer cat's-eye marbles than pearly marbles.
   How many cat's-eye marbles does Anna have?

4. The school had 307 books and 254 bookmarks.
   If one bookmark is put into each book, how many books won't get a bookmark?

5. Anna has 145 white bears and some brown bears.
   All the white bears took a brown bear as a partner, and there were 78 brown bears left without a partner.
   How many brown bears does she have?

6. At the sports day Sonya jumped 3.25 m.
   If Mark had jumped another 0.87 m his jump would have been the same as Sonya's.
   How long was Mark's jump?

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DIAGNOSTIC TASK: How Much Taller?

Operations
KU 1 and KU 2 for Grades 4–7 (ages 10–12+)

Purpose

To see if students are able choose an appropriate operation to solve a comparison problem

Materials

- Line Master: How Much Taller?

Instructions

Do **not** allow students to use calculators for this task.

1. Read the question aloud to the students while they follow on the sheet. Ask them to paraphrase the question so that you are sure they understand what you are asking.

2. Ensure that the students understand the phrase "number sentence" by writing one or two examples on the board: e.g., 7 + 3 = 10 or 10 – 7 = 3. Make sure that you do not use the numbers from the problem.

3. If using this as a whole-class task, follow-up interviews to clarify what some students are thinking may be necessary.

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Name:_____

Grade: _____ **Date:** _____

Line Master **How Much Taller?**

Jesse and Sylvia were chatting on the Net. Jesse said that she was 154 cm tall and Sylvia said she was 132 cm. Jesse said, “I am taller than you.” Sylvia said, “Yes, but not by much.”

1. How much taller is Jesse than Sylvia?_____

2. Explain how you worked out the answer.

_____

_____

_____

_____

_____

_____

3. Write a number sentence that you could put into a calculator to work it out.

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DIAGNOSTIC TASK: Empty Boxes

Operations
KU 2 for Grades 5–7 (ages 10–12+)

Purpose

To see if students are able to use the inverse relationship between addition and subtraction to solve open number problems

Materials

- Line Master: Empty Boxes

Instructions

Do **not** allow students to use calculators for this task.

1. Explain to students that they are to write what they would put into a calculator to solve the problem, not just write the answer.

2. If using this as a whole-class task, follow-up interviews to clarify what some students are thinking may be necessary.

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Name: _____

Grade: _____ **Date:** _____

Line Master **Empty Boxes**

What numbers and symbols would you use on the calculator to solve the following problems?

17 + ☐ = 36 _____

☐ – 27 = 34 _____

35 = ☐ + 16 _____

43 – ☐ = 16 _____

468 + ☐ = 842 _____

283 = 674 – ☐ _____

☐ – 15.78 = 12.43 _____

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DIAGNOSTIC TASK: Story Problems

Operations
KU 3and KU 4 for K–Grade 4 (ages 4–9)

- For K–Grade 2 (ages 4–7), use Story Problems 1.
- For Grades 3 and 4 (ages 8 and 9), use Story Problems 2. You may choose to alter the numbers.

Purpose

To see what strategies students use to solve problems to which multiplication and division apply

Materials

- Line Master: Story Problems 1
- Line Master: Story Problems 2
- A calculator for each student
- Blocks or counters
- Objects that realistically represent the items in the problem; e.g., toy people and tiny clay sausages for the Sausage Problem

Instructions

Individual Interviews: Interviews would be appropriate for K to Grade 2 (5- to 7-year-old) students or for Grade 3 to 4 (8- and 9-year-old) students at risk.

1. Read the first problem from the worksheet.

2. Ask the student to restate the problem in his/her own words to make sure he/she understands the problem, and to get a sense of what that understanding is.

3. Offer the following items in order. (Withhold materials until it becomes obvious that a child cannot proceed without them.)

