

The Maths Masters' Summer Quiz

by Burkard Polster and Marty Ross

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Welcome to our fourth annual Summer Quiz. We have thirty puzzles for you, in three sections: Easy(ish), Medium, and Mighty Hard. The sources for some of our puzzles, and great sources for many more, are the terrific books [*Ants, Bikes and Clocks*](#), [*Mindbenders and Brainteasers*](#), and [*Genius Gymnasium*](#).

Answers to all of the puzzles will appear on [our website](#) on December 2. Detailed solutions will appear on December 5. Of course, please let us know if you think you've found a mistake in a puzzle, or you want to query our suggested solutions.

This is our final column for 2011. So, good luck, enjoy, and see you next year!

EASY

Easy 1

A mini-barbecue can cook two hamburgers at once, and it takes five minutes to cook one side of a hamburger. What is the minimum time required to cook both sides of three hamburgers?



Easy 2

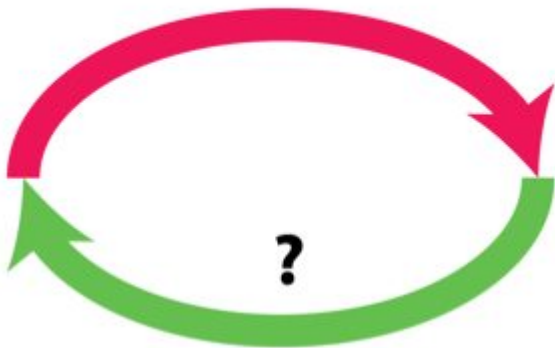
We adjust the Google Chrome browser logo so that the four coloured regions all have the same area. If the new logo has a diameter of 6 centimetres, what is the diameter of the blue circle in the middle?



Easy 3

Craig the marathon runner starts the big race badly, averaging 8 kilometres per hour over the first half of the marathon. He wants to average 16 kilometres per hour for the whole race. Can Craig do it?

8 km/h



Easy 4

128 players enter the Australian Open tennis tournament. Half of the players are eliminated in the first round. Then, in the second round, half of the remaining players are eliminated. This continues until only one player remains undefeated, who is then crowned champion. What is the total number of matches played?



Easy 5

A set of scales works perfectly, except that the zero point is off. When Tony weighs himself, the scales register 70 kilos, and

when Julia weighs herself the scales show 50 kilos. With both of them on the scales, it registers 115 kilos. How much are the scales off, and how much do Tony and Julia really weigh?



Easy 6

The three squares below have sides of length 2 centimetres. How large are the green regions?



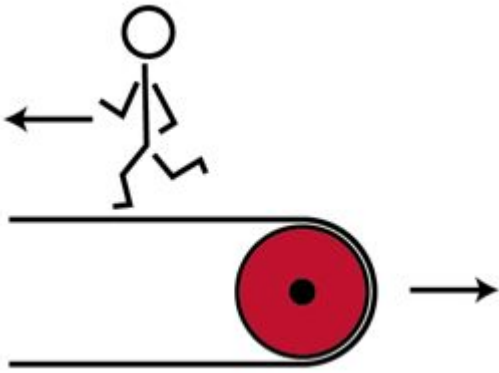
Easy 7

There are 11 people in a room, shaking hands, but Jerry has failed to shake hands with someone. What is the maximum number of people who could have shaken hands with everyone else?



Easy 8

A very foolish army crew is using the caterpillar track of a tank as their treadmill. The tank moves at 5 kilometres per hour. How fast does a soldier have to run to avoid a horrible accident?



Easy 9

You want to place ten coins into three cups so that each cup contains an odd number of coins. How do you do it?



