



First Steps in Mathematics

Number

Diagnostic Tasks – Student Worksheets

Understand Whole and Decimal Numbers

Understand Operations

Calculate

***First Steps* in Mathematics: Number**

Diagnostic tasks - Student worksheets

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Introduction

First Steps in Mathematics: Diagnostic tasks - Student worksheets

Task review and planning sessions are a critical component of using First Steps in Mathematics. After completing each First Steps in Mathematics content session, teachers should use some of the diagnostic tasks with their students and then work with a small group of colleagues to review the completed tasks and plan for further learning.

Diagnostic **TASK**

FOCUS

Understand Numbers

- Key Understanding 4
- Key Understanding 5

Up To And Over 100

Years/Grades 3–7

Purpose

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

Producing work samples

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

Interview individual students when:

- a) the student writes an incorrect number or a number incorrectly. Ask them to 'say' that part of the sequence so that you are able to hear what they actually think the pattern is.
- b) the student generally experiences difficulty when working with numbers.

Up To And Through the Hundreds

Years/Grades 3–7

Purpose

To see if children know the pattern in the way we say numbers, up to and through all of the hundreds

Producing work samples

Provide each child with the provided grids and ask them to fill them in to provide the missing numbers

Interview individual students when:

- a) the student writes an incorrect number or a number incorrectly. Ask them to 'say' that part of the sequence so that you are able to hear what they actually think the pattern is.
- b) the student generally experiences difficulty when working with numbers.

Up To And Through The Hundreds

Name _____ Year/Grade _____ Date _____

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							

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							

Diagnostic TASK

FOCUS

Understand Numbers

- Key Understanding 1

Counting Principles

Years/Grades K–2

Purpose

To assess children's understanding of the principles of counting.

Equipment

General classroom equipment.

Producing work samples

Counting Principles 1, 2 and 3: Show a child a scattered collection of 8 items.

Ask: *Can you tell me how many (e.g. animals) are here?*

Observe if the child:

- says the number names in the right order
- moves the items or keeps track of their starting point?

Counting Principle 5: When the child has completed the count, notice whether they emphasise the last word. Even if they have emphasised the last number ask the next question.

Ask: *How many (animals) are there?*

Observe if the child:

- recounts from the start
- repeats the last number word without recounting

Counting Principle 4: Place the items into a line

Ask: *How many (animals) are there?*

Observe if the child:

- recounts from the start
- restates the number without counting

If the child finishes the count with a different number from the original count

Ask: *So are there (the first number they said) or are there (the second number they said)?*

Counting Principle 3: Take a new collection of items place in a line and ask the child 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 (point to the middle item) make this number one.*

Observe if the child:

- counts from the middle item and includes all of the items
- counts from the middle, omits the first few items in the row.

Diagnostic TASK

FOCUS

Understand Numbers

- Key Understanding 1

Get Me Task

Years/Grades K–2

Purpose

To see if children choose to use counting when asked to get a number of items.

Equipment

General classroom equipment

Procedure

Tell the child that you need some blocks to make a house.

Ask: ‘Can you get me 7 blocks?’

Observe

Does the child:

- choose to use counting to help find the right amount?
- take a handful, ignoring the amount requested?

Use all 7 blocks and build a house. Then ask: *Can you get me 12 spots (counters or squares) for me to make a path to my house please?* Observe the child again using the above criteria. Set out the path around the house and take some time to engage the child in a short play time.

Get Me Task

They have to remember the number word, then count out the number of items, and monitor the requested number while they count.

If children do not know the number string well their working memory is taken up with remembering the sequence and they tend to forget the number they were asked to get.

Baroody A. J., and Wilkins J.L.M. (1999) The Development of Informal Counting, Number and Arithmetic Skills and Concepts. In *Mathematics in the Early Years, Birth to Five*. Ed. Copely, J., NCTM, Reston, p 48-65.

Diagnostic TASK

FOCUS

Understand Numbers

- Key Understanding 1

Ice Cream Task

Years/Grades 1–3

Purpose

To see if children choose to use counting in order to make an equivalent set.

Equipment

A box filled with paper cut out pictures of ice creams.

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.

Producing work samples

Show the child the box of ice creams, place it on a desk some distance away and tell them it is an ice cream shop.

Say to the child,

- *All of these children would like an ice cream.*
- *Can you go to the ice cream shop and get just enough ice creams for all the children?*

Repeat the instruction for the different sized groups.

Observe

Does the child:

- count the starting group?
- use the count of the starting group to count the number of items to be selected?
- just grab an amount of the item?
- choose to give out one at a time, with no counting?

Diagnostic TASK

FOCUS

Understand Numbers

- Key Understanding 1

Skip Counting

Years/Grades 1–4

Purpose

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

Equipment

15 small things, e.g. 15 nuts.

Producing work samples

Give a child 15 small things, e.g. 15 nuts.

Ask: *How many nuts have I given you? How did you decide that?*

Observe if the child:

- counts the 15 nuts accurately, by twos, to 14 then adds the one, stop the interview here.
- counts by ones

If the child counts by ones

Ask: *Will you get the same answer if you count by twos? Count by twos to find out.*

Observe if the child:

- keeps track of the 'twos' and what they do when they reach the remaining single nut.
- at the end of the count, notice if they call the single nut the next number in the 'twos' sequence regardless of whether there are two there or one. For example: Does the child 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 then continue with the next part.

Tip out a collection of more than 50 objects, e.g. pop sticks.

Ask: *How many pop-sticks do you think are there? How could you know exactly how many are there?*

If the child: begins to count the whole collection by ones.

Ask: *How many pop sticks will there be if you count by fives?*

Diagnostic TASK

FOCUS

Understand Numbers

- Key Understanding 6

Calculate

- Key Understanding 4

How Did You Do It?

Years/Grades 3–7

Purpose

To see whether children can use partitioning based on place value to solve a calculation mentally.

Producing work samples

Whole class or small group activity

This lesson needs to be modelled a number of times with simple calculation examples to give children practice in recording their mental strategies before using the examples below. Write one number sentence on the board, e.g. $13 + 16 =$. Allow children time to work out the answer and then ask them to explain how they worked it out. Listen to and record children's strategies on the board including counting strategies if children mention them. After you have modelled the process a number of times, present children one number sentence at a time from either Set A or Set B.

Set A	Set B
$13 - 6$	$84 - 67$
$24 + 16$	8×7
$26 + 37$	27×4
$100 - 38$	$375 + 227$
4×8	$537 - 226$
$15 \div 3$	25×16
$57 + 29$	$189 \div 9$

Children write the number sentence on their page, solve it mentally and then record their strategy in words/and or numbers. If children cannot solve the problem mentally, tell them to work it out on the paper in a way that makes sense to them or use materials if they need to.

Individual Interview

Present the child with one written number sentence. Allow the child time to solve it and then ask them to tell you what they did in their head to find the answer. Record what the child actually says and does. It is important to record their words accurately in order to reflect on what they are thinking rather than what you assume they are thinking.

Diagnostic **TASK**

FOCUS**Understand Numbers**

- Key Understanding 2

The More Game

Years/Grades K–1

Purpose

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

Equipment

Cards made with dots - from 1 through to 6 dots in regular and scattered arrangements.

