Primed for Survival

Key Learning Content

This film introduces prime numbers through the life cycle of insects. It tells the remarkable story of periodical cicadas that have prime-number life cycles, possibly, it is claimed, to protect the species from predators with shorter life-cycles. Prime numbers are defined, and the possible benefits of a prime number life cycle explained.

Knowledge of multiples and factors would be useful prior to watching the film.

Core Outcomes

Learning Points

- Be able to understand and use the terms ‘multiple’, ‘factor’ and ‘prime number’.
- Be able to identify multiples and factors of a given number.

Suggested Activities

- Work out the factors of large numbers by trial and error and by using divisibility rules.
- Work out the factors of numbers used in the measurement of everyday quantities.
- Add fractions by expressing them in terms of the LCM of their denominators.

Extension Outcomes

Learning Points

- Be able to write whole numbers as the product of their prime factors.
- Be able to recognise that square numbers have prime factors in pairs, and cube numbers have prime factors in triples.

Suggested Activities

- List the prime factors of large numbers and then write the numbers as products of their prime factors.
- Work out the square roots and cube roots of numbers by considering their prime factors.

Insects with a life cycle of prime numbered years have the least chance of coinciding with insects born in other cycles.

Related Films

To use before the lesson plan:

The Fibonacci Sequence	This film demonstrates occurrences of this sequence in nature, such as the growth of flowers and trees and the spiral of a snail's shell.
Bees and Their Hives	This film explains how bee hives are not only beautiful tessellations, but are designed for efficiency.

To use after the lesson plan:

A Pattern in Primes?	This film examines the fact that prime numbers seem to appear randomly in the number line, but asks if there a deep pattern that explains when they occur.

Guide Lesson Plan

Introduction

Give students the following problem: two friends agree to meet at one o'clock; one is on time but the other is running four minutes late. The first to arrive sees that their friend is not there so comes back every 15 minutes to see if they have turned up. The friend running late comes back every four minutes to check if the other has turned up. When will they meet?

Show Film

Primed for Survival

Main Activity

Foundation

Define factors and multiples of numbers. Then get students to list the factors of large numbers systematically by writing the number as the product of two factors, e.g. 100 = 1 x 100, 100 = 2 x 50, 100 = 4 x 25 ... Then give divisibility rules for divisibility by 2 (last number even), by 3 (sum of digits divisible by 3), and by 4 (last two digits a multiple of 4) and ask students is they can find similar rules for larger factors. Use divisibility rules to write large numbers as the product of factors.

Advanced

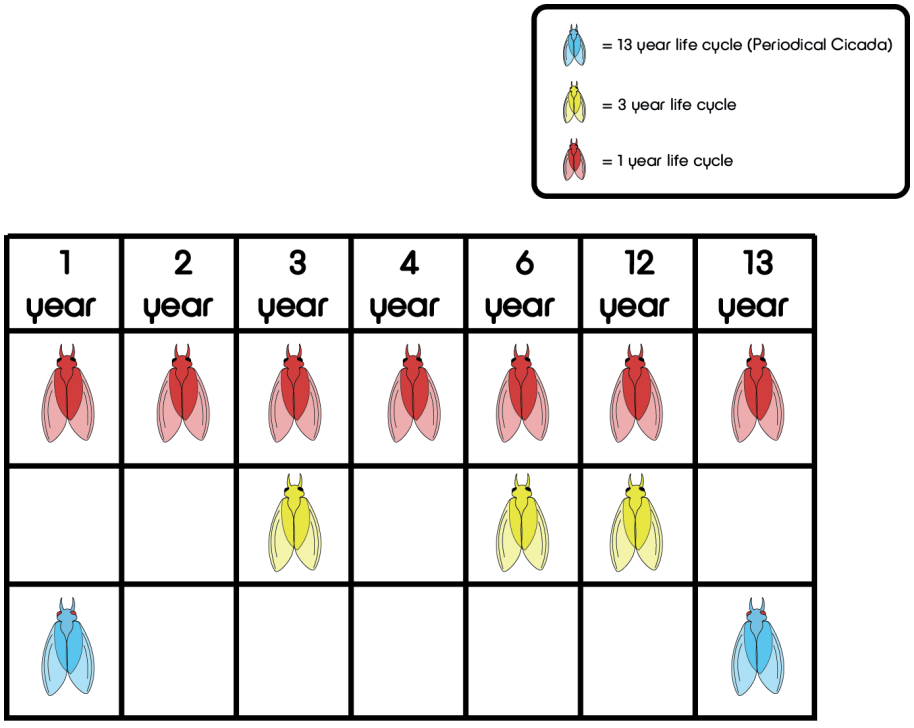
By repeatedly breaking numbers down into products of factors, write large numbers as the product of their prime factors, e.g. 297 = 3 x 99 = 3 x (3 x 33) = 3 x 3 x (3 x 11). Then give students large square and cube numbers and ask them to find square and cube roots by considering prime factors, e.g. 900 = 2 x 450 = 2 x 2 x 225 = 2 x 2 x 5 x 45 = 2 x 2 x 5 x 5 x 9 = 2 x 2 x 5 x 5 x 3 x 3 = $(2 \times 5 \times 3)^2 = (30)^2$.

Extension Activity

Get students to use a spreadsheet to set up arrays (blocks) of numbers, with 1 to 10, 11 to 20, 21 to 30... in successive rows. Then use conditional formatting to highlight numbers in the arrays that are divisible by a given whole number and explore the patterns that multiples of a given number make. Get students to predict the pattern that multiples of higher numbers will make. Explore the patterns of square numbers, cube numbers and prime numbers.

Optional Extra

Get students to research the Sieve of Eratosthenes: what is it, what does it do, and how does it work?



Periodical cicadas use their 13-year life cycle to their advantage, as it allows them to avoid mating with other species of non-periodical cicada, which hatch more frequently.