    - A calculator
    - The problem sheet or a larger blank sheet of paper and a pencil (if they cannot use a calculator)
    - Blocks or counters (if they cannot proceed)
    - Realistic objects appropriate to the problem

Whole Class Activity: Administering this task with the whole class would be appropriate for Grades 3 and 4 (8- and 9-year-old) students.

1. Have the students follow as you read the problems.

2. Offer the following items in order. (Withhold materials until it becomes obvious that a student cannot proceed without them. Then provide that student with the appropriate materials.)
    - Calculator, worksheet and pencil
    - Counters or blocks
    - Realistic objects selected for that problem, e.g., cardboard shapes representing the types of cones and circles of card representing the flavours of ice cream

Note: Students in Grades 3 or 4 who cannot answer Story Problems 1 questions using diagrams, counters, or blocks may require individual interviews with the more realistic materials.

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Name: _____

Grade: _____ **Date:** _____

Line Master **Story Problems 1**

Work out the answer to each story problem. Show how you worked it out.

Animals

The farmer wants to separate his 24 animals into small pens. He wants to put 6 animals in each pen. How many pens does he need?

Sausages

Dad said, “We’re going to have visitors for a barbecue. That means there will be 9 people. We’ll have 3 sausages each.” Dad sent the children to the store to buy the sausages. How many sausages will they need to buy?

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Name:_____

Grade: _____ **Date:** _____

Line Master **Story Problems 2**

Flavours

Katie went to the store. There were 4 ice cream flavours—strawberry, vanilla, chocolate, and bubblegum. There were three types of cones—chocolate, vanilla, and waffle. How many choices of single ice cream cones did Katie have?

Tennis Balls

Sam has 3 tennis balls. Hanna has 5 times as many tennis balls as Sam. How many balls does a Hanna have?

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DIAGNOSTIC TASK: Finding Factors

Operations
KU 5 for Grades 5–7 (ages 10–12+)

Purpose

To see if students know what factors are and how to find them

Materials

- Line Master: Finding Factors
- A calculator for each student

Instructions

The question in the box at the bottom of the page is the crucial part of this task and will give you the most significant information about what students know. It may be necessary to remind students what a factor is and let them practise with easier numbers like 12 or 15.

The students could be given some factor activities on the board, which are similar to the first two top boxes, to enable them to become familiar with the idea of factors and multiples.

Note: This task can be used as an individual interview or as a whole class activity. It may be beneficial to give the top part of the task to the whole class but withhold the last box from the sheet and use it in an individual interview.

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Name: _____

Grade: _____ **Date:** _____

Line Master **Finding Factors**

Find factors for these numbers.

81 _____

Which numbers did you try? _____

Which ones were hardest to find? _____

How did you work it out? _____

_____

105 _____

Which numbers did you try? _____

Which ones were hardest to find? _____

How did you work it out? _____

_____

Sam wondered if 13 was a factor of 105 but did not know what to put into the calculator to find out.

Explain to Sam what he could do to find out.

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DIAGNOSTIC TASK: Calculator Number Sentences

Operations
KU 8 for Grades 4–7 (ages 10–12+)

Purpose

To see if students can think of problems as number sentences. To see if students know how to rewrite number sentences in different but equivalent ways so they can solve them using a calculator

Materials

- Line Master: Calculator Number Sentences
- A calculator for each child

Instructions

Individual Interview: Ask the student if she/he would like to have the problems read aloud or to read the problems independently and write in the numbers sentence as she/he goes. Remind the student that it is not the answer to the problem that is required but the number sentence that would need to be keyed into the calculator.

Some students may use a trial-and-error approach. Note those students who use trial and error to choose the operation; which operations they try; and how they arrive at their final decisions.

Whole Class Activity: Read the problems to the students if they need this level of support. Remind them that it is not the answer to the problem that is required but the number sentence they would need to key into the calculator. Note any trial-and-error approaches as above.

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Name: _____

Grade: _____ **Date:** _____

Line Master **Calculator Number Sentences**

What would you key into your calculator to solve these problems?