Producing work samples

A card game for two players.

Distribute all the cards to the players.

The cards are held 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.

Diagnostic TASK

FOCUS

Understand Numbers

- Key Understanding 2

Subitising

Years/Grades K–2

Purpose

To assess children's ability to subitise quantities up to six.

Equipment

Six blocks (two centimetre cubes)

An ice-cream container or similar

Producing work samples

Place two blocks in a container, show it briefly to the child.

Ask: *How many blocks?*

Then add some or take some to show the following numbers, asking the child to tell you how many each time.

Remember to give the child a brief look so that they are forced to use subitising rather than counting.

Present the items in a non-sequential order, e.g. 3, 2, 1, 5, 4, 6

Diagnostic Map

When might a child be able to subitise?

Diagnostic **TASK**

FOCUS**Understand Numbers**

- Key Understanding 2

Hide the Jelly Beans

Years/Grades K–2

Purpose

To see whether children can partition quantities.

Equipment

Provide a pair of children with a collection of 6 jellybeans or similar small identical objects, which are all the same colour, and an opaque container, e.g. an ice-cream container.

Producing work samples

This is a game for a pair of children to play together and both children may be observed at the same time.

Start with a small number of objects, for example five or six.

Both children agree on how many objects there are by either counting or subitising.

One child closes their eyes while the other child hides some of the objects under the upturned container.

The first child opens their eyes and says how many are hidden.

Recording the responses

Observe the child doing the calculation to see what they know about the numbers and the strategy they use to calculate how many are hidden. You may need to increase or decrease the number of objects in the collection depending on the numbers the children are familiar with.

Diagnostic **TASK**

FOCUS**Understand Numbers**

- Key Understanding 2

Emus/Rabbits/Sheep

Years/Grades 2–4

Emus may be replaced by any animal that lives in small groups, e.g. monkeys in two trees.

Purpose

To find out whether children can partition using materials, or with numbers

Equipment

Sheet of paper

Collections of countable objects if necessary

Producing work samples

Have the children create partitions of the same size collection in response to a story, e.g. read 'Edward the Emu' or 'Edwina The Emu' by Sheena Knowles, 'Peter Rabbit' series by Beatrix Potter.

Ask the child to show all the different ways they could put 12 emus/rabbits in two yards/cages. At first limit the child to paper and pen, if they struggle, then suggest that they use some materials to help.

Observe if the child:

- uses numbers alone by recalling basic facts
- uses numbers alone, moving 'one' from this number to that number
- uses numbers alone, counting on from one number to find the next
- draws lines, dots or other symbols and counts, and then record their partitioning
- uses materials to count and then record their partitioning.

Diagnostic TASK

FOCUS**Understand Numbers**

- Key Understanding 5

Read, Write and Say Whole Numbers Years/Grades 3–7

Purpose

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

Producing work samples

Whole class or small group observations

Provide each student with copies of the 'Read, Write and Say' worksheet.

Call out the following numbers for children to write for questions 1–6.

1. Sixty three
2. One thousand twenty
3. Twenty six thousand fifteen
4. Five hundred six thousand fifteen
5. One million five
6. Five billion, thirty six million, four hundred seven thousand four.

Children complete the rest of the sheet independently.

If needed, interview individuals and ask them to explain how they knew to write the number in the way that they did. The purpose of this is to uncover any invented rules that children may be using.

Read, Write and Say Numbers

Name _____ Year/Grade _____ Date _____

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

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

- | | |
|----------|----------|
| 1. _____ | 4. _____ |
| 2. _____ | 5. _____ |
| 3. _____ | 6. _____ |

Write these numbers in words:

504	
1,768	
250,000	
13,648	
6,003	
13,806,009	

Diagnostic TASK

FOCUS

Understand Numbers

- Key Understanding 5

Dinosaurs

Years/Grades 3–7

Purpose

To examine children's understanding of the meaning of the individual digits in a two digit number

Equipment

The Dinosaur Task sheet and two different coloured pencils or pens, e.g. green and red.

Producing work samples

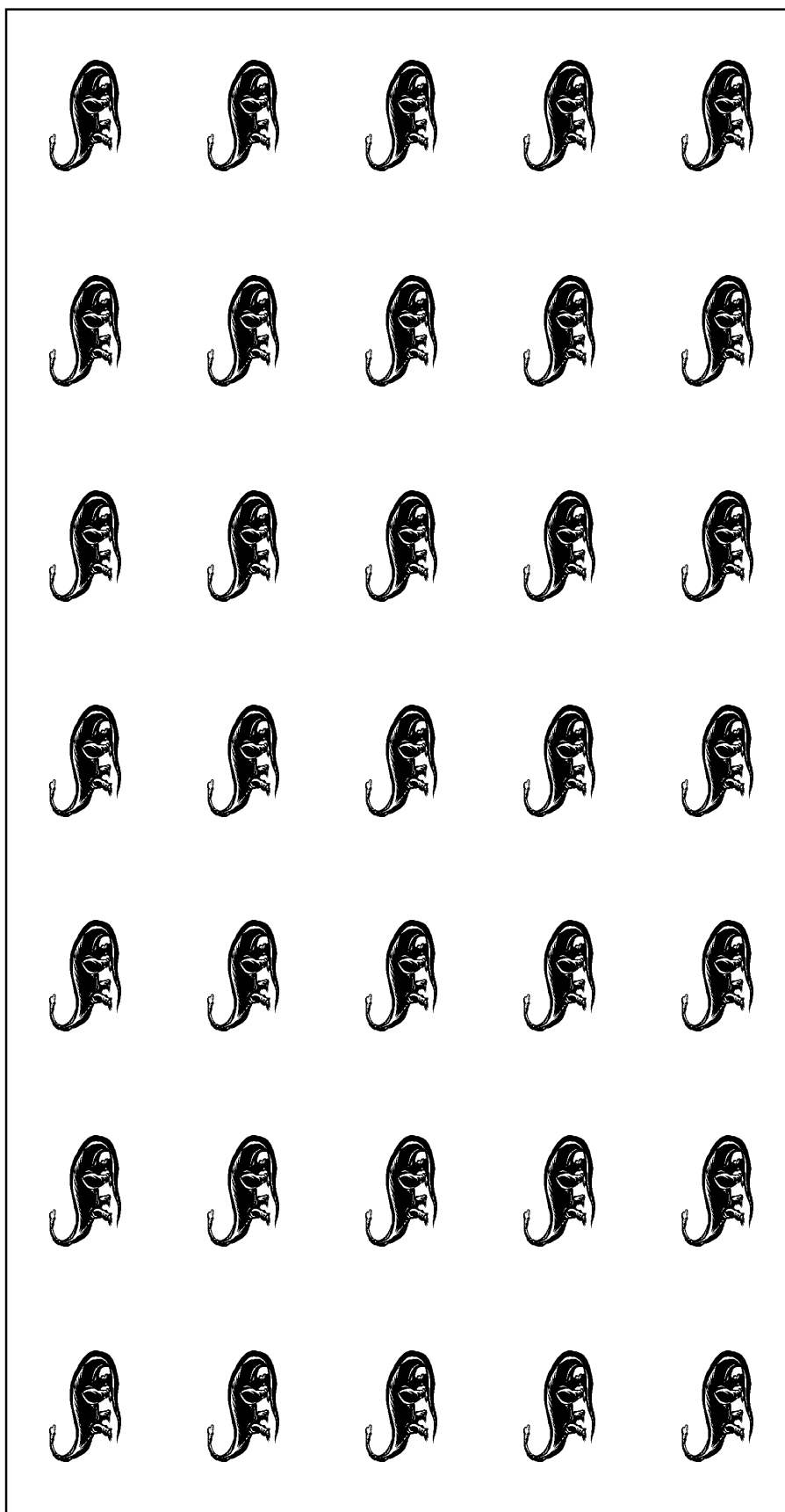
Ask children to work out how many dinosaurs on the page. Children write how many in the space provided.

