

what's the point of...

SEQUENCES?

Counting the cost or splashing out?

You struck it lucky and won £5000 in a prize draw. Having spent some of the cash on a new jacket and festival tickets, you decide to put £4000 of the money in a savings account. But which bank? And what does 5% AER mean?

Your friend wasn't so lucky and is in debt. She owes £300 on her store card and wants to know how fast she needs to pay it off. Being able to work with sequences of numbers is vital for anyone working in the financial sector.

AER stands for the annual equivalent rate and is the percentage of your £4000 that you'll get in interest at the end of the year.

At 5% AER you'll get £200 interest after twelve months. If you've not spent any of those savings then after two years you'll have 5% of £4200, or £210 more interest. The sequence £4000, £4200, £4410, £4630.50, ... is calculated by taking each amount in turn and multiplying it by 105%, or 1.05. After ten years of saving you'll have £6515.58.

How could you make more money? Use your maths skills to get a job working for the bank!

See Facts and Figures below for details of salaries you could earn using your maths skills in a bank.

Your friend can use mathematical functions found on a spreadsheet computer package like Microsoft Excel to work out what she should pay each month.



Shopping shopping shopping!

In most jobs a computer can do the boring bits of the calculations but you would be expected to know enough about how it works to check it's giving a good answer or to explain it to a client or colleague.

Facts & Figures

In 2007 the average graduate starting salary in the UK was £23 000.

The average salary for employed people aged between 22 and 29 years was £18 000 – £19 000.

25% of employed people aged between 30 and 39 years had a salary of less than £14 500.

Graduate starting salaries in investment banks averaged at around £36 000. They hire people with 2:1s in a numerate degree like maths or science. They may also look at candidates' school performance.

Fibonacci sequence

1, 1, 2, 3, 5, 8, 13, 21, 34, 55, ...

Work out what the rule is.

What number comes next?

If you look at the ratio of one term to the previous term, this value tends to the golden ratio: $\frac{1+\sqrt{5}}{2} = 1.6180339...$

Compression compression compression



How do you listen to music? How did your parents?

Thirty years ago if you wanted to listen to music you had to carry around a large and heavy radio. Walkmans, the first personal stereo players, were just coming in.

These days your iPod can fit easily in your pocket. It has more computing power than existed in the world in 1950. How do they get it so small?

Better computer memory can now hold far more data than before. Maths helps microchip designers to make microchips smaller and smaller each year.

But there's more to iPods than just the memory chips inside. A music file which takes up 10 MB of memory when stored on your hard disc can be compressed to a 1 MB file which fits better on your iPod. How does this work?

In the 1930s the American mathematician Claude Shannon invented a new science called information theory. We can understand the text message "c u l8r" even though letters are missing from all of the words. Some of the letters are redundant, and some of the letters contain the information. Redundancy is taken out in the process of compression to make files smaller. This is why the mp3 files played by an iPod are smaller: they've been compressed.

What's this got to do with sequences? Well, a sound wave can be written as a sum of different sine waves, and compression is a process that works with the sequence of these sine waves. This maths is called Fourier analysis and was invented over 200 years ago in France to investigate heat waves. Fourier analysis is widely used in many fields of science and engineering.

Power dressing

Stylists and designers work with shapes, colours and materials to create new fashions and update styles. Computer animation designers also need to create images, but they have to write them in mathematical language.

A cornrow braid hairstyle depends on a geometric sequence. Geometric means that each term in the given sequence is the same multiple of the previous term. So for example $1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \dots$ is a geometric sequence where each number is half of the previous one. You can see the braid getting smaller like this as it curls in on itself. In order to make the style fit the person, a hairdresser has to judge how much hair they use in each bit of the braid.

Hair stylists use their experience to make a hairstyle look good rather than writing down the maths. But what if you were playing a computer game where your character's hair has to move realistically? Lara Croft's ponytail swings perfectly in Tomb Raider because it's generated by a mathematical sequence. Someone's figured out the right equations to make it look real!



Cornrow braid hairstyle

Websites to check out:

www.mathscareers.org.uk
plus.maths.org

Interview with two designers with a maths/science background: plus.maths.org/issue39/interview/index.html

Interview with an accountant who studied maths and PE: plus.maths.org/issue2/career/index.html