The burger place had a special $18 Family Feast Deal. It was packed with people. There were about 6 people at each table and there were about 36 tables. About how many people were there?	A bulk box of gummy worms cost $5.40. There were 216 worms in the box. If there were 27 students in the class and the worms were given out, how many worms would each child get?	The Grade 6 students were selling cupcakes to raise funds for the school camp. The cupcakes cost $4.80 a box. The parents had baked 400 cupcakes and needed to put them into boxes of 8. How many boxes would they need?
Helen likes to walk 20 km every day. She walks at an average speed of 5 km/h. How far does she walk in 3 hours?	Jeremy picked 6 bags of apricots. If a 3 kg bag of apricots costs $12.60, what is the price per kilogram?	Apricots cost $4.30 a kilogram. If a box of apricots costs $12.60, how much must it weigh?
Every week at the ski hill each age group has 4 races. There were 6 times as many boys racing as girls. There were 18 girls and 36 parents. How many boys were there?	An enlarged picture is three times taller than its original. The picture is 180 mm tall. How tall was the original?	There were 15 kids at the barbecue. One of the older kids hid some prizes. Simon found 30 prizes. This was 6 times as many his sister Sharn. How many prizes did Sharn find?
John needed $2.00 to go to the dance. He had 4 pairs of shorts and 5 tops. How many outfits could he choose from?	Sarah was planting corn. The seeds cost $2.50 a packet. She had 75 seeds and wanted to plant 15 rows. How many seeds in each row?	A rectangle with an area of 208 cm² has one side 16 cm long. How long is the adjacent side?

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DIAGNOSTIC TASK: Hide the Jelly Beans

Computations
KU 1 and KU 2 for K–Grade 1 (ages 4–6)

Purpose

To see what students know about the numbers involved and what strategies they use to compute

Materials

- An opaque container
- Jelly beans or other collection of small objects all in one colour

Instructions

This is a game for two students to play together; both students can be observed at the same time.

Start with a small number of objects, e.g., five or six. Both students count the objects to agree on how many there are. One student closes his/her eyes while the other student hides some of the objects under the upturned container. The first student opens his/her eyes and says how many are hidden.

Observe the child doing the computation to see what he/she knows about the numbers and the strategy he/she uses to calculate how many are hidden. Increase or decrease the number of objects in the collection depending on the numbers the students are familiar with.

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DIAGNOSTIC TASK: How Many Want Jelly Beans?

Computations
KU 2 for Grades 1–3 (ages 6–8)

- How Many Want Jelly Beans? (Problem A) is suitable for Grades 1–2 (ages 6–7).
- How Many Want Jelly Beans? (Problem B) is suitable for Grades 2–3 (ages 7–8).

Purpose

To see if students know how to think of a number as a sum or difference in different ways

Materials

- Line Master: How Many Want Jelly Beans? (Problem A)
- Line Master: How Many Want Jelly Beans? (Problem B)

Instructions

Provide each student with the appropriate line master. Read it aloud to them to make sure they understand what they need to find out. Explain that they can just do it in their head or work it out by drawing or using some materials. After each student has found an answer, ask them to say how they worked it out and record their descriptions on their page.

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Name:_____

Grade: _____ **Date:** _____

Line Master **How Many Want Jelly Beans? (Problem A)**

At a party 5 children wanted red jelly beans and 8 children wanted yellow jelly beans. How many children altogether want jelly beans?

_____

_____

_____

_____

How did you work it out?

Write your explanation in this box.

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Name: _____

Grade: _____ **Date:** _____

Line Master **How Many Want Jelly Beans? (Problem B)**

At a party some of the children wanted red jelly beans.
5 more children wanted yellow jelly beans.
Now 13 children want jelly beans.
How many children want red jelly beans?

_____

_____

_____

_____

How did you work it out?

Write your explanation in this box.