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

When giving the following instructions it is important that you **do not** say the words '**three**' or '**five**'.

- 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.*
- 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.*

Name _____ Year/Grade _____ Date _____



How many dinosaurs are here? _____

Diagnostic TASK

FOCUS

Understand Numbers

- Key Understanding 5

52 and 43 Lollies/Candies/Sweets

Years/Grades 3–7

Purpose

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

Producing work samples

52 Lollies

Provide each student with copies of the Lollies/Candies/Sweets worksheet. Make sure that students understand the sweets can be bought as single sweets or in rolls of ten.

- **Ask:** *How many lollies(candies/sweets) are represented altogether?*
- **Talk** with the class about their answers. Make sure that all students agree that there are 52. Observe students as they record 52 on their page.
- **Write** '52' on the board in view of all students.
- **Point** to the '2' in the '52' on the board and say: *Use a blue pen to colour in what this part of the '52' means in the drawing.* It is important not to mention the word 'two' as you point.
- **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.* It is important not to mention 'five' or 'fifty' as you point.

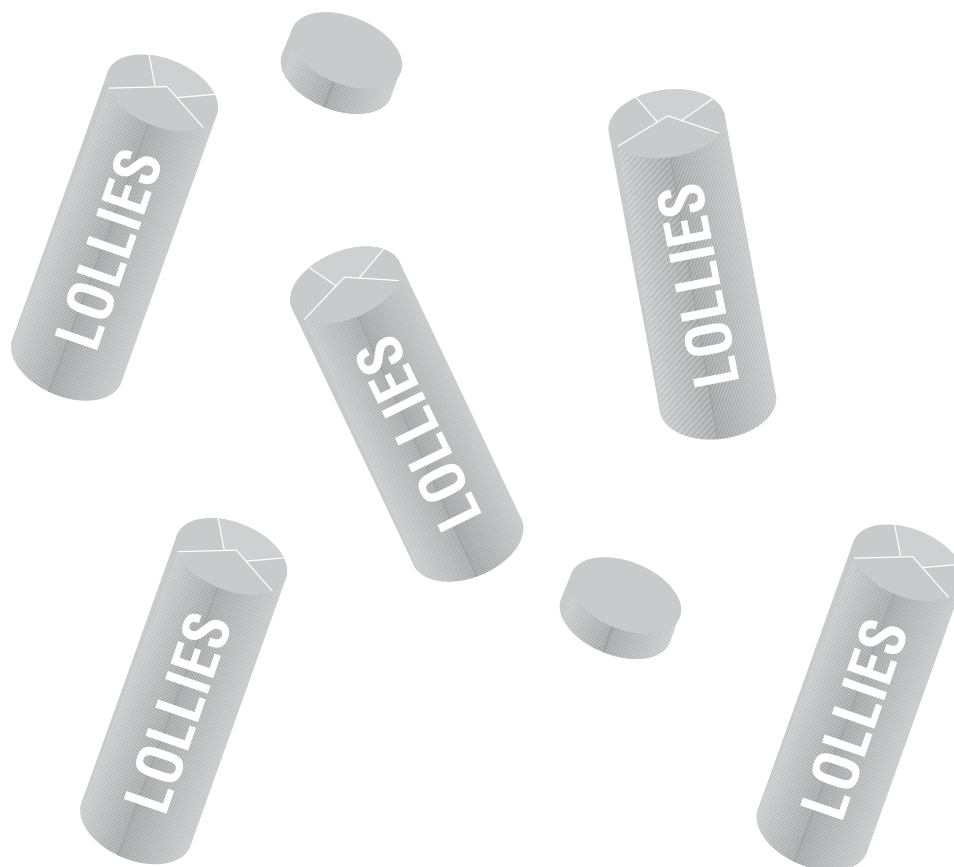
43 Lollies

- **Ask:** *How many lollies(candies/sweets) are represented altogether?*
- **Talk** with the class about their answers. Make sure that all students agree that there are 43. Observe students as they record 43 on their page.
- **Write** '43' on the board in view of all students.
- **Point** to the '3' in the '43' on the board and say: *Use a blue pen to colour in what this part of the '43' means in your drawing.* It is important not to mention 'three' as you point.
- **Point** to the '4' in '43' on the board and say: *Use a red pen to colour in what this part of the '43' means in your drawing.* It is important not to mention 'four' or 'forty' as you point.

Lollies/Candies/Sweets

Name _____ Year/Grade _____ Date _____

Lollies can be bought as single lollies or in rolls of ten as shown here.