Easy 10

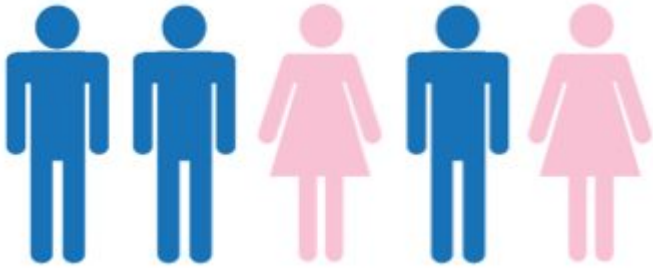
The local newspaper, the Melbourne Spun, reports the findings of their survey of 1000 readers: 723 of the readers enjoy footy, and 647 are keen on cricket. As well, 249 of the readers indicated they actually enjoy both footy and cricket. However, you're suspicious of the Spun's survey. Why?



MEDIUM

Medium 1

In the backward country of Genderdum, parents prefer sons to daughters. Each couple has up to two children; if the first child is a boy then they have no more children, and otherwise they have a second child. What is the ratio of boys to girls in Genderdum?



Medium 2

Which number on the die is hidden directly beneath the skull?



Medium 3

In the Olympic final, Larry finished in the middle of the runners. Curly finished in 10th place, somewhere behind Larry. Mo finished in 16th place. How many runners were in the race?



Medium 4

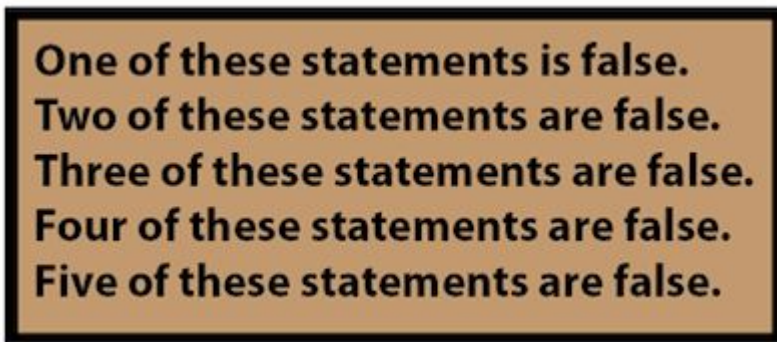
In an episode of the TV show *Survivor Thailand*, the two tribes were given a challenge involving 21 flags. The tribes took turns removing the flags: on each turn they could remove their choice of one, two or three flags. The tribe to remove the last flag was

declared the winner, which turned out to be the tribe that went second. Should they have won?



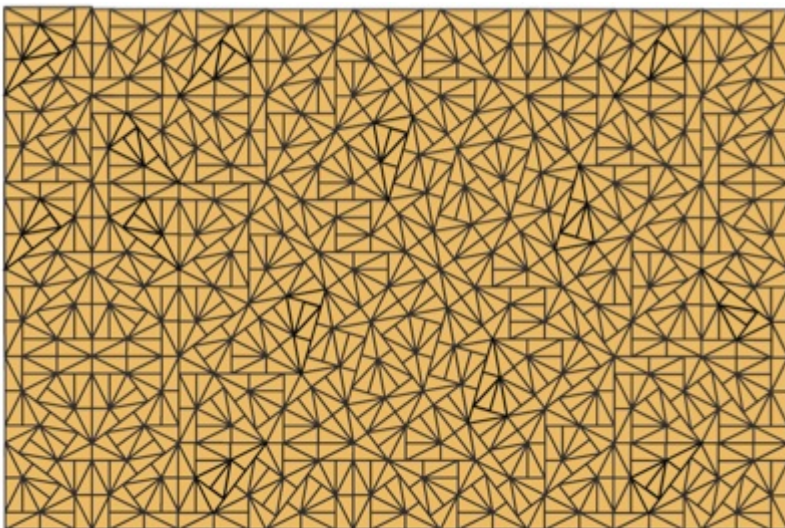
Medium 5

Which of the statements below are true?



Medium 6

Below is one of the walls of Federation square. The tiles are all right-angled triangles, with shorter sides 60 centimetres and longer sides 120 centimetres. How many tiles have been used to cover the wall?



Medium 7

Wendy's sock drawer contains 4 blue socks, 4 red socks and 4 black socks. If Wendy pulls out three socks at random, what are the chances that there is a matching pair among the three?