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DIAGNOSTIC TASK: Find the Solutions

Computations
KU 1 through KU 6 for Grades 3–7 (ages 8–12+)

- Find the Solutions (Sets A and B) are suitable for Grades 3–4 (ages 8–9)
- Find the Solutions (Sets B and C) are suitable for Grades 5–7 (ages 10–12+)

Purpose

To see what strategies students use to solve problems requiring addition, subtraction, multiplication, or division

Materials

- Line Master: Find the Solutions (Set A)
- Line Master: Find the Solutions (Set B)
- Line Master: Find the Solutions (Set C)

Instructions

1. Provide each student with the appropriate line master(s). Read the questions with them to make sure they understand what they need to find out.

2. Explain to the students that they need only work on the problems that they think they can do. It is important to end the interview when the child indicates the questions are getting too hard. You may wish to copy only the left-hand set of questions for the students you believe might feel inadequate for not progressing to the end.

Individual Interview: Sit with a student as she/he works out each question. When she/he has an answer, ask about the strategy the student used. The focus is on revealing some of the repertoire the student has developed; commenting on whether the answer is right or wrong is inappropriate in this situation. It is important to end the interview when the student indicates that the questions are getting too hard. Record the numbers the students uses as she/he partitions, re-arranges, orders, and operates on a separate copy.

Whole-Class Task: Provide each student in the class with a copy of the questions. Ask them to read the question, and work out the answer in their head. Interview a few students of different abilities to find out how they thought of the numbers and how they worked each question out. Record the numbers they use as they partition, re-arrange, order, and operate on a separate copy.

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Name:_____

Grade: _____ **Date:** _____

Line Master **Find the Solutions (Set A)**

1. On the bus there are 25 children from Mr. Foster's class and 30 children from Mr. Singh's class. How many children are on the bus?	2. There were 100 paper clips in the box. We have used 37 of them. How many are left?
3. Your mother made 24 pancakes in the first batch and 18 in the second batch. How many pancakes did she make?	4. Sean's family is on the way to town. They have already travelled 15 km and the town is 65 km from their home. How far do they still need to travel to reach town?
5. There are 18 slices of bread in a loaf. How many slices will there be in 5 loaves?	6 There was $120 in $10 bills. How many bills should there be?

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Name: _____

Grade: _____ **Date:** _____

Line Master **Find the Solutions (Set B)**

1. In Joe's school each class has 25 children in it. The school has 16 classes. How many children are in the school?	2. Crystal has 375 newspapers to deliver. She has delivered 127. How many does she still have to deliver?
3. Every week Ted earns $235. Does he earn more or less than $900 every 4 weeks? How do you know?	4. Jeremy has to deliver 226 newspapers. How many more does he need to deliver until all of the 537 newspapers in his paper route are delivered?
5. Abi has two short paper routes. She delivers 374 in one route and 227 in the other. How many newpapers does she deliver altogether?	6. There were 1035 newspapers to deliver and 10 delivery people. How many papers did they each deliver?

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Name:_____

Grade: _____ **Date:** _____

Line Master **Find the Solutions (Set C)**

25 + 30	25 x 16
24 + 18	375 – 124
18 x 5	226 + __ = 537
100 – 3	374 + 227
15 + __ = 65	1035 split into groups of 10
120 split into groups of 10	27 x 16
235 x 4 Estimate. Will the answer be more or less than 900? Why?	

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DIAGNOSTIC TASK: Buying Apples

Computations for Grades 4–7 (ages 9–12+)

Purpose

To see if students know how to use place value and basic number facts to calculate with whole and decimal numbers

Materials

Line Master: Buying Apples

Instructions

Provide each student with a copy of the problem and ask them to record how they solved it. Record the computational strategies each student used and what each student knows about numbers and operations.

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Name: _____

Grade: _____ **Date:** _____

Line Master **Buying Apples**

Apples
$3.20 per kilogram



Evan bought 0.4 kilograms of apples.

