GOLDBACH CONJECTURE

LESSON PLAN

GRADE:	SUBJECT:	DATE:

LESSON FOCUS AND GOALS:
To investigate what the Goldbach conjecture is, practice understanding of prime numbers and become fluent in primes below 100.

MATERIALS NEEDED:
Lots of paper
Projector (if possible)
These slides

LEARNING OBJECTIVES:
Improve recall of first fifty prime numbers
understanding of proof

STRUCTURE / ACTIVITY:

The Set Up (5-10 minutes):
Depending on student ability, you might want to recap on prime numbers first.
Students to come up with as many ways to make 30 by adding two prime numbers together. Then they choose their own even number and see if they can find a pair of prime numbers that add to make that number.

The Investigation (20 - 30 minutes)

Make a sweeping statement - can all numbers be made by adding two prime numbers together?

First try some odd numbers with the class (try not to choose one that is two more than a prime, try 27 or 17 or 29 - see if they can establish that this is hard as primes (except two) are odd and therefore it cannot result in an odd number.

Then move on to trying to find an even number that doesn't work - keep the numbers below 50 for now. Try to make it sound like there is one so that they keep searching. "You haven't found one yet?", "You still haven't found one?" etc.
Did you find any numbers that didn't work?
Do you think ALL even numbers can be made this way?

Then show slide four and talk about William Goldbach (more information is on our website) and his idea (conjecture) that this is true. Explain how this is one of the unsolvable maths problems that every mathematician dreams of solving. The next slide shows how proof by exhaustion is impossible as a way to solve the problem.

On the next slide there are some linked challenges, it is interesting to see how the students set out their work here. The common way to show Goldbach is through lines (search Goldbach Conjecture on Google Images) and you can prompt to do it that way too if preferred.

COLLATZ CONJECTURE

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THE INVESTIGATION (CONTINUED)

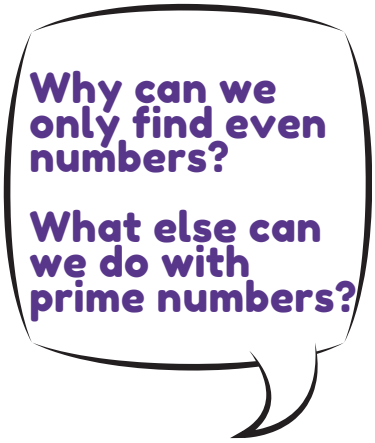
Once playing around with these challenges, switch the conversation to finding the number of different ways to make certain numbers.
Again simplify the challenge by asking, which number less than 50 has the most prime addition pairs?

Introduce the notation for students to practise how mathematicians share their work.

Depending on time, you can extend this into numbers less than 100, and have a prize or award for the person who finds the number with the most combinations. (Answers on slides)

The Follow Up

Give time for the write up (below), about ten minutes (depending on age). There are some other investigations and follow up questions. Goldbach's weak conecture is that any odd number can be made by adding three prime numbers together. Explore this and see if the students discover that this actually is quite easy to prove if the main conjecture is finally proven.



There is a further step where you can start multiplying two prime numbers together - which is the first step towards prime factorisation, the idea that all numbers can be written as a product of prime numbers.

ASSESSMENT:

Have the students create a simple paragraph explaining the Goldbach Conjecture, and an example with a few even numbers.

Finally ask them to write down how two prime numbers larger than two always add to make an even number.

This task does not require much assessing, though you could do a quick quiz game on prime or not prime with numbers up to 100.

For further Goldbach results and to find prime pairs click here