

Patterning



1. Full moons and Friday the 13ths are two of the many interesting events marked on a calendar. How many Friday the 13ths are possible in one year?

What is a blue moon? Use the library or the Internet to research blue moons. How many blue moons could occur in one year?

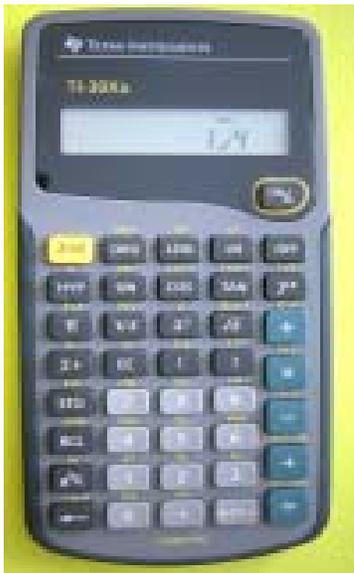
Use paper and pencil or technology to investigate and answer these questions. Show a possible calendar for the maximum number of Friday the 13ths and a possible calendar for the maximum number of blue moons.

2. Consider the number 6. It has factors 1, 2, and 3. The sum of these factors is 6, so we call 6 a *perfect number*.

Are there other perfect numbers? Use paper and pencil or technology to investigate the numbers from 1 to 100.

If the factors of a number add up to less than the number itself, the number is called *deficient*. If the factors of a number add up to more than the number itself, the number is called *abundant*. Identify the deficient and abundant numbers in your list.

How many perfect, deficient, and abundant numbers are there from 1 to 100?



3. Before the days of electronic calculators and computers, people who worked with numbers (e.g., accountants, merchants, etc.) used many number tricks to estimate or check the accuracy of their calculations. One of these tricks was *casting out nines*.

Research on the Internet or in a library to find out how casting out nines works. Show one example for checking each of addition, subtraction, multiplication, and division. Are there any cases where casting out nines does not work?

A related trick is casting out elevens. Investigate this method, and show one example.

4. You have 25 light bulbs, numbered from 1 to 25, and arranged in a 5×5 square. Each light bulb is controlled by a toggle switch, and all of the switches are initially off. Begin by toggling the switch of any bulb whose number is divisible by 1. Then, toggle the switch of any bulb whose number is divisible by 2. Note: Toggling a switch will turn a bulb off if it is on, and on if it is off.

Toggle switches for bulbs whose number is divisible by 3, 4, 5, etc. and continue until you have toggled the switches for bulbs whose number is divisible by 25. Which bulbs will be on when you finish?

Simulate this process using cards numbered from 1 to 25. Place them all face down to simulate bulbs that are off, then work through the simulation.

Repeat the simulation using 36 cards, and then with 49 cards. Determine the pattern for the bulbs that are on.