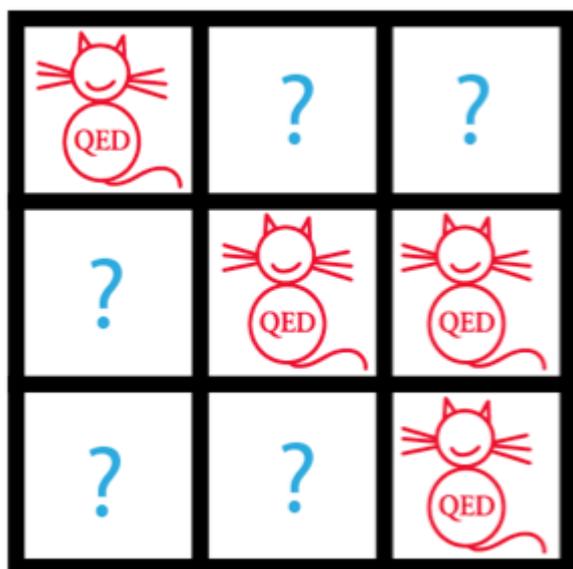# The Maths Masters' Summer Quiz

by Burkard Polster and Marty Ross

The Age, 12 November 2012

Welcome to our fifth annual Summer Quiz. Below are thirty puzzles, ranging from Easy(ish) to annoyingly Hard, all designed to help you while away a summer's day. Some of the puzzles below, and tons more, can be found in the excellent collections *Mindbenders and Brainteasers*, *Mathematical Snacks* and *Mathematical Mind-Benders*.

Answers to all of the puzzles will appear on our website on November 30, and we will post detailed solutions on December 3. Of course, feel free to ask questions and to make suggestions in the comments below.

This is our final column for 2012. We would like to extend a huge, huge thank-you to our wonderful editor Ken Merrigan. We wish you all a great summer, and we look forward to being back next year. Enjoy the puzzles!

EASY

Easy 1
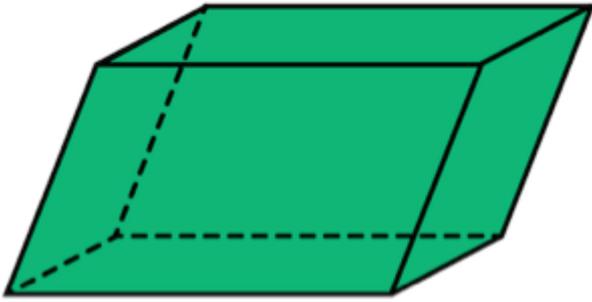
Above is a picture of a parallelobox. How many diagonals (from corner to opposite corner) does it have?

Easy 2

A runner and a walker are standing together on a 400 metres circular track. They take off in opposite directions, the runner at 4 metres per second and the walker at 1 metre per second. How long will it take until they meet again?

Easy 3

Three empty glasses are lined up next to three full glasses. You want the empty and full glasses to alternate, but you are only allowed to touch one of the glasses. How do you do it?

Easy 4
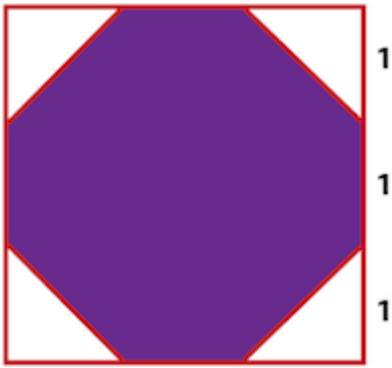
What is the area of the purple octagon?
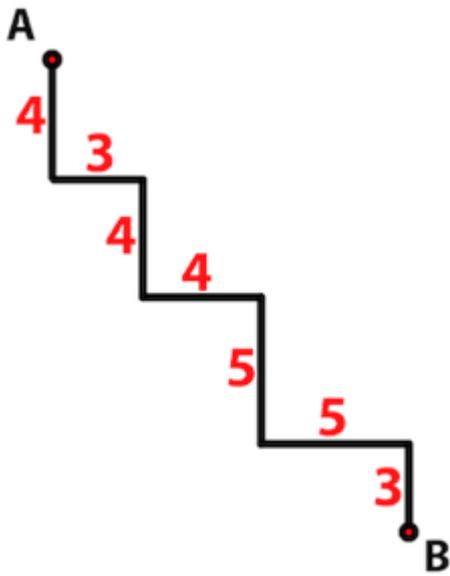
Easy 5

Together, four rabbits can dig four holes in four days. How long would it take eight rabbits to dig eight holes?

Easy 6

Karl: Mina is lying.
Mina: Lara is lying.
Lara: I am not lying!