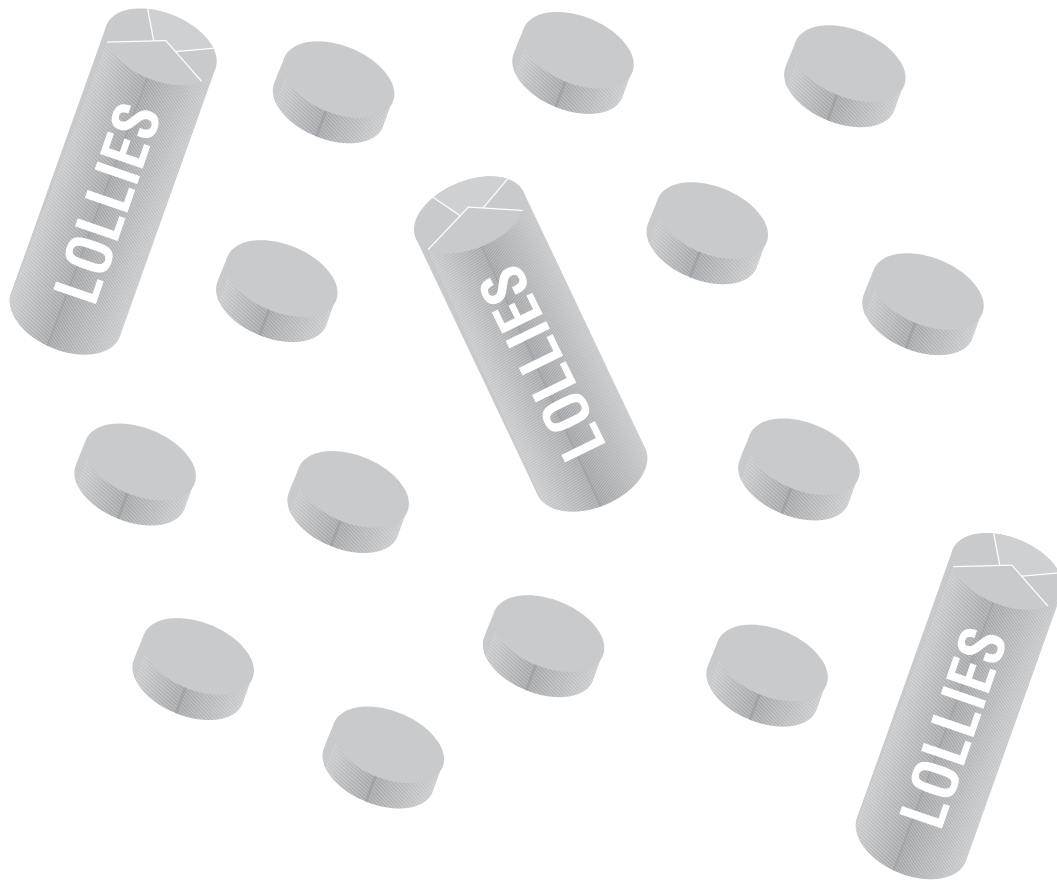
How many lollies are shown here? _____

Task based on Ross, S., 1989, Parts and Wholes and Place Value: A Developmental View, *Arithmetic Teacher*, 36 (6), p 47–51

Lollies/Candies/Sweets

Name _____ Year/Grade _____ Date _____

Lollies can be bought as single lollies or in rolls of ten as shown here.



How many lollies are shown here? _____

Task based on Ross, S., 1989, Parts and Wholes and Place Value: A Developmental View,
Arithmetic Teacher, 36 (6), p 47–51

Diagnostic TASK

FOCUS

Understand Numbers

- Key Understanding 5
- Key Understanding 7

800 Game

Years/Grades 5–7

Purpose

To see the extent of children's understanding of the relationship between the places. For example, do the students know that 80 is ten times greater than 8 and ten times smaller than 800.

Equipment

800 sheet with cards as shown, scissors and a calculator

Producing work samples

Whole class or small group activity

To make the game easier use only two zeros with the eight and omit the decimal point. Instructions for players:

- Each person makes a number with their cards.
- Decide how you could change the value of your eight so that it is equal to the value of your partner's eight.
- Use a calculator to try out your suggestion.
- Try some more examples.
- Talk to other players. Are they doing it the same way as you?
How do you account for any differences?

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

800 Game

You will need: 800 cards as shown, scissors and a calculator.

0	0	0	●	8
0	0	0	●	8

1. Cut out the cards so that each person has six zeros, a decimal point and an eight.
2. Each person makes a number with their cards.
3. Decide how you could change the value of your eight so that it is equal to the value of your partner's eight.
4. Use a calculator to try out your suggestion.
5. Try some more examples.
6. Talk to other players. Are they doing it the same way as you?
How do you account for any differences?

0	0	0	●	8
0	0	0	●	8

Diagnostic **TASK**

FOCUS**Understand Numbers**

- Key Understanding 5
- Key Understanding 7

Circle the Biggest

Years/Grades 6 and up

Purpose

To see whether children are able to compare numbers using multiplicative relationships.

Producing work samples

Whole class or small group activity

Distribute the worksheet and ask children to write a full explanation of their reasoning for each choice. You may need to conduct some individual interviews where children's reasoning is not clear from the written explanation.

Circle the Biggest

Name _____ Year/Grade _____ Date _____

1. Circle the biggest number:

37

370

How do you know it is bigger?

How many times bigger is it?

2. Circle the smallest number:

647

6470

How do you know it is smaller?

How many times smaller is it?

3. Circle the biggest number:

0.37

0.0037

How do you know it is bigger?

How many times bigger is it?

Diagnostic **TASK**

FOCUS

Understand Numbers

- Key Understanding 5

116 Lollies/Candies/Sweets

Years/Grades 6 and up

Purpose

To explore whether students can produce standard and non-standard partitions of a quantity.

Producing work samples

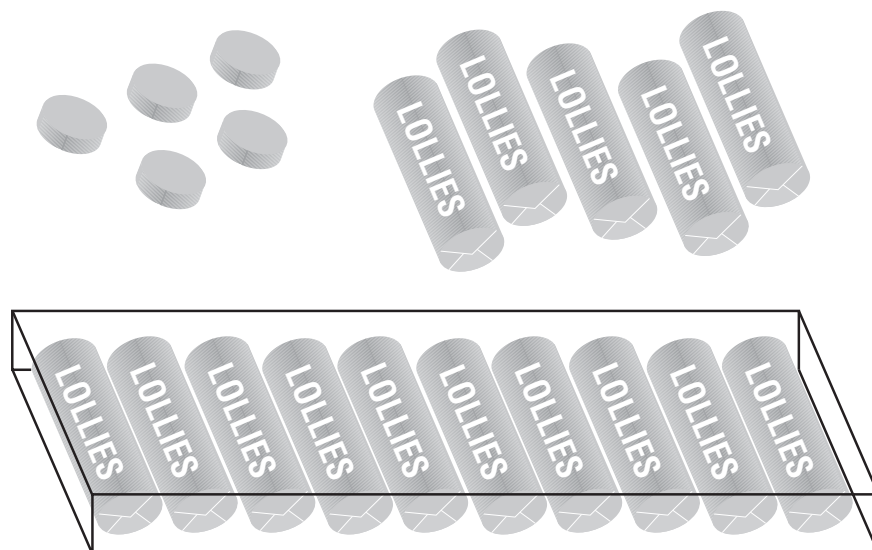
Whole class or small group observations

Provide each student with copies of the 116 Lollies/Candies/Sweets task. Read the introductory sentence to make sure all students understand that lollies/candies/sweets can be bought as single lollies/candies/sweets, in rolls of ten or boxes of 100 (10 rolls of ten). Ask the students to complete the task independently.

116 Lollies/Candies/Sweets

Name _____ Year/Grade _____ Date _____

Lollies can be bought as single lollies, in rolls of ten or in boxes of 100 (like in the picture here).



How many different ways could you buy 116 lollies? Draw or write your answer.

Diagnostic TASK

FOCUS

Understand Numbers

- Key Understanding 6

Flexible Numbers

Years/Grades 6–8

Purpose

To explore children's understanding that numbers can be partitioned in many ways (and how), and if children can produce non-standard partitions of a number.

Producing work samples

Whole class or small group activity

Children complete the worksheet individually. Interview some individuals and ask them to explain how they knew to make the number in the way that they did.

Children cut the numbers page into separate cards and use the cards to make each of these numbers: 312, 400, 454, 401, 204, 61 in as many ways as they can. They record the ways they made each number on the worksheet and then put the cards back into the centre to make the others.

Teaching place value concepts separately as a prerequisite to double digit addition and subtraction is ineffective and unnecessary. ... In fact, manipulative materials may actually detract from thinking because tasks are too easy to do with the materials.

Ross, S., 1989, Parts and Wholes and Place Value: A Developmental View, *Arithmetic Teacher*, 36 (6), p 47–51

Flexible Numbers

Name _____ Year/Grade _____ Date _____

Use the cards on the Flexible Numbers Cut Out Sheet 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 from the card sheet.

