Mathematician of the week

Sofia Kovalevsky
Born: Moscow Jan 15th 1850
Died: Stockholm 1891

Sofia Kovalevsky was born in Moscow. Her father was a general in the Russian army. She was educated until she was an adult at home by her strict English governess. She lived in a large castle near the Lithuanian border. Her bedroom was wallpapered with old mathematical university lecture notes that her father had bought while at university and she spent hours trying to decipher the various squiggles.

Women were not allowed to study at Russian universities in those days but if they were married they could travel round the universities of Europe. Sofia ran away form home and married a Geology student in order to pursue her studies. Even in most of Europe women were not allowed to study officially but finally she managed to beg Karl Weierstrass at the University of Berlin to allow her to study as a private student.

In 1874 she was appointed a professor at the University of Stockholm. She was known as the "Princess of Science".

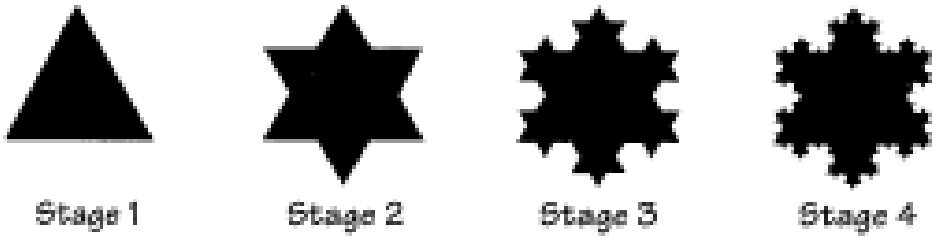
Sofia Kovalevsky is the only Russian woman in mathematics to have a postage stamp in her honour. Her motto was

"Say what you know,
Do what you must,
Come what may"

Kovalevsky made valuable contributions to the theory of differential equations and was interested in infinite series.

Questions that Sofia Kovalevsky would have been interested in.

1. The snowflake curve.
   Even a small snowflake with less than 6 cm^2 can have a perimeter of more than 160 million kilometres!



Assume that the original equilateral triangle has a side length of 1 cm.
Fill in the table below

Stage number	Number of sides	Length of side (cm)	Perimeter of snowflakes (cm)
1	$3 \times 4^0 = 3$	$\frac{1}{3^0} = 1$	$3 \times 1 = 3$
2	$3 \times 4^1 = 12$	$\frac{1}{3^1} = \frac{1}{3}$	$12 \times \frac{1}{3} = 4$
3	$3 \times 4^2 = 48$	$\frac{1}{3^2} = \frac{1}{9}$	$48 \times \frac{1}{9} = 5\frac{1}{3}$
4	$3 \times 4^3 = 192$	$\frac{1}{3^3} = \frac{1}{27}$	$192 \times \frac{1}{27} = 7\frac{1}{9}$
5			
60			
100			
n			

2. According to ancient legend, the king of India wanted to show appreciation to the servant who had invented the game of chess for the king's entertainment. "All I ask, your majesty", said the servant, "is some grains of wheat for each square on the chessboard. Give me one grain on the first square, two grains on the second square, four on the third, eight on the fourth, and so on. Double the number from one square to the next until all 64 are covered. The king quickly agreed.

   How much wheat did he need?

   Amazing fact: To fulfil the promise the King would need more wheat than the world has produced in the last 2000 years!

Answers to Sofia Kovalevsky quiz

1.

Stage number	Number of sides	Length of side (cm)	Perimeter of snowflakes (cm)
1	$3\times4^{0}=3$	$\frac{1}{3^{0}}=1$	$3\times1=3$
2	$3\times4^{1}=12$	$\frac{1}{3^{1}}=\frac{1}{3}$	$12\times\frac{1}{3}=4$
3	$3\times4^{2}=48$	$\frac{1}{3^{2}}=\frac{1}{9}$	$48\times\frac{1}{9}=5\frac{1}{3}$
4	$3\times4^{3}=192$	$\frac{1}{3^{3}}=\frac{1}{27}$	$192\times\frac{1}{27}=7\frac{1}{9}$
5	$3\times4^{4}=768$	$\frac{1}{3^{4}}=\frac{1}{81}$	$768\times\frac{1}{81}=9\frac{13}{27}$
60	3×4^{59}	$\frac{1}{3^{59}}$	$\frac{4^{59}}{3^{58}}\approx 70$ million
100	3×4^{99}	$\frac{1}{3^{99}}$	$\frac{4^{99}}{3^{98}}\approx 7$ billion
n	$3\times4^{n-1}$	$\frac{1}{3^{n-1}}$	$\frac{4^{n-1}}{3^{n-2}}$

2. Chessboard problem

Number of squares	Total grains
1	1
2	3
3	7
4	15
n	$2^{n}-1$
64	$2^{64}-1=1.8\times10^{19}$