

Solution to Problem 1414
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Buffon's square

1414. *Proposed by Stan Wagon, Macalester College, St. Paul, Minnesota.*

Suppose a square whose diagonal's length is $\frac{5}{9}$ of an inch is thrown randomly (with uniform distribution) onto a flat surface ruled with parallel lines one inch apart. What is the probability that the square will touch one of the lines?

SOLUTION:

The answer is $\frac{10\sqrt{2}}{9\pi}$ or approximately 0.5001757312.

The problem and its solution appear as example 4, pp. 43-44, B. V. Gnedenko, *The Theory of Probability*, 2nd ed., Chelsea, New York, 1963 where the solution is given by $P(\text{cross}) = a/(\pi d)$ with a = the perimeter of an n -sided convex polygon whose diameter is less than d the distance between the lines.

A generalization to this result can be found in J. F. Ramely, *Buffon's Noodle Problem*, *American Mathematical Monthly*, October 1969, pp. 916-918 where the following theorem appears:

THEOREM: Let N be a wet noodle of length a thrown at random onto an infinite grid of parallel lines with common distance d between them. Then the expected number of line crossings $e(N)$ is given by $e(N) = (2a)/(\pi d)$.