**Simulations and Probability**

**1.** Anya invited 4 friends to play board games.
What is the probability that at least 2 of the 5 people have a birthday in the same month?

Simulate the problem using five 12-sided dice.
Throw the dice at least 100 times.
For each throw, record whether you get no matches, 2 matches, 3 matches, 4 matches, or 5 matches.
Use the tally chart to record your results.

| No Matches | 2 Matches | 3 Matches | 4 Matches | 5 Matches |
|---|---|---|---|---|
| | | | | |

Calculate the experimental probability of a match.

$$\text{Experimental Probability} = \frac{\text{number of favourable outcomes}}{\text{total number of trials}}$$

**2.** You can find the value of π by throwing sticks onto a striped fabric, such as a bedsheet.
Find sticks, such as toothpicks, and measure the length of one. Call that length $l$.
Find a fabric that has parallel lines that are farther apart than the length of the stick.
Measure the distance between the parallel lines, and call it $d$.
Toss the sticks onto the fabric. Write down the number of sticks you threw, and call it $n$.
Write down the number of sticks that fell across one of the lines and call it $c$.

You can calculate π from the formula $\pi = \frac{2ln}{dc}$.

Example: $l = 6$ cm
$d = 8$ cm
$n = 10$
$c = 5$

$$\begin{aligned}\pi &= \frac{2ln}{dc}\\ &= \frac{2\times 6\times 10}{8\times 5}\\ &= \frac{120}{40}\\ &= 3\end{aligned}$$

Try the experiment using 10 throws. How close is your result to the value of π?

**Patterning**

**1.** How many Friday the 13ths are possible in 1 year?
Use paper and pencil or technology to find out.
Show a possible calendar for the maximum number of Friday the 13ths.

What is a blue moon?
Use the library or Internet to research blue moons.
How many blue moons could occur in one year? Show a possible calendar for the maximum number of blue moons.

| | | | | | | |
|---|---|---|---|---|---|---|
| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
| | | | | | | |
| | | | | | | |
| | | | | | | |
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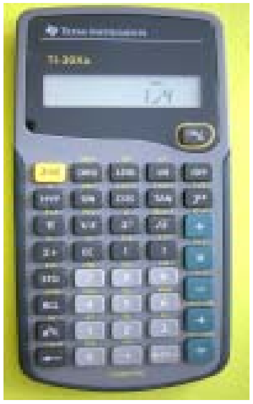
**2.** The number 6 is called a *perfect number* because its factors (1, 2, and 3) add up to 6: $(1 + 2 + 3 = 6)$.



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, it is called *deficient*. For example, 8 is a deficient number. The factors of 8 are $1 + 2 + 4 = 7$.
If the factors of a number add up to more than the number, it is called *abundant*. For example, 12 is an abundant number. The factors are $1 + 2 + 3 + 4 + 6 = 16$.

Identify the deficient and abundant numbers in your list.

**3.** Before calculators and computers were invented, accountants used a trick to check their calculations. It was called *casting out nines*.

Research casting the nines on the Internet or in the library to find out how it works.

Show 1 example for addition, subtraction, multiplication, and division.

Are there any cases where casting out nines does not work?

**4.** You have 25 cards numbered from 1 to 25, and arranged in a $5 \times 5$ square.

Flip over every card that is divisible by 1.
Then, flip every card that is divisible by 2.
Continue to flip every card that is divisible by 3, 4, 5, etc. until you have flipped the cards divisible by 25.

Which cards will be face up when you're done?

Repeat the experiment for 36 cards. What is the pattern?