5 hundreds

3 tens

2 ones

61

312

454

Flexible Numbers

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

Diagnostic **TASK**

FOCUS**Understand Numbers**

- Key Understanding 7

Apples and Money

Years/Grades 4–7

Purpose

To see whether students can recognise and interpret a decimal number in an unusual context without clues or prompts. Notice that the word 'decimals' doesn't appear on the task.

Producing work samples

Whole class or small group activity

Depending on the age of your students, give them either both examples together, or if they are younger students, one at a time. After distributing the worksheet ask students to write a full explanation of their reasons for each of their answers.

You may need to conduct some individual interviews where children's reasoning is not clear from the written explanation.

Name _____ Year/Grade _____ Date _____

Apples

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

Say how many apples you think you would have to give me if I asked for **85.6** apples?
Explain how you worked this out?

Explain how many apples you think you would have to give me if I asked for **2.19** apples?

Money

Jacob had to share \$33 among 8 people.

He used his calculator and pressed $33 \div 8 =$ and this is what he saw
on his calculator: **4.125**

How much money should he give each person? _____

Explain how you decided.

How much money would be left over? _____

Diagnostic TASK

FOCUS

Understand Numbers

- Key Understanding 4
- Key Understanding 7

Library Books

Years/Grades 5–7

Purpose

To find out whether students can compare and order decimal fractions with different numbers of decimal places.

Producing work samples

Whole class or small group activity

Distribute the worksheet and ask students to write a full explanation of their reasons for each of their answers. Read through the task with the students and if necessary answer student's questions to clarify the task. Be careful to clearly paraphrase the question rather than providing hints of how to complete the task. After students have completed the sheet, you may need to conduct some individual interviews where their reasoning is not clear from the written explanations.

Name _____ Year/Grade _____ Date _____

Library Books

Sonya said, "When we put books on the library shelf we put **65.6** before **65.125** because 6 comes before 125." But Tao didn't agree.

Who do you think is right? _____

Explain why you think this?

Diagnostic TASK

FOCUS

Understand Numbers

- Key Understanding 7

Digit Values and Number Sequence

Years/Grades 6–7

Purpose

Digit Values: To see whether students understand how the values in each place can be renamed.

Number Sequence: To see whether students understand the multiplicative relationships between the numbers in the given sequence.

Producing work samples

Whole class or small group activity

Depending on the age of your students, give them either both examples together, or if they are younger students, one at a time. After distributing the worksheet ask students to write a full explanation of their reasons for each of their answers. You may need to conduct some individual interviews where children's reasoning is not clear from the written explanation

Number Sequence: It is best to give this task without a calculator to begin with to see if students know what is needed without experimentation. If they do not know, then make a note of this then you can provide a calculator and ask them to try and find out what they can enter. If they don't understand what 'generate a number sequence' means they are likely to just tell you how to enter each of those numbers in the calculator, rather than suggesting a single operation on 2 that would result in 0.2 and then 0.02 and so on.

Name _____ Year/Grade _____ Date _____

Digit Values

Alan said the 2 in 0.203 means *2 tenths* but Kerryn said the 2 also means *20 hundredths*, and Adrian said the 2 means *200 thousandths*. What do you think?

How could the 2 in 0.203 mean different fractions?

Number Sequence

Explain how you could use a calculator to generate this number sequence? (That is, if you enter 2 and then press some keys and then the = key you will get 0.2, and so on.)

2 0.2 0.02 0.002

Diagnostic **TASK**

FOCUS

Understand Numbers

- Key Understanding 7

Decimal Numbers

Years/Grades 6–7

Purpose

To find out whether students know the meaning of zeros in decimal numbers and the relationship between decimal numbers and fractions.

Producing work samples

Whole class or small group activity

Distribute the worksheet and ask students to write a full explanation of their reasons for each of their answers. Read through the task with the students and if necessary answer student's questions to clarify the task. Be careful to clearly paraphrase the question rather than providing hints of how to go about the task. After students have completed the sheet, you may need to conduct some individual interviews where their reasoning is not clear from the written explanations.

Name _____ Year/Grade _____ Date _____

Decimal Numbers

Kevin, Yenchae and Marie looked on the board in the next classroom and saw:

0.5 0.05 0.50

Those three numbers all mean exactly the same!

Kevin _____

No, they don't! Two of them mean the same amount, but the other one means something really different

Yenchae _____

I think you're both wrong, they all have to mean something different, they can't be the same amount!

Marie _____

Who do you think is right? (Tick which one)

Explain what the numbers mean and say how they are the same or different. (If you like you can use diagrams to help explain.)

0.5

0.05

0.50

Corey said 0.5 is $\frac{1}{2}$ (written as a simple or unit fraction).

So how would you write 0.05 as a simple (or unit) fraction?

What about 0.50? And 0.005?

Explain how you worked out these fractions.

From: Tomazos, D., 2002, *Knowing What They Know*, Department of Education, Western Australia, East Perth

Diagnostic TASK

FOCUS

Understand Numbers

- Key Understanding 1
- Key Understanding 2

Calculate

- Key Understanding 1

How Many?

Years/Grades K–3

Purpose

To find out which strategies children have available to them to solve an addition subtraction, multiplication and division problems.

Equipment

Provide each child with the word problem work sheet and access to a range of familiar counting materials.

Producing work samples

Whole class or small group observations

Tell them the problem and allow plenty of time for them to work it out.

Ask children to work out the answer in their head if they can. If a child appears to be struggling, say *Would you like to use your pencil and paper to jot something down?*

If this doesn't help, then suggest that they use a diagram to help. If they still struggle, then offer them a selection of materials.

Ask children to write a sentence to explain what they did in their head, with their pencil and paper, with their diagram or with the materials, to get their answer.

Individual interviews

Explain that for this activity they can work it out in their head or if they can't do it in their head they can use pencil and paper or some materials. Read the problem to the children to make sure they understand what they need to find out. Ask the child to explain or draw how they worked out the answer.

Record what the child does to arrive at an answer then ask them to say how they worked it out. Record their descriptions on their work sheet.

How Many? 1

Name _____ Year/Grade _____ Date _____

Ellen had 4 tomatoes and then picked 3 more tomatoes from the garden.
How many does she have now?

How did you work it out?

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

How did you work it out?

The children needed lots of beanbags for a game. In one basket there were 13 beanbags.
In another basket there were 8 beanbags. How many beanbags did they have altogether?

How did you work it out?

How Many? 2

Name _____ Year/Grade _____ Date _____

There were 8 dogs playing and then 5 ran away. How many dogs are there now?

How did you work it out?

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

How did you work it out?

The children had 15 beanbags for a game. There were 6 green beanbags and the rest were red. How many beanbags were red?

How did you work it out?

How Many? 3

Name _____ Year/Grade _____ Date _____

Dirk has 5 bags of jelly beans with 3 jelly beans in each bag. How many jelly beans does he have all together? _____

How did you work it out?

Jesse has 12 bags of jelly beans with 5 jelly beans in each bag. How many jelly beans does he have all together? _____

How did you work it out?

How Many? 4

Name _____ Year/Grade _____ Date _____

Desiree has 12 Jelly Beans. She wants to put 3 Jelly Beans in each bag. How many bags would she need? _____

How did you work it out?