How much did he pay? _____

Explain your answer.

_____

_____

_____

_____

_____

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Think Board

Other number sentences to solve the same problem

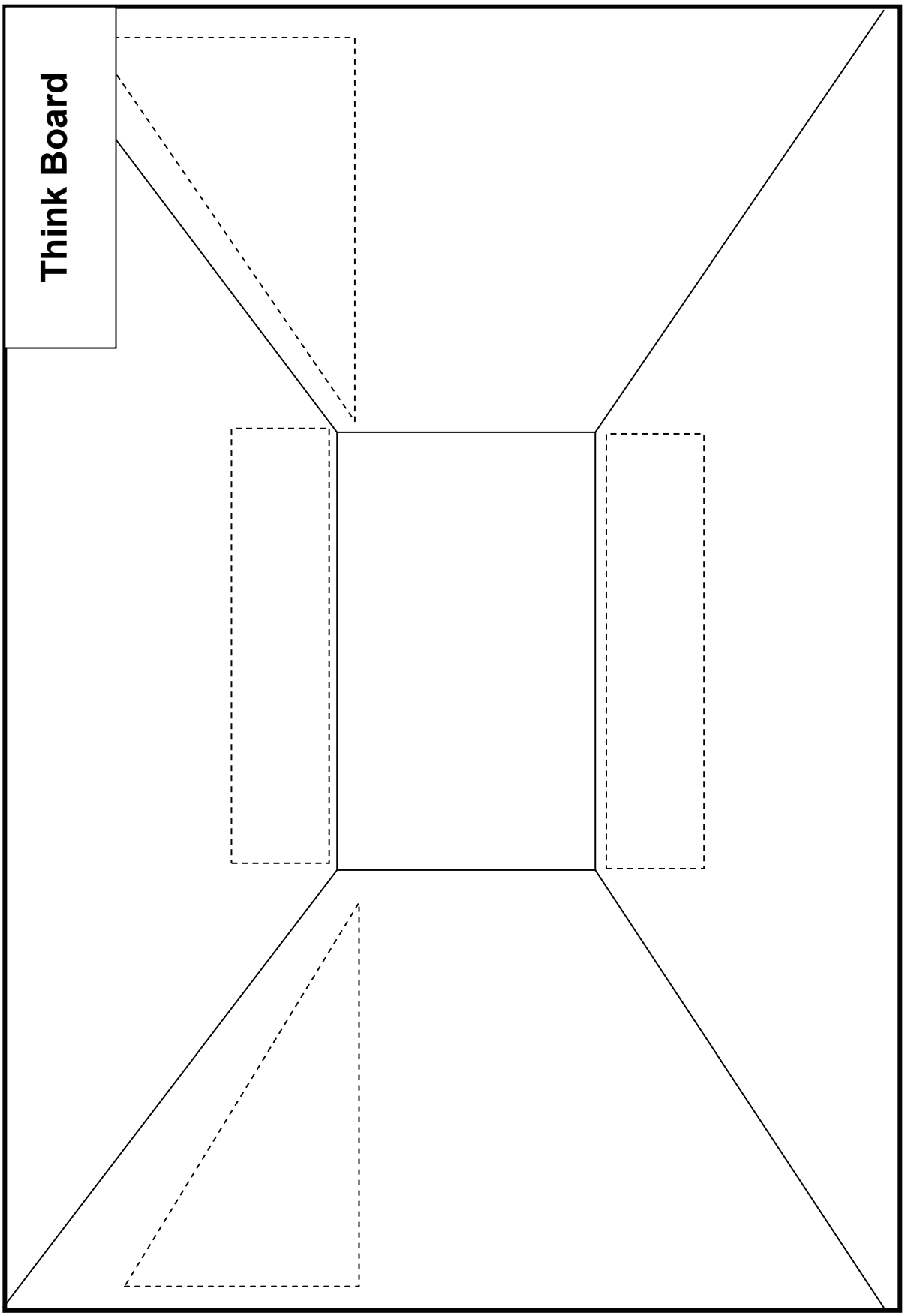
Show the problem
Draw a picture or use things to show the problem part of the story.

