Kantor Ri Primary Mathematics Masterclasses

Patterns in Primes Masterclass

Thanks for helping with this Masterclass session! Your support is much appreciated.

The session leader should be able to tell you more about the content of the session, and exactly how they'd like you to help, but this sheet should give you some basic information you may find useful. If any of this seems obvious to you, that's great!

In general, for Masterclass sessions:

- While the session leader is talking to the group, don't interrupt them or distract the students unless something is wrong that needs fixing urgently. You should also watch and pay attention to what they're saying, to set a good example.
- If things need handing out to the students, wait for the session leader to signal you to do this, as it can distract the students if you start to hand things out before they're ready.
- If the students are given a task to work on, you should circulate the room to talk to the students. Wait until they've had a chance to tackle the problem before you interrupt them, and encourage anyone who looks like they haven't started yet.
- Try not to give away the answers to the students, especially if they're working on the problem and about to discover it for themselves - if they are really struggling, you can give them a hint or suggest where they might start looking.

In this session:

This workshop is an exploration of Patterns in Primes. Prime numbers are pretty special, they are numbers that have exactly two factors; 1 and itself. What is even more special is that unlike other number sequences, like squares, cubes, or triangular numbers, there isn't a distinct pattern to help us predict the next prime number. However, there are certain patterns that we can see even in the pattern-less appearance of primes. The session is based on the research and talks given by Dr. Vicky Neale of Oxford University.

The main activities are:

1. **Settler – finding factors of a number using any method**
2. **Use number blocks to find patterns of factors**
3. **Shade primes on the 6 column grid, and see that there are patterns in primes (apart from 2 and 3 all primes are either one more than or one less than a multiple of 6)**
4. **Using the Sieve of Eratosthenes, find primes greater than 36, and see if the pattern holds true:**
    a. **Starting with 100 number grid**
    b. **Moving on to choose an even bigger number grid to work with.**

Thanks again for your help with this session! If you have any other questions, please ask the session leader.

In this session:

This session is about 'discovering' primes and finding patterns in primes.

Students will have already come across prime numbers before and will probably even be able to easily identify those (especially those less than 20) however, this session attempts to get students to think deeply about the properties of primes, and the patterns that are created by the nature of multiples.

The main activities are:

1. **Settler – finding factors of a number using any method**

Students are asked to use any method they like to find factors of 360.

The aim of this task is just to remind students what factors are – students will need to be able to find factors of the numbers 1-36 in the next task.

They can use any method they like and should be encouraged to talk and share their ideas.

As a class, we will discuss one method given, and students can contribute further ideas if they like.

2. **Use number blocks to find patterns of factors**

Using the methods discussed in the settler, students need to find the number of factors for each number on the 1-36 number grid. Using the multi-kink cubes, students should then represent the number of factors – one cube represents one factor.

Students will work together on this, and check each other's work. Students should start to see some patterns in the heights of the towers (the numbers of factors) of each number.

- Some numbers have odd numbers of factors – this means they are square numbers.
- Some numbers have two factors – these are prime
- The primes have some pattern – they only appear in two columns (apart from 2 and 3)

3. **Shade primes on the 6 column grid, and see that there are patterns in primes (apart from 2 and 3 all primes are either one more than or one less than a multiple of 6)**

The primes follow a pattern in that all primes (apart from 2 and 3) are one more than or one less than a multiple of 6. Students can start to discuss why this is – all numbers in the 2,4,6 columns are all even, and therefore will never be primes. All numbers in the 3 column, after 3, are all multiples of 3 and therefore not primes.

This is the research of Dr. Vicky Neale – and there are some really interesting conjectures that can come out of this about 'twin primes' which are primes that differ by two.

4. **Using the Sieve of Eratosthenes, find primes greater than 36, and see if the pattern holds true.**

In order to see if the conjecture about primes one more than or one less than a multiple of 6, we first need to find the primes that are larger than 36. The Sieve of Eratosthenes will help us do this by following a logical algorithm, crossing out multiples of each prime, until only the 'uncrossed' ones, the primes, are left.

Students learn how to use the sieve for larger number grids and investigate whether our previous conjecture still holds.