Understanding Equality

At all levels students should be able to

- consolidate the idea that equality is a relationship expressing the idea that two mathematical expressions hold the same value

Learning equality as a relationship between number sentences is a crucial aspect of learning mathematics. A lack of such understanding is one of the major stumbling blocks in moving from arithmetic towards algebra. This document describes seven different types of tasks that offer teachers ideas of how they can understand and develop their student's understanding of equality and at the same time teach algebra informally.

These tasks are ideal for mixed ability classes as they can be differentiated to suit the learner's needs. As you read through the tasks think

- What mathematics can my students learn from engaging with these tasks?
- How could I use these with *my* class?
- How could I adapt these tasks to suit *my* class?
- When will I use these tasks with my class?
- What prior learning will I expect them to have had?

Problem solving reminder: If you are going to use these tasks remember, answers are important but what is more important is the mathematics students can learn from engaging with the task.

Box on the left side

These types of tasks are designed to allow learners to construct a greater understanding of the concept of equality. They help learners gain awareness of the fact that the equality symbol does not always come at the end of a number sentence or at the right hand side of the equation. There is no one answer, if you are using tasks like these encourage learners to find more than one way to complete the equality statement and to discuss and justify their solutions with others. Increase the cognitive demand by challenging learners to find as many ways as they can to complete the sentences in a given period of time or include restrictions on the amount of numbers that can appear in the brackets

Task:

Complete the equality sentences in as many ways as you can

(   ) = 64 + 374   (   ) = 376 - 88   ( ) = 45 x 98   (   ) = 24 ÷ 6

Darragh Fifth Class

$$(438) = 64 + 374$$

$$(60 + 30 + 70 + 4 + 4) = 64 + 374$$

$$(60 + 378) = 64 + 374$$

$$(374 + 64) = 64 + 374$$

Boxes on Both sides

The purpose of these types of task is to expand learners understanding of equality by presenting them with the opportunity to think about different statements of equality in complex number sentences. As with the other tasks encourage learners to explain their reasoning.

Task:

Complete the equality sentences in as many ways as you can

26 + (   ) = 12 + (   )   (   ) – 17 = 5 – (   )   (6 x ( )) +5 = (4 X ( )) +13

Symbolising

These tasks help learners build an understanding of letter symbolism in equations.

Usiskin (1997) described algebra as a language which includes unknowns, formulas, generalised patterns, placeholders, and relationships. He added that a number can be represented by a word, a blank, a square, a question mark or a letter, all of them are algebra.

Task:
- What number when added to 12 gives 18?
- Put a number in the square to make this sentence true

    14+ ☐ =25
- a + 2 = 5
    - is this sentence true?.
    - what do you think about this sentence?
    - which one is larger *a* or *5*?

Reading Equation Sentences:

This type of task not only provides learners with the opportunity to reinforce their understanding of the concept of equality but also provides teachers with an opportunity to asses their understanding.

Task: Read the following sentences

( ) = 5 + 32   245 – 29 = ( )   616 = 88 x 7

( ) = 4 x 26   35 ÷ 7 = ( )   ( ) = 63 ÷ 3

The cognitive demand of this type of task can be increased by asking learners to write story contexts for each sentence and represent the sentence with a diagram or with concrete objects

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Task: Write a story context to describe the following arithmetic sentence
$$35 \div 7 = 5$$
Represent the sentence with a diagram or with concrete objects.

Aoibhinn First Year

35 Sweets Shared between 7 people is the same as 5 sweets for each person!
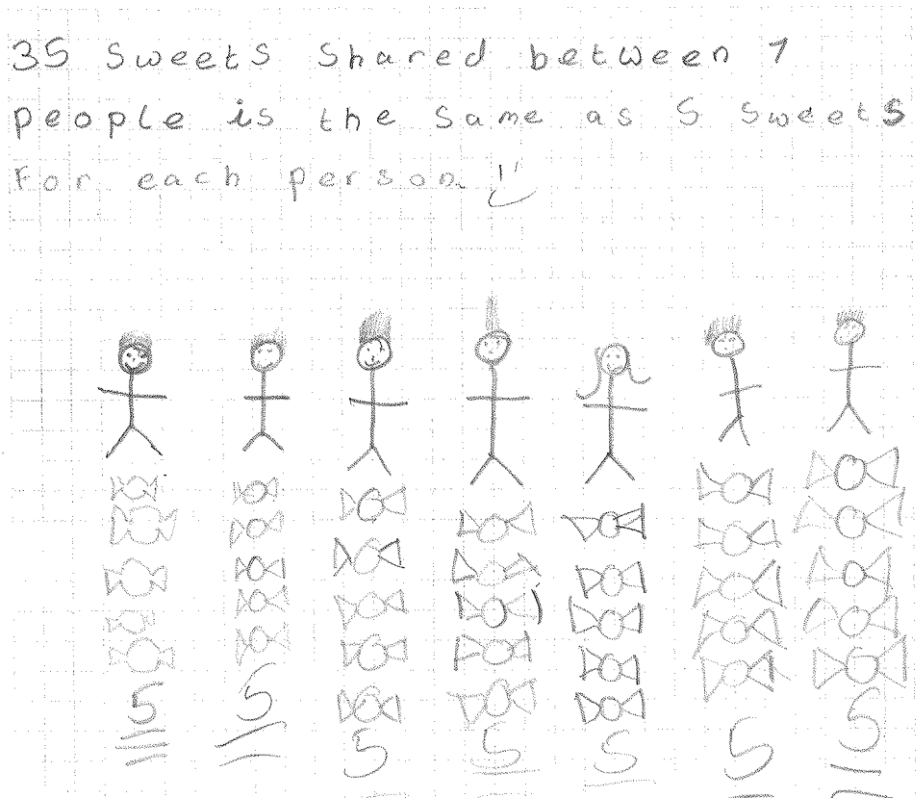
True/False Statements

This type of task gives teachers an opportunity to assess learners' understanding of the concept of equality.

Task: Decide whether each of the following statements are true or false. Justify your decision

27 + 14 = 41   15 ÷ 3 = 5 x 2   14 - 9 = 5 – 2

Examining learners' answers to these questions gives teachers the opportunity to assess students' understanding of the concept of equality.

Alternative ways and *Finding Missing Numbers*

These two types of task focus on representation and encourage learners to write numbers in alternative ways. These tasks not only lead learners to understand the equality concept, but also to understand each number as a composite unit of other numbers. By doing such tasks learners are not only finding arithmetical relationships but are also thinking algebraically.

Task: Solve the following problem and write your answer in as many different ways as possible.

8+7

Sarah Louise Fist Year

$$8+7 = 15$$

$$8+7 = \frac{30}{2}$$

$$8+7 = \frac{60 - 30}{2}$$

$$8+7 = 3 \times 5$$

$$8+7 = 30 \times \frac{1}{2}$$

$$8+7 = 7 \times 2 + 1$$

$$8+7 = 8 \times 2 - 1$$

Task: Complete the equality statements

$$18 = (\;) \times (\;)$$
$$18 = [(\;) \times (\;)] \times (\;)$$
$$18 = [(\;) \times (\;)] \div (\;)$$

Summing Up

This task helps learners build up numerical strategies for operating with numbers, it encourages flexible thinking.

Task: The grey box is the place for the sum of the numbers. Complete each of the boxes.

19	20
21	

	48

	110
110	333