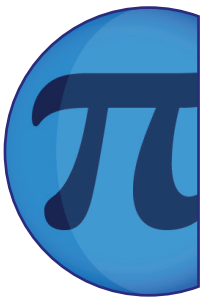
Chinese Development of Maths

Key Learning Content

This film tells the story of Chinese mathematics, which developed independently but in parallel with mathematics in the West. The story is told through examples: Lo Shu number squares, also known as magic squares; the Gougo Rule, essentially Pythagoras' Theorem; the calculation of Pi to seven decimal places; and Yang Hui's triangle, more commonly known as Pascal's triangle.



Core Outcomes

Learning Points

- Be able to use the four rules of addition, subtraction, multiplication and division.
- Be able to understand and use Pythagoras' Theorem.
- Be able to find circumferences and areas of circles using Pi.

Suggested Activities

- Complete magic squares and generalise solutions using algebra.
- Solve problems using Pythagoras' Theorem with both numbers and algebra.
- Solve problems using the formulae for circumference and area of a circle.

Although numbers had existed in the Chinese language for many thousands of years, they were first written down around 1500 BC.

Extension Outcomes

Learning Points

- Be able to understand the construction of Pascal's triangle and be able to identify the different number sequences it contains.
- Be able to find subsequent terms of an integer sequence, e.g. 1, 3, 6, 10, …
- Be able to generate terms of a sequence using term-to-term definitions of the sequence.
- Be able to understand and use estimates or measures of probability from theoretical models.

Suggested Activities

- Construct the first ten rows of Pascal's triangle, and find a formula for the general term in the nth row of the triangle.
- Use Pascal's triangle to help model the number of heads someone is likely to get when spinning a coin n times.

Related Films

To use before the lesson plan:

Numbers: Life Without Numbers	This film speculates as to what life may have been like before the invention of mathematics.
Numbers: The Discovery of Zero	This film describes how some civilisations took many years to discover the most basic mathematics.

To use after the lesson plan:

The Most Populous Country	This film explores an extension of the idea of a number sequence, in the use of the inequalities < and > to order numbers.
Can You Trust Your IQ?	This film asks what the ability to complete number squares might indicate about your intelligence.
Proving Pythagoras	This film tells the story about the theorem that bears Pythagoras' name.
Calculating Pi: Archimedes	This film relates how a Greek scholar used polygons to

Guide Lesson Plan

Introduction

Ask students what they know about the history of China. Draw up a rough timeline of events in Chinese history (e.g. building of the Great Wall in 200 BC, invention of the magnetic compass around 100 BC, invention of paper around 100 AD, invention of printing around 700 AD, invention of gunpowder around 900 AD, founding of the Ming dynasty in 1368 AD...). Then ask what they know about Chinese mathematics.

Show Film

The Chinese Development of Maths

Main Activity

Foundation

Explain how magic squares work (sum of rows, columns and diagonals the same), then get students to generate their own 3x3 magic square with the numbers 1 to 9. Then extend to 4x4, 5x5 and 6x6 squares. Then set the same task but with the product of rows, columns and diagonals the same *(hint: raise 2 to the power of the number in each additive square)*.

Main Activity cont ...

Advanced

Explain how Pascal's triangle is constructed then get students to complete the first ten rows of the triangle. Ask them what patterns they can find within the triangle (for example: 1s, natural numbers, triangle numbers, tetrahedral numbers along successive downward diagonals; rows sum to powers of 2; cross-diagonal sums give Fibonacci numbers).

Extension Activity

Foundation

Tell students that the sum of the first n natural numbers is $\frac{1}{2}.n.(n+1)$. Get them to use this fact to work out what the sum of rows/columns/diagonals will be in an (n x n) magic square. (Hint: consider just the sum of the n rows in the square). Ask them if they can find any more generalisations of the pattern of numbers in an (n x n) magic square.

Advanced

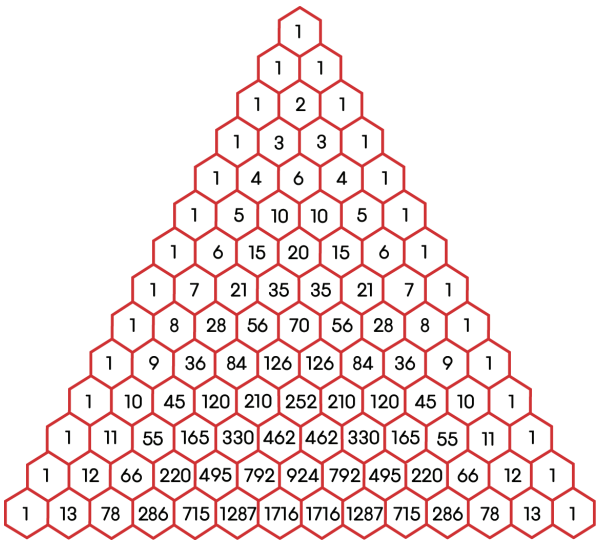
Explain the factorial notation to students and then tell them that the rth term in the nth row of Pascal's triangle is given by the formula ${}_nC_r = \frac{n!}{(n-r)!r!}$

(Start numbering the first row as n=0; by convention, 0! = 1.)

Get students to check this result (many calculators have an nCr button). Then explain how the numbers in Pascal's triangle relate to a binomial probability distribution and use the triangle to work out the probability of getting r heads when spinning a coin n times.

Optional Extra

Research Liu Hui's algorithm for calculating Pi and compare it with Archimedes' method. Compare Liu Hui's estimate with those made by other mathematicians and comment on its relative accuracy.



Yang Hui's Triangle reveals a pattern in which the inside numbers are the sum of the two above.