Tilopa has 12 lolly pops. She wants to share the lolly pops into 4 bags with the same number in each bag. How many lolly pops are in each bag? _____

How did you work it out?

Diagnostic TASK

FOCUS

Understand Numbers

- Key Understanding 1

Calculate

- Key Understanding 5

Number Tiles

Years/Grades 1–7

Purpose

To see whether students can use combinations to ten to add one and two digit numbers.

Equipment

A collection of number tiles, with numbers 1–10 and numbers 12, 14, 26 and 38.

See attached sheet

Producing work samples (Individual Interview)

Put out the tiles, 1, 3 and 9 and ask the child to add the numbers on the tiles.

Put out the tiles 6, 4 and 7 and ask the child to add the numbers on the tiles.

Put out the tiles 2, 10, 5 and 8 and ask the child to add the numbers.

If the child is able to use combinations to ten then continue with the next examples.

Put out all the tiles from 1–10 and ask the child to add all of the numbers.

Put out the tiles, 12, 14, 26 and 38 and ask the child to add all of the numbers.

Recording responses

After the child has found an answer ask them to explain how they did it. Record what they say on the attached sheet, noticing whether they use the combinations to ten.

Number Tiles Recording Sheet

Name _____ Year/Grade _____ Date _____

Put out the tiles **1, 3 and 9** and ask the child to add the numbers on the tiles.

Put out the tiles **6, 4 and 7** and ask the child to add the numbers on the tiles.

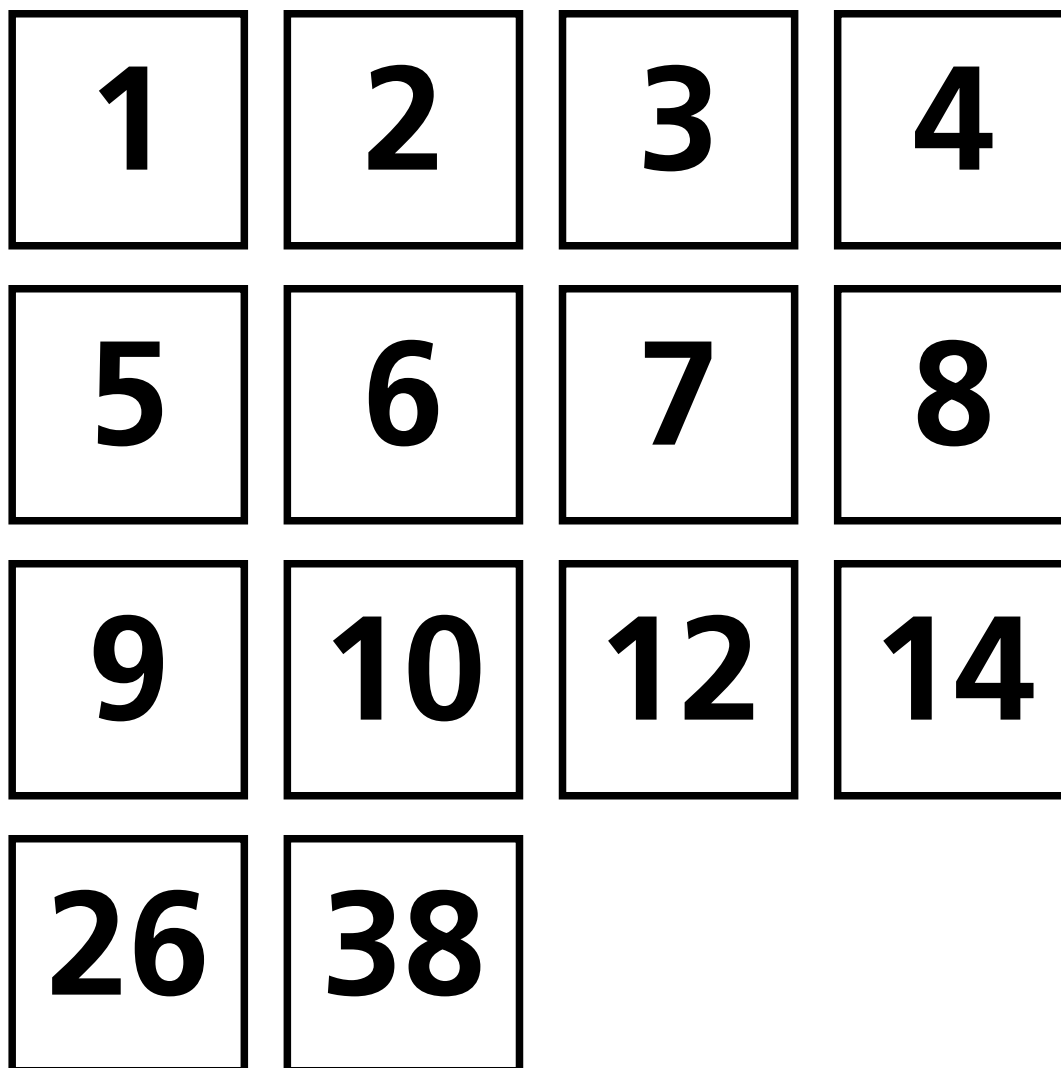
Put out the tiles **2, 10, 5 and 8** and ask the child to add them.

If the child is able to use the combinations to ten then continue with the next examples.

Put out all the tiles from **1–10** and ask the child to add all of the numbers.

Put out the tiles with **12, 14, 26 and 38** and ask the child to add all of the numbers.

Number Tiles



Diagnostic TASK

FOCUS

Understand Numbers

- Key Understanding 1
- Key Understanding 2

Calculate

- Key Understanding 1

Blocks in a Box

Years/Grades K–2

Purpose

To see whether students can use known facts to add and subtract small amounts.

Equipment

Blocks or other small items

A box or container with a lid

Part One

Place one block into the container, show the child and ask them to tell you how many blocks. Cover the container and ask again. Add one block to the covered container, tell the student you are adding one block and ask them how many blocks in the box. Do not show the student the blocks in the box. Add another block and ask them how many blocks in the box. Repeat the process for the following amounts. Start with 1.

1 +1 = 2 + 2 = 4 + 1 = 5 - 2 = 3 -1 = 2 -1 = 1

Start again with 1

1 + 2 = 3 - 1 = 2 + 2 = 4 - 2 = 2 +3 = 5 -2 = 3

Part Two

Without using the materials, ask students to answer the following questions.

What is one add two?

What is two add two?

What is four take two?

What is two add three?

What is five take two?

Recording student's responses

Use the recording sheet to make a note of students' responses. Notice whether they use counting or not. If they count, how do they count? Do they use fingers, do they count all, count on?

Blocks in a Box



How is the first part of the task different from the second part?

Blocks in a Box Recording Sheet

Name _____ Year/Grade _____ Date _____

Part One

Using Blocks in a Box	Student's response
$1 + 1 = 2$	
$+ 2 = 4$	
$+ 1 = 5$	
$- 2 = 3$	
$- 1 = 2$	
$- 1 = 1$	
Start again	
$1 + 2 = 3$	
$- 1 = 2$	
$+ 2 = 4$	
$- 2 = 2$	
$+ 3 = 5$	
$- 2 = 3$	

Part Two

Without Materials	Student's response
What's one add two?	
What's two add two?	
What's four take two?	
What's two add three?	

