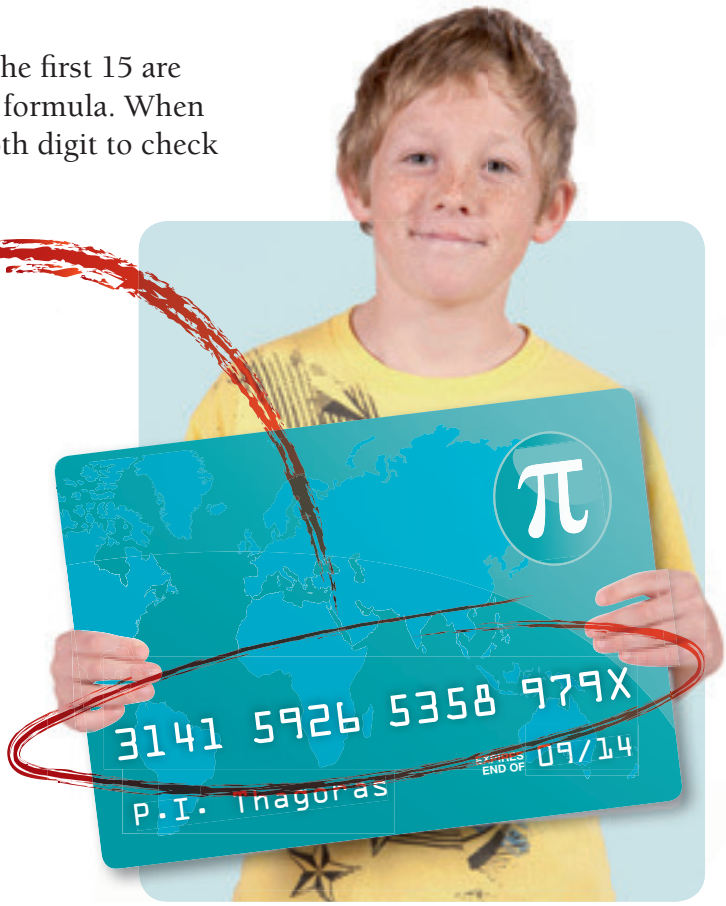
Safety in Numbers

You need ★ a calculator

TECHNOLOGY **The Internet has changed the way many people shop. The process of buying and selling products online is called e-commerce. It has made it easy to trade around the world, but has also created security and privacy problems.**

Activity One

Sam's dad is doing his supermarket shopping online. When he enters his credit card number to pay for his purchases, the computer tells him that he has made an error. How does the computer know?



1. Credit cards have a unique 16-digit number. The first 15 are decided by the bank. The 16th is decided by a formula. When a number is entered, the computer uses the 16th digit to check whether it has been entered correctly.

a. Here are the first 15 digits of a credit card number:

3141 5926 5358 979

i. Add the digits in the odd positions and double the total.

ii. Add the digits in the even positions.

iii. Count the number of digits in the odd positions that are greater than 4.

iv. Add together your answers to **i**, **ii**, and **iii**.

b. The 16th (check) digit is the number needed to bring this total up to the next multiple of 10. What is this number?

The system is designed to pick up all single-digit errors (for example, keying 5 instead of 2) and other common errors (for example, entering two digits in the wrong order).

2. **a.** Change one digit in the credit card number above. Find the new check digit.

b. Choose two digits that are next to each other. Swap their order and find the new check digit.

Activity Two

Some computer hackers try to steal credit card numbers or other private information. Encryption (coding) is used to prevent this. Most encryption systems are based on prime numbers.

1. How are prime numbers different from other numbers?

2. a. Write down the factors of these numbers:

   i. 10 ii. 15 iii. 33 iv. 65

   b. What do you notice about the factors?

   c. Find three other numbers that have only four factors.

> When two prime numbers are multiplied together, they create a "product of two primes". If one prime factor is known, it is easy to find the second. But if the product is very large, and neither factor is known, it is very difficult for a computer to work out the factors.

3. A product of two primes can be used as a "public key" to securely lock (encrypt) messages. Once encrypted, a message can only be unlocked and read by the person with the matching "private key" (one of the two prime factors).

   a. Solve these two problems:

   i. 31 x 17 =

   ii. Find two prime numbers that multiply to give 611.

   b. Which problem was easier to solve? Why?

4. a. Two prime numbers have been multiplied to give 437.
   One of the numbers is 19.
   What is the other number?

   b. Two prime numbers have been multiplied to give 21 506 237.
   One of the numbers is 7393.
   What is the other number?

5. Create a product of two primes that is less than 200. Give it to your classmate and challenge them to find the two factors.