

## So Many Relatives

### Purpose:

The purpose of this task is to engage students in solving a problem involving investigating with whole numbers using graphical means and/or generalising.

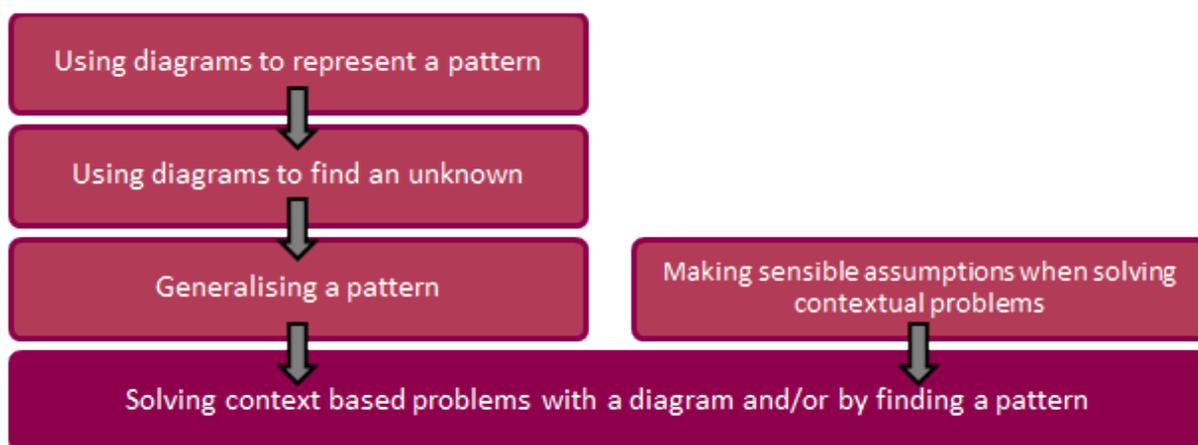
### Achievement Objectives:

NA4-1: Use a range of multiplicative strategies when operating on whole numbers.

NA4-8: Generalise properties of multiplication and division with whole numbers.

### Description of mathematics:

The background knowledge and skills that need to be established before and/or during this task are outlined in the diagram below:



#### Using diagrams to represent a pattern

*Show, in a diagram, the arrangement of bricks used to build a triangular stack with a base of 3, 4, 5...*

#### Using diagrams to find an unknown.

*How many bricks are needed to build a triangular stack with a base of 12?*

#### Generalising a pattern.

*How many bricks are needed to build a triangular stack with a base of  $n$  bricks?*

#### Making sensible assumptions when solving contextual problems.

*If retirement age is 65 and a typical person expects to be employed for at least 80% of their working lives, how many weeks will they work after the age of 20?*

#### Solving context based problems with a diagram and/or by finding a pattern.

*It takes three slices of bread and two eggs to make two egg sandwiches. There are twenty five slices of bread in a loaf, including crusts. How many eggs will be used if sandwiches are made from five loaves of bread?*

In approaching this activity, the students will need to make assumptions. Making different assumptions will mean that their final solutions are not likely to be exactly the same. The students might need to be reassured that this does not mean any solution is wrong, rather that it fits a different interpretation of the question. When discussing the assumptions the students will need to make, there is an opportunity to discuss the term average and to introduce the idea of central

tendency and also discuss the likelihood of the mean, median and mode being very similar for a large sample size. This task may be carried out with step by step guidance, or by allowing the student to follow their own method of solution. The approach should be chosen in sympathy with students' skills and depth of understanding.

**Activity:**

Task: The average person (with their partner) has two children before the age of 30 (that grow up to have their own....) and then lives to 75 years of age.

With approximately how many people living on the planet do you share a common ancestor/relative within seven generations?

