# ASK A SCIENTIST
PI APPROXIMATION DAY PUZZLE PARTY
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1. Scrambled Dice

Two cubical dice each have removable numbers 1 through 6. The twelve numbers on the two dice are removed, put into a bag, then drawn out one at a time and randomly reattached to the faces of the cubes, one number to each face. The dice are then rolled and the numbers on the two top faces are added. What is the probability that the sum is 7?

2. Diamonds

The figures F_1, F_2, F_3 and F_4 shown are the first in a sequence of figures. For $n \geq 3$, F_n is constructed from F_{n-1} by surrounding it with a square and placing one more diamond on each side of the new square than F_{n-1} had on each side of its outside square. For example F_3 has 13 diamonds. How many diamonds are there in figure F_{20}?

F_1 F_2 F_3 F_4
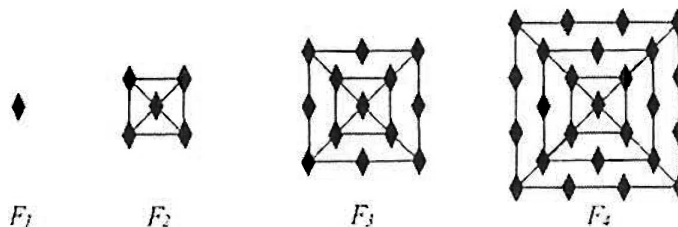
3. Wacky Fractions

$$\frac{3}{23} = \frac{1}{A} + \frac{1}{B}$$ where A and B are positive integers.

What are A and B?

4. Intersecting Spheres

If two spheres whose centers are 50 feet apart have radii of 40 feet and 30 feet, what is the diameter of the circle of intersection?

5. What Comes Before Eleven?

If the numbers from one to ninety-nine thousand nine hundred ninety-nine are spelled out and written in alphabetical order (ignoring hyphens), what comes right before eleven?

Note: hyphens should be considered equal to spaces; spaces alphabetize as the character before "A". So "six" comes before "sixty." And "six hundred" comes between them.

6. The Polygon

The interior angles of a convex polygon form an arithmetic progression with a common difference of 4°. Determine the number of sides of the polygon if its largest interior angle is 172°.

7. The Power of Pi

What digit is in the ones column of 227^{314}

8. The Metal Rod

You have a metal rod that is exactly 40 pounds and 40 inches (with uniform density). You can make three cuts, to divide it up into four pieces. What cuts do you make such that you could weigh out any integer from 1-40 on a balance? (The kind where you put weights on both sides of the fulcrum.)

SOLUTIONS

1. Scrambled Dice

The probability is 2/11

2. Diamonds

761

3. Wacky Fractions

A and B are 8 and 184

4. Intersecting Spheres

The diameter is 48 feet

5. What Comes Before Eleven?

Eighty two thousand two hundred and two

6. The Polygon

12 sides

7. The Power of Pi

9

8. The Metal Rod

Divide the rod into pieces weighing 1, 3, 9 and 27 pounds