**Tournaments**

**Learning objective: To work out how many events in a tournament**

In this investigation you will be working out how many matches there will be in a tournament involving three or more schools.

To start with, the class will decide which three schools are taking part in the tournament. You can choose your own school plus two more nearby.

You then have to decide (perhaps by a class vote) what sport is to be played. It must be one that can be played by boys and girls.

In your tournament, each school plays every other school **at home and** **away.**

You must think how to show your working out. There is not just one right way of doing this. You can draw diagrams, write lists, or use any other method you can think of. Your teacher may ask you to explain your method to the rest of the class.

**Your task:**

* How many games will be played in your tournament?
* What happens if another school joins the tournament? How many games will there be now?
* How many games for five schools? For 6 schools?
* Can you think of a way to predict how many games for 7 schools? 8 schools?

**Things to think about:**

* How can you show your method for working out the number of games?
* You can use any method you like – diagrams, lists, tables, etc.
* Can you see any patterns in the numbers you work out?
* Can you use these patterns to work out the number of games for 100 schools?
* Can you work out the number of games for any number of schools?

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| **Key words**  patterns, sequences, predictions, systematic, listing, tables |

Now use the Level Ladder to achieve your target level.

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| **To get level:** | **You should:** |
| 2 | Work out how many games in a tournament with 3 and 4 schools.  Show your method of working this out (diagram, list or table).  Make at least one statement about a pattern that you have noticed (*I have found out that …).* |
| 3 | Work out how many games in a tournament with 5, 6 and 7 schools. Can you spot a pattern that will help you predict the results for 8 and 9 schools? *(I predict that …).* |
| 4 | Use a table to help you identify patterns. How many games with 50 schools? With 100 schools? |
| 5 | Can you extend your predictions to any number of schools? Imagine that there are so many schools that you can’t count them all, so use a letter (**s** or **n**) to stand for this number.  Using the same letter, can you give an expression using algebra for the number of games?  Can you write a formula for the number of games for any number of schools?  Check that your formula works for some of the results that you worked out for levels 2 and 3. |
| 6 | Use what you have done to investigate a more complex problem (*I wonder if …).*  Find a formula and try to explain why it works. |
| 7 | Investigate a more complex sequence, including square numbers.  Explain the link between the sequence and the algebraic formula.  Explain how you know that your formula will always be true. |

**Now use the Level Ladder to assess your work and decide on improvement targets.**

**NC requirements:**

* Use simple formulae (manipulation/substitution)
* Generate and describe linear number sequences (patterns/sequences)
* Express missing number problems algebraically (construct equations/solve equations/inequalities)
* Find pairs of numbers that satisfy an equation with two unknowns (graphs/functions)
* Enumerate possibilities of combinations of two variables

**Key ideas:**

* Permutations, systematic listing, repeated addition, multiplication as a short cut.
* Use of symbols and expressions.
* Starting with small numbers, working towards the language of generalised number.

**Prior skills and understanding:**

* Systematic representation, by drawing or listing, of combinations and permutations.

**Key questions:**

* What is the relationship between the number of schools and the number of games?
* How can you work out the number of games for **any** number of schools? Can you write this as an equation using algebra?

**Solutions:**

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| **Number of schools** | **Number of games** |
| 3 | **3 x 2 = 6** |
| **4** | **4 x 3 =12** |
| **5** | **5 x 4 = 20** |
| **6** | **6 x 5 = 30** |
| **7** | **7 x 6 = 42** |
| **8** | **8 x 7 = 56** |
| **9** | **9 x 8 = 72** |
| **10** | **10 x 9 = 90** |
| **20** | **20 x 19 = 380** |
| **100** | **100 x 99 = 9900** |
| **1000** | **1000 x 999 = 999000** |
| **n** | **n x (n – 1)** |

**Possible extensions:**

If children are happy about using a letter to stand for ‘any number’, give them some stories to reinforce this concept (using different letters), e.g.

“There are **d** ducks on a pond. The following day there are **d + 2** ducks. What can have happened?”

Then encourage children to make up their own stories and share with the rest of the class.