One of the three people above is lying and the other two are telling the truth. Who is the liar?
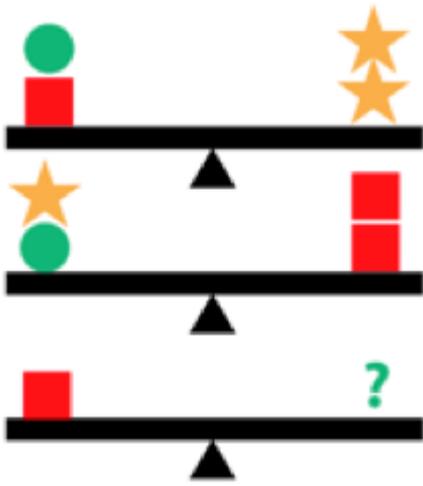
Easy 7

A

4

3

4

4

5

5

3

B

How far is it from A to B?

Easy 8

You have a pile of 10 cent, 5 cent and (very old) 2 cent coins.
In how many different ways can you make exactly 31 cents?

Easy 9

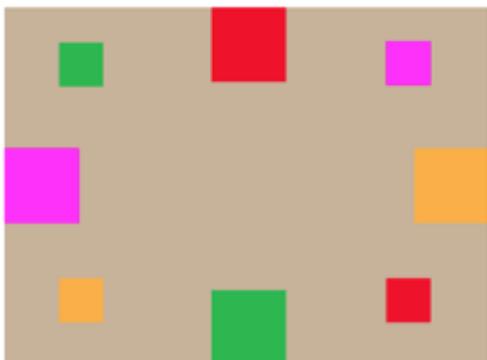What will balance the red square (apart from another red square)?

Easy 10

In English there is only one natural number which when written as a word has its letters in alphabetical order. Which number is it?

MEDIUM

Medium 1

Find four paths that connect the squares of the same colour. The paths should not intersect and should not leave the brown playing area.

Medium 2

A grandfather clock strikes once for 1 o'clock, twice for 2 o'clock and so on. Roman clocks have two bells, the first striking once for each I and the second striking once for each V. (Here, X counts as two V's, and the number 4 is written as IV rather than IIII). During a twelve hour period which clock will strike more often?

Medium 3

The hot water tap fills the bath tub in 9 minutes and the cold water tap fills it in 6 minutes. How long will it take to fill the tub if both taps are used?

Medium 4
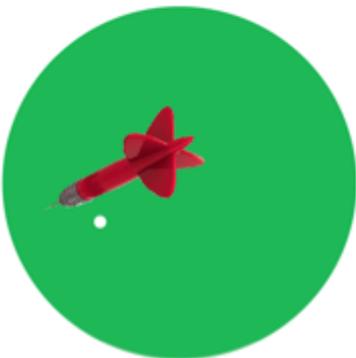
Your friend tosses a 10 cent coin somewhere on the MCG. You are above in a hot air balloon and you blindly toss a dart down onto the field. What are the chances that your dart hits the coin? The diameter of the coin is about 24 millimetres, and you can assume the MCG is also circular, with a diameter of 160
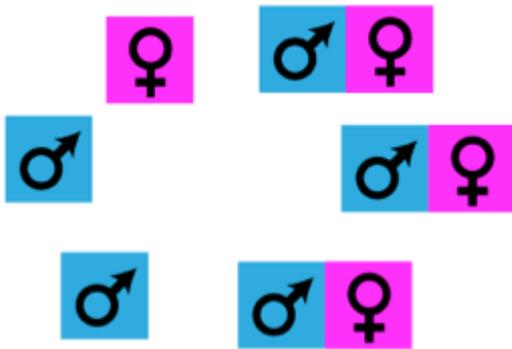
metres. (The chances turn out to be about the same chance as that of a ticket winning Division 1 in Oz Lotto).

Medium 5

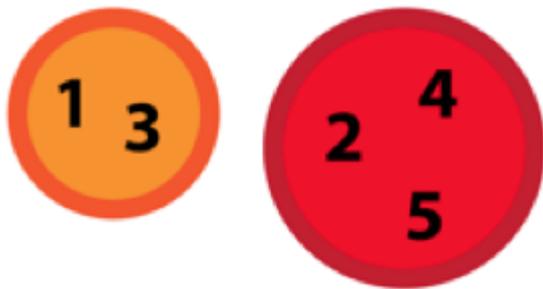$$\frac{3}{7} + \frac{5}{6} = \frac{8}{13}$$

A popular method of adding fractions is to separately add the numerators and the denominators. Does this method ever actually give the correct answer? You can assume the numerator and denominator are both positive.
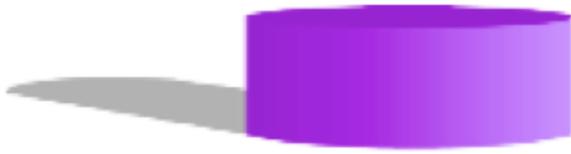
Medium 6

100 adults inhabit a village. There are 62 women and 14 single men. How many married men are there in the village?