Diagnostic TASK

FOCUS

Calculate

- Key Understanding 1
- Key Understanding 2
- Key Understanding 3
- Key Understanding 4
- Key Understanding 5
- Key Understanding 6

Find the Solutions

Years/Grades 3–7

Purpose

To find out which strategies students use to solve addition, subtraction and multiplication problems mentally.

Producing work samples

Whole class or small group activity

Provide each student with either of the Set A, B or C of the word problems. Ask students to work the problem out and to write an explanation of how they solved it.

Individual Interview

Provide the student with the problems one at a time, in written form, and ask them to solve it mentally. After they have given you the answer, ask them to explain how they solved the problem. Ask for example, *what did you do in your head to work out the answer?*

Record the strategies described by each student in the same box as the word problem.

Find the Solutions

Name _____ Year/Grade _____ Date _____

<p>On the bus there are 25 children from Mr Bender's class and 30 children from Mr Tubby's class. How many children are on the bus?</p>	<p>There were 100 paper clips in the box. We have used 37 of them. How many are left?</p>
<p>Mum made 24 pancakes in the first batch and 18 in the second batch. How many pancakes did she make?</p>	<p>Sean's family are on the way to town. They have already travelled 15 kilometres and town is 65 kilometres from their home. How far do they still need to travel to reach town?</p>
<p>There are 18 slices of bread in a loaf. How many slices will there be in 5 loaves?</p>	<p>There was \$120 in \$10 notes. How many notes should there be?</p>

Find the Solutions

Name _____ Year/Grade _____ Date _____

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

Find the Solutions

Name _____ Year/Grade _____ Date _____

15 x 16	25 + 30
375 – 124	24 + 18
226 + ____ = 537	18 X 5
374 + 227	100 – 37
235 X 4 Estimate, is this more or less than 900? Why?	15 + ____ = 65
1035 splits into groups of 10	120 splits into groups of 10
27 X 16	

Diagnostic TASK

FOCUS

Calculate

- Key Understanding 3

Finding Equal Groups

Years/Grades 3–7

Purpose

To see how children partition quantities multiplicatively. Are they able to find all of the factors for a given number?

Equipment

Provide children with a sheet of paper. If they are unable to find a solution then provide them with materials.

Producing work samples

Ask children to find as many ways as possible of putting a given number into equal groups. For example, how many different ways could you put twelve mice into cages in equal groups?

Provide children with a sheet of paper and ask them to show the different ways in some form. This might include numbers alone, e.g. $2 + 2 + 2 + 2 + 2 + 2$ or 2×6 . It might be using a diagram with numbers associated, it might be with diagrams alone.

If they are able to show all of the possible groups for the given number, ask them, on another day, to find the factors for a larger number. (e.g. 16, 18, 20, 24, 36, 48). If not, then give them a smaller number.

Recording the responses

Notice whether children can do this with numbers alone, or whether they need diagrams or materials for support.

Diagnostic TASK

FOCUS

Understand Operations

- Key Understanding 1

Kangaroos and Comparing Bananas Years/Grades K–3

Purpose

To see how students represent simple addition and subtraction problems.

Equipment

The worksheet, calculator, pencils and paper, blocks or counters, objects that realistically represent the items in the problem, i.e. bananas, biscuits and smarties.

Producing work samples

Individual interview

Individual interviews would be appropriate for this task. Read the problem to the child and ask them to restate the problem in their own words to make sure they understand the problem. Offer the following items to the child in the order below.

- A calculator or pencil and paper.
- If they cannot use these items, offer them blocks or counters etc
- If they cannot use these then offer realistic objects selected for that problem, e.g. biscuits for the first problem.

If the child solves it mentally, ask them to write down the numbers and symbols that show what they did in their head. If a child uses a picture or diagram ask them to write down the numbers and symbols that show what is happening in their picture. After they have written the numbers and symbols, ask the child to read out what they have written. Write down what they say. If the problems seem too easy for some children, you may choose to make the numbers larger.

Whole class or small group activity

This task may be administered as a whole class or small group activity, although it will be difficult to get in-depth information as a whole class activity. As for the individual interview, read the problems to the children while they follow on their sheet. Withhold materials until it becomes obvious that a child cannot proceed without them. It may be necessary to do some follow-up individual interviews to clarify what children are thinking.

Kangaroos

Name _____ Year/Grade _____ Date _____

There were 3 kangaroos drinking at a river. 2 more kangaroos came to drink at the river. How many kangaroos are drinking at the river?

Sann had 9 biscuits and then gave his brother 5 of them. How many biscuits does he have now?

There were 9 rabbits and 7 pieces of carrot. Are there enough carrots for all of the rabbits? How many rabbits miss out?

Comparing Bananas

Name _____ Year/Grade _____ Date _____

Dan had 8 bananas. Tracy had 3 more than Dan. How many bananas did Tracy have?

Fran had 7 smarties. Tom gave her some more. Now she has 19. How many did Tom give Fran?

Gloria went shopping. She spent \$16 and when she arrived home she had \$18 left. How much money did she have to start with?

Diagnostic TASK

FOCUS

Understand Operations

- Key Understanding 2

How Much Taller?

Years/Grades 4–7

Purpose

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

Producing work samples

Individual interview, small group or whole class

Read the question out to the students while they follow on the sheet. Ask them to paraphrase the question so that you are sure they understand what it is asking. Ensure that the students understand the phrase 'number sentence' by writing one or two on the board e.g., $7 + 3 = 10$ or $10 - 7 = 3$. Make sure that you do **not** use the numbers from the problem.

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

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

How Much Taller?

Name _____ Year/Grade _____ Date _____

Jesse and Sylvia were chatting on the net. Jesse said that she was 154 centimetres tall and Sylvia said she was 132 centimetres. Jesse said, 'I am taller than you.' Sylvia said, 'Yes, but not by much.'

How much taller is Jesse than Sylvia? _____

Explain how you worked out the answer.

Write a number sentence that you could use in a calculator to work it out.

Diagnostic TASK

FOCUS

Understand Operations

- Key Understanding 2

Empty Boxes

Years/Grades 5–7

Purpose

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

Producing work samples

Individual interview, small group or whole class

- Explain to students that they are to write what they would put into a calculator to solve the problem, rather than just the answer.
- Do not allow students to use calculators for this task.

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

Empty Boxes

Name _____ Year/Grade _____ Date _____

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

$$17 + \boxed{} = 36 \quad \underline{\hspace{10cm}}$$

$$\boxed{} - 27 = 34 \quad \underline{\hspace{10cm}}$$

$$35 = \boxed{} + 16 \quad \underline{\hspace{10cm}}$$

$$43 - \boxed{} = 16 \quad \underline{\hspace{10cm}}$$

$$468 + \boxed{} = 842 \quad \underline{\hspace{10cm}}$$

$$283 = 674 - \boxed{} \quad \underline{\hspace{10cm}}$$

$$\boxed{} - 15.78 = 12.43 \quad \underline{\hspace{10cm}}$$

Diagnostic TASK

FOCUS

Understand Operations

- Key Understanding 2

Change Task

Years/Grades 3–7

Purpose

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

Producing work samples

Individual interview, small group or whole class

Begin with Change Task 1 and if students are successful on this task, then at a later time, ask them to complete Change Task 2.