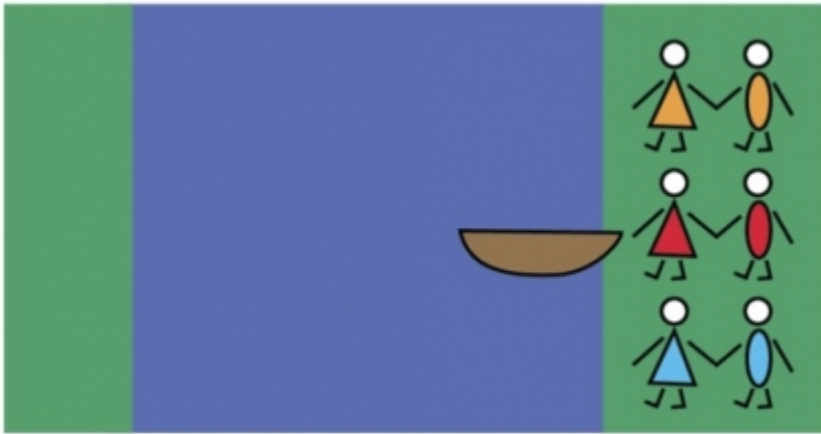
Medium 8

The Great Burk is juggling five balls, four red ones and a green one. On each beat of the music, he tosses a ball in the air, from one hand to the other; so, each ball is tossed on every 5th beat. You watch Burk for a minute, and in that minute you see him toss the green ball with his right hand 30 times. What is the total number of tosses that the Great Burk makes in a minute?



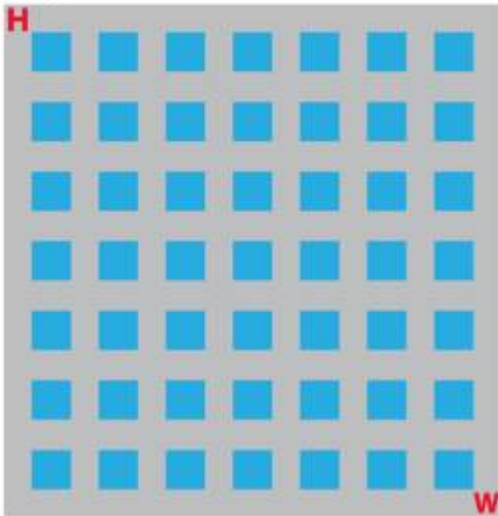
Medium 9

Three married couples arrive at a river. There is a boat they can use to cross the river, but it can only carry two people at a time. Also, no man is ever permitted to be alone with a woman other than his wife. Can they cross the river?



Medium 10

The city of Blueville consists of seven by seven blocks, and Angela's apartment and her workplace are at opposite corners of the city. What is the smallest number of blocks that Angela must travel to get from her apartment to work? How many different ways are there for her to make such a journey?



HARD

HARD 1

Three coins are placed in a bag: one is an ordinary coin, the second has heads on both sides, and the third has tails on both sides. A coin is taken from the bag, is flipped, and comes up heads. What are the chances that the other side of the coin is heads?



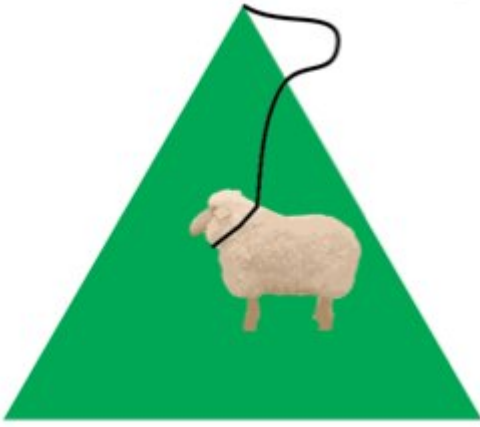
HARD 2

Two ants are on a cylindrical glass that is 5 centimetres in diameter. The ants are on opposite sides of the glass, 5 centimetres down from the glass's rim. If both ants are on the outside of the glass, what is the shortest distance required for one ant to crawl to the other? What if one ant is on the outside of the glass and the other is on the inside?



