Supporting African Maths Initiatives

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SIXTH FORM

Puzzle Booklet

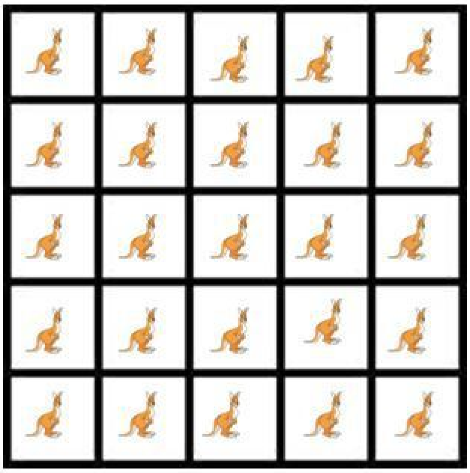
Puzzle 1

Each term in a sequence of positive integers is obtained from the previous term by adding it to its largest digit. What is the greatest possible number of successive odd terms in such a sequence?

Puzzle 2

There is a kangaroo in the centre of each square of a 5-by-5 grid of squares. Lightning strikes, and each kangaroo simultaneously jumps one square up, down, left or right. What is the greatest possible number of empty squares that could remain?

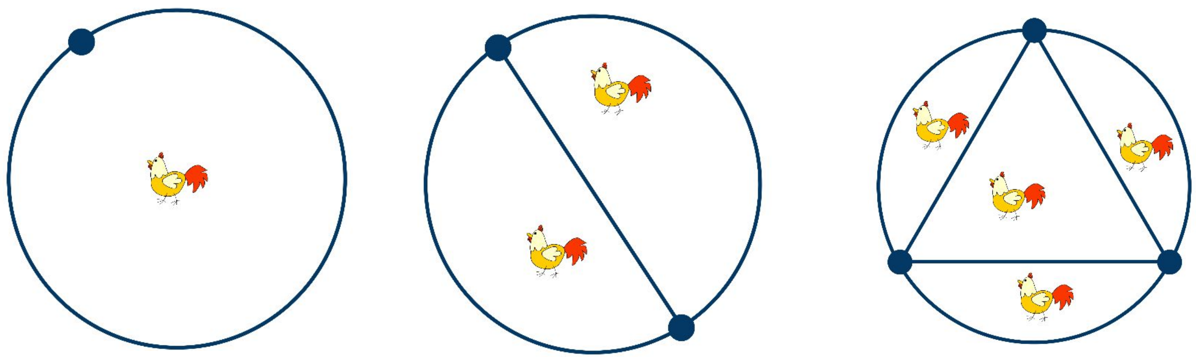
Here is the setup:



Puzzle 3

A farmer keeps his chickens in circular fields, separated by fence posts and straight fencing.

1 fence post → 1 chicken 2 fence posts → 2 chickens 3 fence posts → 4 chickens



How many chickens can the farmer keep if he has 6 fence posts?

Puzzle 4

Let x be the answer to this problem, where x is a positive integer, and let y be the sum of its digits. Calculate 2x-2y.

Puzzle 5

To play soccer with three people, two field players try to score past the player in goal, and whoever scores stands in goal for the next game. Arne, Bart and Cauchy play the game, with A playing 12 times on the field, B playing 21 times on the field, and C playing 8 times in goal.

Who scored the 6th goal?

Puzzle 6

c		m				h			19
	f						e		10
			m						
			k		g	m	c		23
g				p					11
							h	f	14
	g				m				13
	a			e			k	h	11
k			c		f	a			22
17	19		16	5	22	14	16	14	

I have replaced each number from 1 to 9 in the Sudoku puzzle above with a letter. Given that the number at the end of a row or at the bottom of a column is the sum of the letters shown in that row or column, can you find which letter corresponds to which number, and then solve the Sudoku?

Puzzle 7

This question concerns calendar dates of the form

$$d_1d_2/m_1m_2/y_1y_2y_3y_4$$

in the order day/month/year.
The question specifically concerns those dates which contain no repetitions of a digit. For example, the date 23/05/1967 is such a date but 07/12/1974 is not such a date as both $1=m_1=y_1$ and $7=d_2=y_3$ are repeated digits.