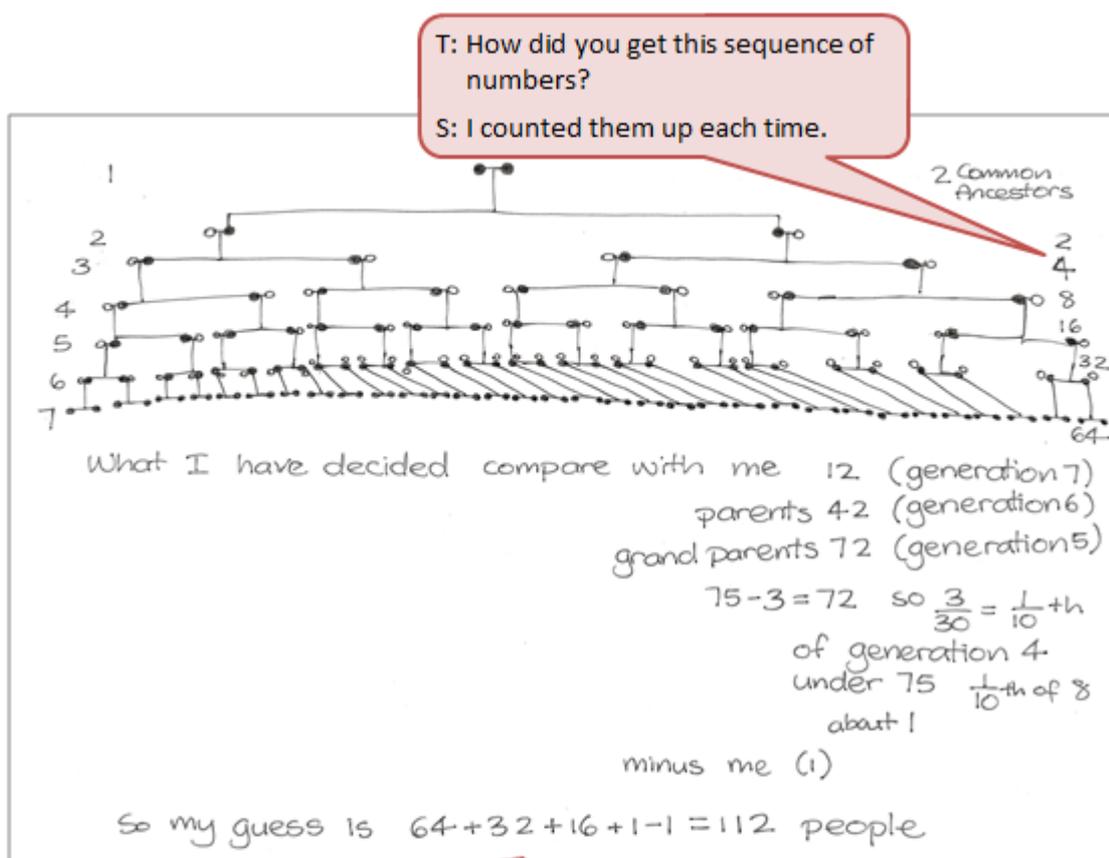


## The arithmetic approach

The student is able to make assumptions and to use a diagram to represent the pattern, in order to solve the problem.

Prompts from the teacher could be:

1. How are you going to go about solving this problem? Can you show generations on a diagram?
2. Which of the people on your diagram are related to the original ancestor(s)?
3. What assumptions do you need to make about the ages of the people involved?
4. Which of the people on your diagram are likely to still be alive?



T: Talk me through this diagram.

S: I started 7 generations ago to work out how many people had been born and that's 2, 4, 8, 16 etc. Then I had to work out who's alive.

T: That's the 12, 42, and 72?

S: Those are ages. I counted everyone under 75 as alive.

T: And I see you've done something to work out how many grandparents you expect to be alive.

S: Yeah, I did that as a kind of proportion. I didn't get a whole person so I rounded up.

## The conceptual approach

The student is able to make assumptions, to use diagrams and/or to generalise in order to solve the problem.

Prompts from the teacher could be:

1. Consider the way you can represent the generations of people involved.
2. What assumptions do you need to make???
3. Which of the people involved are likely to still be alive?

The image shows a student's handwritten work on a problem. At the top, a tree diagram represents three generations of people, with 'MF' (Male/Female) labels for each individual. The first generation has 1 person, the second has 2, and the third has 4. To the right of the tree, the numbers 1, 2, and 4 are written next to each level. Below the tree, a table lists 'How Many' and 'Age' for each generation. The 'How Many' column has values 1, 2, 4, 8, 16, 32, 64. The 'Age' column has values 72, 42, 12. The student has circled 'How Many' and 'Age' in the table. To the right of the table, the calculation  $63 + 32 + 16 = 111$  is written, with '111 people' circled and underlined. Two red speech bubbles contain teacher and student dialogues.

**T:** I see you have stopped your diagram at the third line.

**S:** Yeah, I got the pattern, just doubling, so I didn't think it was worth drawing out and counting.

**T:** Tell me about the 63, I see 64 in your pattern.

**S:** The question asks how many relatives I share, so I can't count myself.