Medium 7

As pictured, the numbers $1, 2, 3, 4$ and 5 can be split into two groups so that no two numbers and their sum appear in the same group. Can you do the same with the numbers 1 through 6? How far can you go?

Medium 8

You want to cut a cake into identical pieces. What is the maximum possible number of pieces if you make three straight cuts?

Medium 9

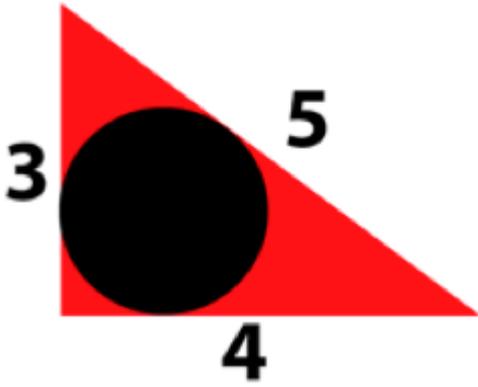What is the last digit (i.e. the digit in the ones place) of the monster number above?

Medium 10

You go for a swim in a circular lake. You jump in the water, swim 300 metres east and reach the edge of the lake. You then swim 400 metres south and again reach the edge of the lake again. What is the diameter of the lake?
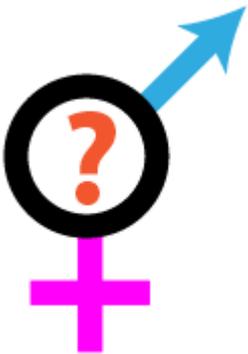
HARD

Hard 1

$$2 = \sqrt{x\sqrt{x\sqrt{x\sqrt{x\sqrt{x\sqrt{x\sqrt{x\sqrt{x\sqrt{x\cdots}}}}}}}}}$$

Solve for x.

Hard 2

You draw a line connecting the 5 and 9 on a clock face, and another line connecting the 3 and 8. What is the angle between the two lines?

Hard 3

In his will, a man leaves 7 full, 7 half-full and 7 empty wine barrels to his three sons. Every son is supposed to receive the same number of barrels and the same amount of wine. How can this be done? You are not allowed to pour wine from one barrel to another.
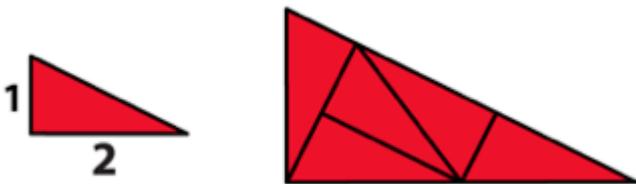
**Hard 4**

What is the radius of the circle?

Hard 5

A postman knocks on the door of a house where two children live, and the door is answered by a little girl. What are the chances that the other child is also a girl?

Hard 6

The right-angled triangles that make up the façade of Federation Square have the beautiful property that five of the triangles can be combined into a larger triangle of the same shape. Can you find a right-angled triangle for which two such triangles combine into a triangle of the same shape? What if you want three triangles to combine into the same shape, or four?

Hard 7
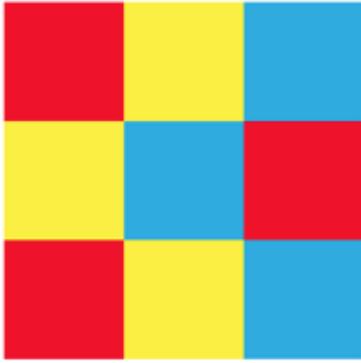
You have nine square tiles: three red, three blue and three yellow. In how many ways can you arrange the tiles into a 3 x 3 square so that no two tiles of the same colour meet along an edge?

Hard 8
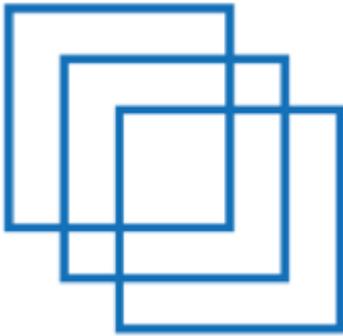
Draw this combination of squares as one path. The path cannot cross itself, and you cannot lift your pen from the paper.

Hard 9

$$a \times b \times c = a + b + c$$

You are told to multiply three numbers together but instead you add them. By luck, you wind up with the correct answer. What are the numbers?

Hard 10

An enclosure contains 12 blue, 16 green and 20 red chameleons. Whenever two chameleons of different colours meet they both change to the third color. Can all the chameleons wind up the same colour?

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.

Marty Ross is a mathematical nomad. His hobby is smashing calculators with a hammer.

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