We will use the Gregorian Calendar throughout (this is the calendar system that is standard throughout most of the world).

1. What was the last date before today, 03/11/2010, with no repetition of digits?
2. When will the next such date be?
3. How many such dates were there in years from 1900 to 1999? Explain your answer.

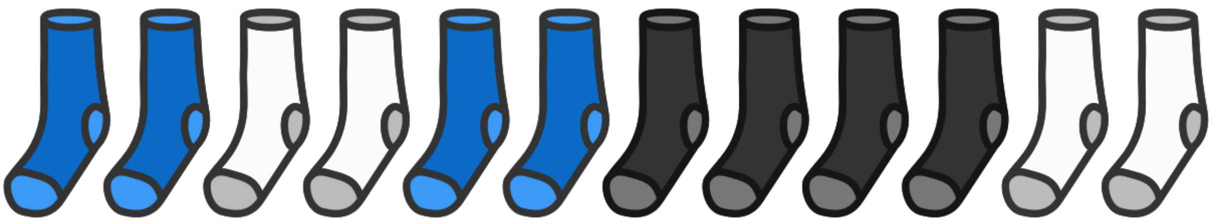
Puzzle 8

You do a load of laundry containing identical black socks, identical blue socks, and identical white socks. When it is finished, you randomly place all the socks in a single row on a table so that you can match them later on.

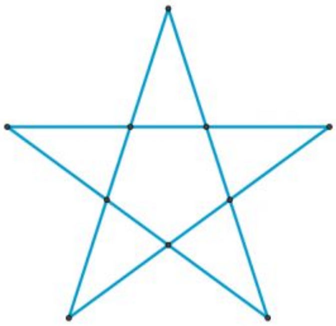
To your surprise, all pairs of socks are already beside their match!

The probability that a match-up is already complete is 1/x

What is x ?



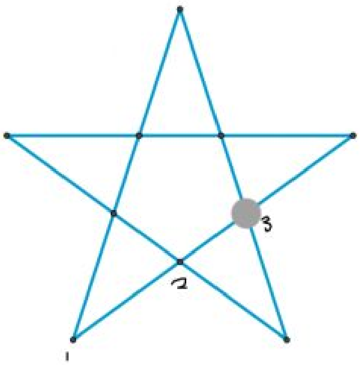
Puzzle 9

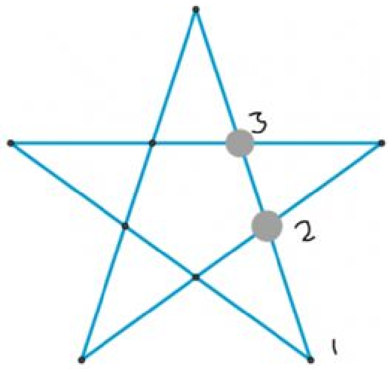


Draw a star and try to place 9 coins on any of the black vertices.

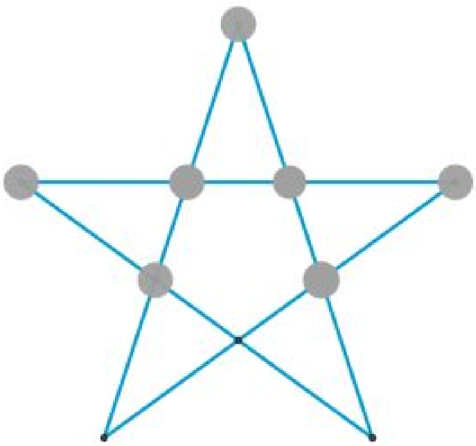
You can place coins by starting from a vertex which is empty, moving in a straight line and counting 1,2,3. Number 1 is the vertex you start on, number 2 may or may not have a coin on it, and number 3 is where you place your coin.

Two possible opening moves are shown below





Here is an attempt that has gone wrong! 7 coins have been placed but there is no way to place any more, because you must start on an empty vertex.