THE STORY PROBLEM

Write a number sentence
Write numbers and signs to show how to solve the problem part of the story.

Diagram
Use marks or dots to show the numbers of things, then use a sign to show what to do with the marks or dots to solve the problem.

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Planning Master: Grades K–1

Curriculum expectation/outcome:

1. What is my teaching goal?

Key Understanding:

2. How will I find out what my students know and believe?

Diagnostic Task:

3. What do my students know and believe?

Diagnostic Map: Phases of thinking summaries

Emergent: The child recognizes that numbers may be used to signify quantity.
- At the end of the Emergent phase for this KU, students...

Matching: The child uses one-to-one relations to share and count out.
- At the end of the Matching phase for this KU, students...

Quantifying: The child uses part-part-whole relations for numerical quantities.
- At the end of the Quantifying phase for this KU, students...

Partitioning: The child uses additive thinking to deal with many-to-one relations.
- At the end of the Partitioning phase for this KU, students...

5. What evidence of learning do I see and hear?

Observations and next steps:

4. What Tasks and Focus Questions will advance their learning?

Sample Learning Activity:
Resource Book and page:
Focus Questions and paraphrasing:

…to move students from the Emergent phase to the Matching phase:

…to move students from the Matching phase to the Quantifying phase:

…to move students from the Quantifying phase to the Partitioning phase:

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Planning Master: Grades 2–5

Curriculum expectation/outcome:

1. What is my teaching goal?

Key Understanding:

2. How will I find out what my students know and believe?

Diagnostic Task:

5. What evidence of learning do I see and hear?

Observations and next steps:

What do my students know and believe?

Diagnostic Map: Phases of thinking summaries

Matching: The child uses one-to-one relations to share and count out.
- At the end of the Matching phase for this KU, students...

Quantifying: The child uses part-part-whole relations for numerical quantities.
- At the end of the Quantifying phase for this KU, students...

Partitioning: The child uses additive thinking to deal with many-to-one relations.
- At the end of the Partitioning phase for this KU, students...

Factoring: The child thinks both additively and multiplicatively about numerical quantities.
- At the end of the Partitioning phase for this KU, students...

4. What Tasks and Focus Questions will advance their learning?

Sample Learning Activity:
Resource Book and page:
Focus Questions and paraphrasing:

…to move students from the Matching phase to the Quantifying phase:

…to move students from the Quantifying phase to the Partitioning phase:

…to move students from the Partitioning phase to the Factoring phase:

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Planning Master: Grades 4–8

Curriculum expectation/outcome:

1. What is my teaching goal?

Key Understanding:

2. How will I find out what my students know and believe?

Diagnostic Task:

3. What do my students know and believe?

Diagnostic Map: Phases of thinking summaries

Quantifying: The child uses part-part-whole relations for numerical quantities.
- At the end of the Quantifying phase for this KU, students...

Partitioning: The child uses additive thinking to deal with many-to-one relations.
- At the end of the Partitioning phase for this KU, students...

Factoring: The child thinks both additively and multiplicatively about numerical quantities.
- At the end of the Partitioning phase for this KU, students...

Operating: The child can think of multiplications and divisions in terms of operators.
- At the end of the Partitioning phase for this KU, students...

5. What evidence of learning do I see and hear?

Observations and next steps:

4. What Tasks and Focus Questions will advance their learning?

Sample Learning Activity:
Resource Book and page:
Focus Questions and paraphrasing:

…to move students from the Quantifying phase to the Partitioning phase:

…to move students from the Partitioning phase to the Factoring phase:

…to move students from the Factoring phase to the Operating phase:

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