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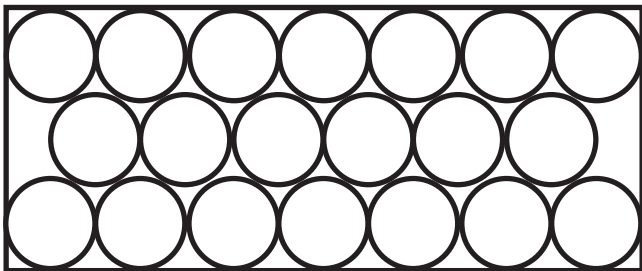
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9. The Track

A running track has straight parallel sides and semicircular ends. One lap of the track measures y long as you go along the inside edge of the inside lane. The innermost lane is Lane 1. The next lane out from Lane 1 is Lane 2. Lane 3 is the next lane out from Lane 2, and so on to the width of the track. Each lane is one meter wide. Assume that the finish line is at the center of one of the straight sides and perpendicular to that straight side of the track. The race we are discussing is a one-lap race that requires runners to stay in their respective lanes for the entire race so a staggered start is necessary to compensate for the radii of the circles in the ends. How far ahead of the starting mark for Lane 1 should the starting mark for Lane 2 be placed so both runners cover the same distance as they make their lap? Write an explanation of how you got your answer.

10. Circles in Box



You have 20 congruent circles in a rectangle whose length (p) is greater than its width (q) and both are positive integers. All circles are tangent at points of contact with other circles

or the sides of the rectangle, as shown. The ratio of length to width is $\frac{\sqrt{p-q}}{2}$. Find $p + q$.

39. The Finest Pyramid

?

28

496

8128

33550336

8589869056

Find the number that begins this pyramid.

40. Picky Numbers

A number is called a “Picky Number” if it is a positive integer and the preceding and succeeding whole numbers are prime. In other words, 4 is a “Picky Number” since it is a positive whole number and both 3 and 5 are prime numbers. Find the average of all “Picky Numbers” less than 100.