Puzzle 10

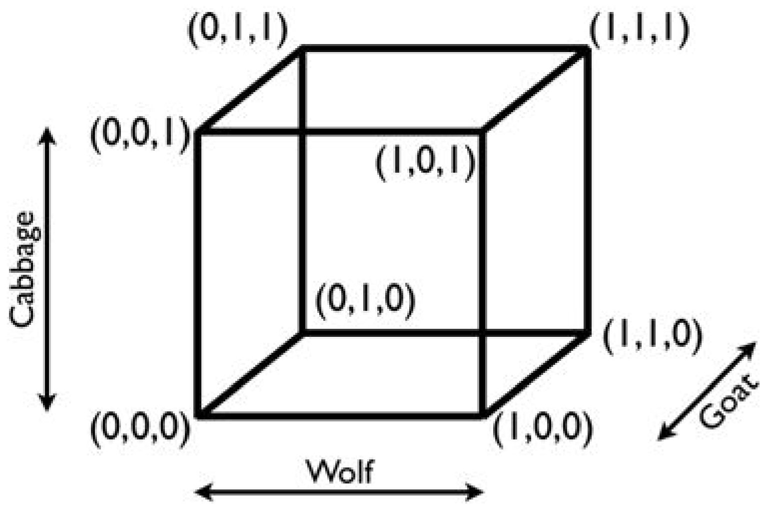
You are given two eggs and access to a 100-storey building.

If an egg is dropped and does not break, it can be dropped again. Once the egg breaks, it cannot be used again. If an egg breaks when dropped from floor n, then it would also have broken from any floor above that. If an egg survives a fall, then it will survive any fall shorter than that.

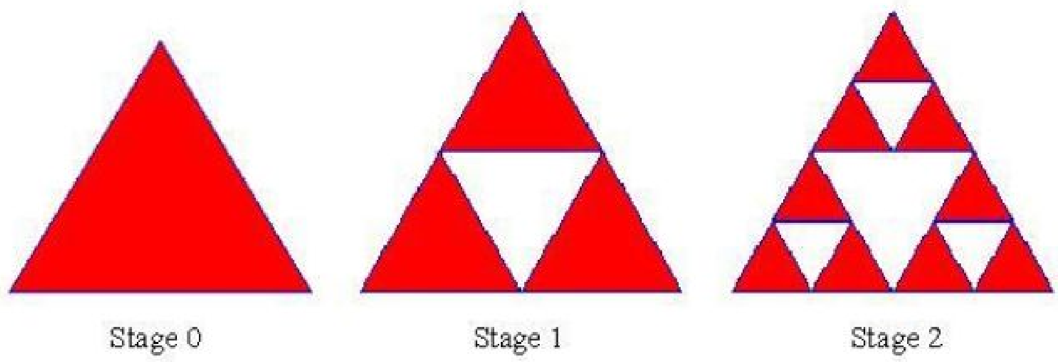
How would you find out what the highest floor is from which an egg will not break when dropped out of the window? How would you minimise the number of egg drops it might take to find this out?

Puzzle 11

What famous puzzle does this cube relate to? How does it help show the solutions?



Puzzle 12



In Stage 0 you can see one triangle, in stage two you can see 5 triangles, etc.

How many in Stange n?

Puzzle 13

On a piece of paper, draw a triangle (any triangle -right angled, equilateral, isosceles, scalene). Colour one of the vertices red, the second blue, and the third green.

Now draw a point in the triangle. This point is the seed for the game. Roll a die. If you get a 1 or a 2 this is Red, 3 or 4 this is Blue, 5 or 6 this is Green. Draw a point halfway inbetween the seed and the appropriately colored vertex. Now do the same, using your new point as the seed for the next. After a few rolls you might have a drawing like this (without the arrows):

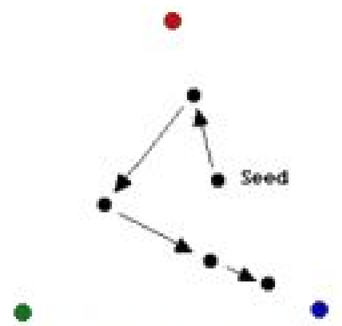


Figure 1: Playing the game with rolls of red, green, blue, blue.

Now continue in this fashion for five rolls of the dice. Then rub out all the points except the most recent seed and the coloured points.
Now carry on but don't erase any points.
Will you eventually shade in the whole triangle?