HARD 3

Fluffy the sheep is chained at one corner of an equilateral triangular field. The field has an area of 100 square metres, and Fluffy's chain is just long enough so that she can graze half the area of the field. How long is her chain?



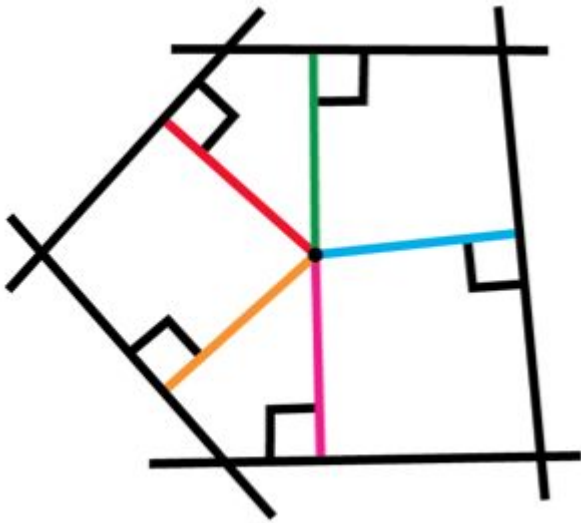
HARD 4

A room is lined with closed lockers, numbered from 1 to 100. A student enters the room and opens all the lockers. A second student enters the room and closes every second locker, all those labelled with an even number. A third student enters the room and walks up to every third locker: if it is open she closes it, and otherwise she opens it. Similarly, a fourth student enters the room, goes up to every fourth locker, opens the closed ones and closes the open ones. This continues until the 100th student has had his go at the lockers. When all the students are done, which lockers are open?



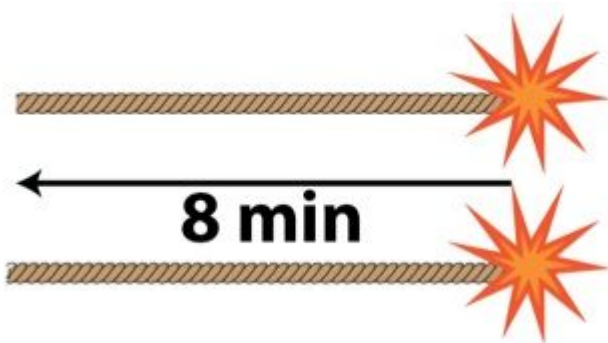
HARD 5

A pentagon is constructed in the following manner: five straight lines of length 4 centimetres are drawn from a point, and then perpendicular lines are drawn to these five lines. It turns out that the pentagon has a perimeter of 40 centimetres. What is its area?



HARD 6

You are given two fuses. Each fuse burns for a total of 8 minutes, but they don't burn evenly along their length. How can you use the fuses to measure a time of 6 minutes?



HARD 7

15 irregular paper shapes are used to completely cover the top of a table. The shapes may overlap and may hang over the edge of the table. Show that you can remove five of the paper shapes so that the remaining ten shapes cover at least $\frac{2}{3}$ of the table.



HARD 8

You are blindfolded and led to a table, upon which lie 112 coins. 38 of the coins are showing heads, with the rest being tails. How can you separate the coins into two groups, so that each group has the same number of heads? You may move the coins, but you're not allowed to feel them to determine which side is up.



HARD 9

A number of planks are piled on top of each other on a flat floor, as pictured. The planks are all the same size and shape. Which point of the pile is highest above the floor?



HARD 10

You want to drive around a circular route. You can choose to start at any petrol station along the route, with an empty tank. However, because of a shortage, the petrol stations between them have just enough petrol for you to complete the route. Show that if you choose the beginning station correctly, you can still manage your trip.

Burkard Polster teaches mathematics at Monash and is the university's resident mathemagician, mathematical juggler,

origami expert, bubble-master, shoelace charmer, and Count von Count impersonator.

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