

The Ryder-Voros Crossnumber

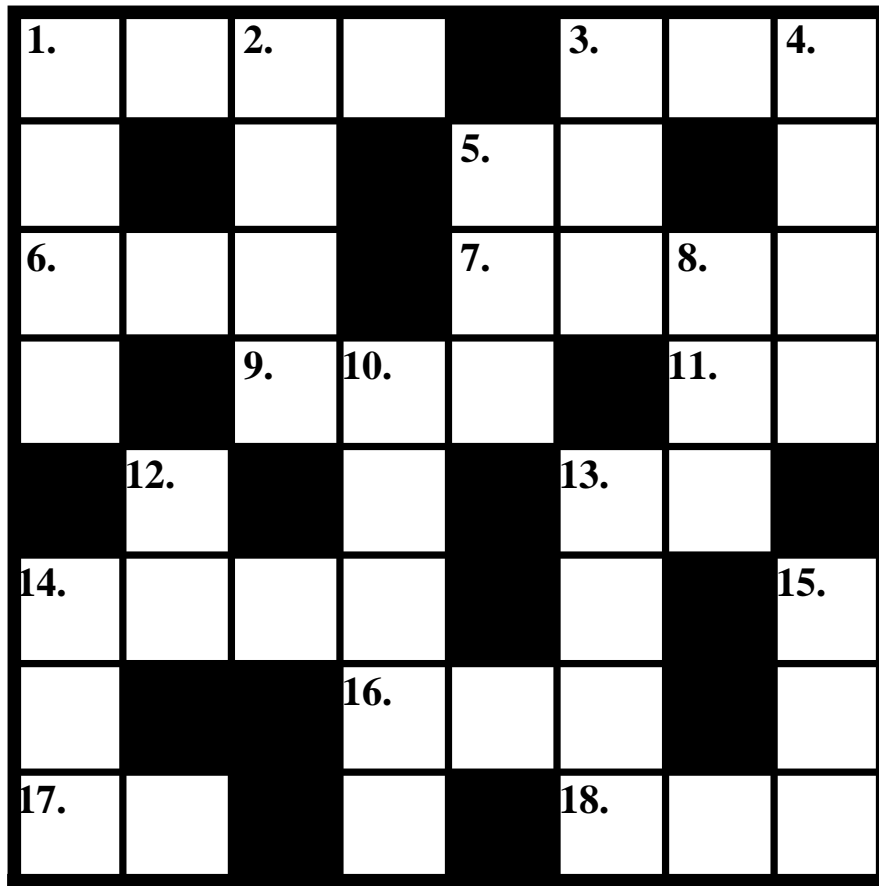


Figure 1:

Across Clues

1. The ternary representation of the decimal number 53.
3. To calculate the Chirathivat number of a positive integer n you add together all the factors of n and then divide that sum by n . Positive integers which produce the same Chirathivat number are known as friends. Find a friend of 30.
5. In an idealised world, imagine that every computer code is six characters long and uses only the digits 0 and 1. Now suppose a computer code will halt if it contains the sequence 011. How many computer codes will halt in this idealised world?
6. The value of the series

$$\begin{aligned}
 & (36 + 24 + 16 + \frac{32}{3} + \frac{64}{9} + \cdots) + (4 + \frac{16}{5} + \frac{64}{25} + \frac{256}{125} + \cdots) \\
 & + (1 + \frac{6}{7} + \frac{36}{49} + \frac{216}{343} + \cdots) + (\frac{9}{25} + \frac{72}{225} + \frac{576}{2025} + \cdots) \\
 & + (\frac{4}{25} + \frac{40}{275} \cdots) + \cdots .
 \end{aligned}$$

7. A number divisible by 17.
9. A permutation of the digits of a square number.
11. A product of three prime numbers.
13. The probability function of the Geometric distribution, which has parameter p , is $P(X = r) = p(1-p)^{r-1}$, with a sample space of $\{1, 2, 3, 4, \cdots\}$. Calculate the expectation of the Geometric distribution when $p = \frac{1}{15}$.
14. The values of x and y such that $f(x, y) = 164x + 68y - 2xy - 3x^2 - y^2 - 2016$ is maximised, concatenated to form a four-digit number.
16. The number Ω has been described as an unknowable number. It represents the probability that a randomly chosen computer code will halt on a particular computer. In an idealised world, imagine that every computer code is six characters long and uses only the digits 0 and 1. Now suppose a computer code will halt if it contains the sequence 011. To two decimal places, what would Ω equal in this idealised world? Include the leading zero in your answer.

- 17.** To calculate the Chirathivat number of a positive integer n , $\chi(n)$, you add together all the factors of n and then divide that sum by n . Calculate $\chi(20)$.
- 18.** The mysterious constant γ is defined as $\lim_{N \rightarrow \infty} [\sum_{r=1}^N \frac{1}{r} - \ln N]$. Calculate γ to two decimal places. Include the leading zero in your answer.

Down Clues

1. The value of the series

$$\frac{1}{(1+x)^2} + \frac{2}{(1+x)^3} + \frac{3}{(1+x)^4} + \frac{4}{(1+x)^5} + \frac{5}{(1+x)^6} + \dots$$

when $x = 3$, written to four decimal places. [Hint: Try integrating the series.]

2. Four consecutive digits from the decimal expansion of π .
3. A product of two prime numbers.
4. The principal value of i^i to three decimal places. Include the leading zero.
5. A multiple of 2 and 13.
8. The number Ω has been described as an unknowable number. It represents the probability that a randomly chosen computer code will halt on a particular computer. In an idealised world, imagine that every computer code is five characters long and uses only the digits 0 and 1. Now suppose a computer code will halt if it contains the sequence 011. What would Ω equal in this idealised world? Ignore the leading zero in your answer.
10. The binary representation of the decimal number 25.
12. $k!$ where k is the number of subgroups of the cyclic group

$$\{1, x, x^2, x^3, x^4, x^5 | x^6 \equiv 1\}.$$

13. The value of the definite integral $\int_0^{\frac{1}{2}} (2 + \frac{1}{\cosh x}) dx$, written to three decimal places.
14. The maximum value of $f(x, y) = 164x + 68y - 2xy - 3x^2 - y^2 - 2016$.
15. Given that $e^x = 1 + x + \frac{x^2}{p} + \frac{x^3}{q} + \frac{x^4}{r} + \dots$, where p , q and r are constants, calculate the value of $p \times q \times r$.