- Explain that they are to write what they would put into a calculator to solve the problem, rather than just the answer.
- Read out all of the problems while the students follow on the sheet.
- Do not allow students to use calculators for this task.
- If using this as a whole class task, follow-up interviews to clarify what some students are thinking may be necessary.

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

Change Task 1

Name _____ Year/Grade _____ Date _____

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

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

Anna had 6 jellybeans but would like to have 11. How many more does she need to get?

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

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

Anna had 13 jellybeans and then she gave her brother some. She now has 7. How many did she give her brother?

Anna had some lollies and gave her brother 3 of them. Now she has 8 left. How many did she have to start with?

Change Task 2

Name _____ Year/Grade _____ Date _____

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

Anna has 112 techno-swap cards and some champion swap cards. She has 87 more champion swap cards than techno-swap cards. How many champion cards does she have?

In the long jump final at the Sydney Olympics, the Canadian athlete jumped 8.55 metres, and the Australian athlete jumped 7.67 metres. How much further did the Canadian athlete jump than the Australian athlete?

Anna has 156 pearly marbles and some cats-eye marbles. She has 89 fewer cats-eye marbles. How many cats-eye marbles does Anna have?

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

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?

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

Diagnostic TASK

FOCUS

Understand Operations

- Key Understanding 3
- Key Understanding 4

Story Problems

Years/Grades K–4

Purpose

To find out how children represent and solve multiplication and division problems.

Equipment

The worksheets, a calculator for each child, pencils and paper, blocks or counters, objects that realistically represent the items in the problem, e.g. Lego™ people and tiny play-dough sausages for the sausage problem.

Producing work samples

Individual Interview

Interviews would be appropriate for K–Year 2 students or for Year 3–4 students whom teachers consider to be at risk. Read the first problem from the worksheet.

Ask the child to restate the problem in their own words to make sure they understand the problem, and to get a sense of what that understanding is. Offer the following items to the child, in the order below.

- A calculator
- If they can't use the calculator offer them either the problem sheet or a larger blank sheet of paper and a pencil
- If they cannot proceed, offer blocks or counters
- If they still cannot proceed offer them the realistic objects selected for that problem.

Whole class activity

Administering this task with the whole class would be appropriate for Year 3–4 students. Read the problems while students follow as you read. Offer the following items in order. Withhold materials until it becomes obvious that a child cannot proceed without them. Then provide that child with the appropriate materials.

- Calculator, worksheet and pencil
- Counters or blocks
- Realistic objects selected for that problem, e.g. cardboard shapes representing the different types of cones and circles of card representing the different flavours of ice cream.

Note: Students in Year 3 or 4 who cannot solve page 1 problems using diagrams, counters or blocks may require individual interviews with the more realistic materials.

Story Problems 1

Name _____ Year/Grade _____ Date _____

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

The emu farmer wants to separate his 24 emus into small paddocks. He wants to put 6 emus in each paddock. How many paddocks does he need?

Dad said, "We're having visitors for a barbecue tea. That means there will be 9 people. We'll have 3 sausages each." Dad sent the children to the butchers to buy the sausages. How many sausages would they have to ask the butcher for?

Mrs Beattie wanted to put her 24 cows into 6 paddocks. How many cows should she put in each paddock if she wants the same number of cows in each paddock?

Story Problems 2

Name _____ Year/Grade _____ Date _____

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

Katie went to the deli. There were 4 icecream flavours – strawberry, vanilla, chocolate and bubblegum. There were three types of cones- chocolate, vanilla and waffle. How many choices of single icecreams did Katie have?

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

Your class is planning a vegetable garden. Thomas said, "Let's plant 5 pea seeds in each row." Georgia said, "Lets plant 4 rows" How many pea seeds would be planted?

Diagnostic **TASK**

FOCUS**Understand Operations**

- Key Understanding 3
- Key Understanding 4

Calculator Number Sentences

Years/Grades 4–7

Purpose

To find out if children can choose the appropriate operation to solve a wide range of multiplication and divisions problems with a calculator.

Equipment

Worksheets and calculator for each child

Producing work samples

Individual interview

Ask the child if they would like to have the problems read to them or if they would prefer to read the problems themselves and write in the number sentence as they go. Remind them that it is not the answer to the problem but the number sentence they need to key into the calculator that is required.

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 but the number sentence they need to key into the calculator that is required. Note any trial and error approaches as above.

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 arrived at their final decisions.

Calculator Number Sentences

Name _____ Year/Grade _____ Date _____

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

<p>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?</p> <div style="border: 1px solid black; height: 40px; width: 100%;"></div>	<p>A bulk box of lolly snakes costs \$5.40. There were 216 snakes in the box. If there were 27 students in the class and the snakes were given out, how many snakes would each child get?</p> <div style="border: 1px solid black; height: 40px; width: 100%;"></div>	<p>The year 6's were selling cup cakes to raise funds for the school camp. The cakes cost \$4.80 a box. The canteen had cooked 400 cakes and needed to put them into boxes of 8. How many boxes would they need?</p> <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
<p>Helen likes to ride 20 kilometres every day. She rides at an average speed of 5 kilometres per hour. How far does she ride in 3 hours?</p> <div style="border: 1px solid black; height: 40px; width: 100%;"></div>	<p>Jeremy picked 6 bags of apricots. If a 3 kilo bag costs \$12.60, what is the price per kilo?</p> <div style="border: 1px solid black; height: 40px; width: 100%;"></div>	<p>Apricots cost \$4.30 a kilo. If a sack of apricots cost \$12.60 how much must it weigh?</p> <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
<p>Every week at B.M.X. 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?</p> <div style="border: 1px solid black; height: 40px; width: 100%;"></div>	<p>A picture, which has been enlarged three times its original size, is now 180 mm high. What was its original height?</p> <div style="border: 1px solid black; height: 40px; width: 100%;"></div>	<p>There were 15 kids at the barbecue. One of the older kids hid some prizes. Simon found 30 prizes and his sister Sharn found 5. How many times more prizes did Simon find than Sharn?</p> <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
<p>John needed \$2.00 to go to the T Ball disco. He had 4 pairs of shorts and 5 tops. How many outfits could he choose from</p> <div style="border: 1px solid black; height: 40px; width: 100%;"></div>	<p>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?</p> <div style="border: 1px solid black; height: 40px; width: 100%;"></div>	<p>A rectangle of area of 208 sq metres has one side 16 metres long. How long is the adjacent side?</p> <div style="border: 1px solid black; height: 40px; width: 100%;"></div>

Diagnostic TASK

FOCUS

Understand Operations

- Key Understanding 5

Finding Factors

Years/Grades 5–7

Purpose

To find out if children understand and can use the inverse relationship between multiplication and division.

Equipment

Worksheet and a calculator for each child

Producing work samples

Individual interview or whole class activity

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 will 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 boxes to enable them to become familiar with the idea of factors.

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.

Finding Factors

Name _____ Year/Grade _____ Date _____

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.