# The Egyptians and Multiplication

Key Learning Content

This film begins with a look at the Rhind papyrus, an ancient Egyptian document that describes mathematical problems. The film then moves on to discuss the Egyptian method of multiplication by successive doubling. A simple example is given and the method is explained using powers of two.

The film can be used as an introduction to binary mathematics. No prior mathematical knowledge beyond basic arithmetic is required prior to watching it.
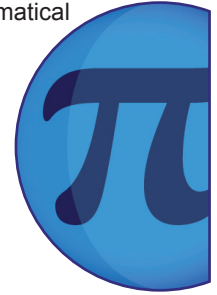
Core Outcomes

Learning Points

- Be able to use the four rules of addition, subtraction, multiplication and division.
- Be able to use index notation for positive integer powers.

Suggested Activities

- Multiply numbers using long multiplication.
- Multiply numbers using the Egyptian method.
- Research and compare other traditional methods of multiplication.

Extension Outcomes

Learning Points

- Be able to understand that the decimal system is base 10 and that other number bases exist.
- Be able to understand and interpret numbers in binary form.
- Be able to carry out calculations in binary.

Suggested Activities

- Convert decimal numbers to binary and vice versa.
- Explain how the Egyptian multiplication method works in terms of binary numbers.
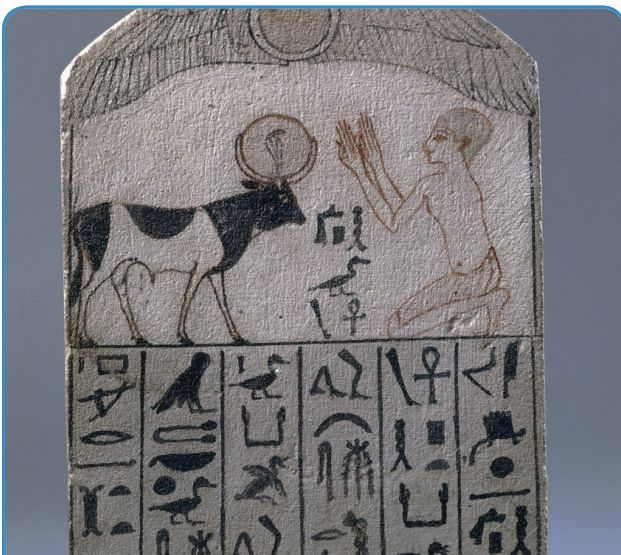
This Egyptian method of multiplication works for any size of number, large or small.

Related Films

To use before the lesson plan:

The Babylonians and Plimpton 322

This film presents evidence that the Babylonians were solving quadratic problems 3500 ago.

To use after the lesson plan:

The Romans and Numerals

This film discusses the Romans' mathematical legacy and the use of Roman numerals today.

Binary: What Is Binary?

This film explains the number system that underpins the Egyptians' method of multiplication.

The Emperor's Chess Board

This film tells the story of how successive doubling led to an emperor giving away a vast amount of wealth.

How Long is a Metre?

This film explains how the Egyptians standardised their system of measurement thousands of years before Europeans did the same with the metre.

Guide Lesson Plan

Introduction

Begin with a mental maths test, giving multiplication questions that become progressively more difficult. Ask students about any multiplication 'tricks' they use, from adding a zero when multiplying by 10, to dividing by 4 and adding two zeros when multiplying by 25. End with problems such as 67 x 84 and ask, how would this have been done before calculators?

Show Film

The Egyptians and Multiplication

Main Activity

Foundation
Go over the Egyptian multiplication method shown in the film then set questions for students to complete. Suggest that it would help to have a table of powers of two ready to use for the multiplication and draw this up. See just how complex a multiplication problem the students are able to do with this method. Then set a challenge to see whether the Egyptian method or modern long multiplication is faster; divide the class into two teams and get teams to compete to answer questions faster than the other.

Main Activity cont ...

Advanced

Go over the multiplication method, then explain how binary numbers work. Get students to convert numbers between binary and decimal, and practise binary arithmetic. Then ask students, What is the connection between Egyptian multiplication and binary numbers? Get students to rewrite Egyptian multiplication using binary.

Extension Activity

The Russian Peasant Method is closely related to the Egyptian multiplication method yet subtly different. Instead of starting with '1' in the second column, start with the multiplying number. Then at each step, double the number in the first column (as before) but halve the number in the second column; if this number is odd, divide it by two and ignore the remainder. Continue until the number in the second column is '1'. Then go back and cross out each row where the number in the second column is even. Add up all the remaining numbers in the first column. The total is the answer to the multiplication!

Get students to practise this method, then compare and contrast it with the Egyptian method. What are the benefits or drawbacks of each method? Which method do students prefer?

Optional Extra

Research other multiplication algorithms, such as (Arabic) lattice multiplication, or (Babylonian) quarter square multiplication. Alternatively, research logarithms and show how logarithms turn multiplication into addition.

$2^0 \times 3$ 2^0

$2^1 \times 3$ 2^1

$2^2 \times 3$ 2^2
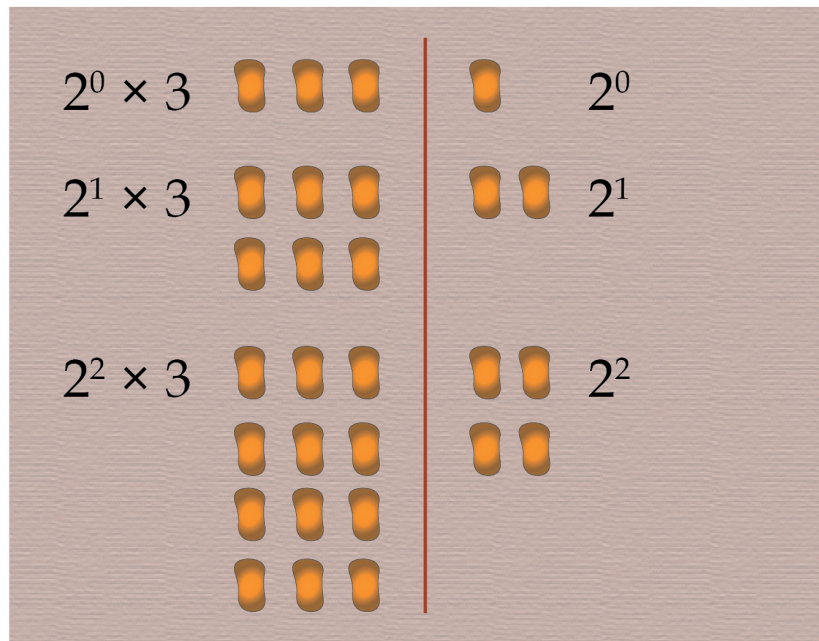
This method of multiplication works because it is based on the fact that every number can be expressed either as a power of two or as the sum of powers of two.