1. Circle C_1 passes through the center of circle C_2, and circle C_2 passes through the center of circle C_1. If C_1 has radius 2, find the radius of C_2.

   (a) 1
   (b) $\sqrt{2}$
   (c) $\sqrt{3}$
   (d) 2
   (e) $\sqrt{5}$

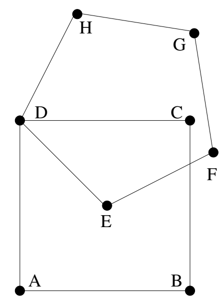
2. Today is Tuesday, October 7, 2025. On what day of the week will October 7, 2026 fall?

   (a) Monday
   (b) Wednesday
   (c) Thursday
   (d) Friday
   (e) Sunday

3. Suppose $3^x = 45$. Find 3^{-2x}.

   (a) $\frac{1}{90}$
   (b) 2025
   (c) $\frac{1}{2025}$
   (d) 90
   (e) -90

4. In the picture, $ABCD$ is a square with center E and $DEFGH$ is a regular pentagon. Find the measure of $\angle CDH$.



(a) $33°$

(b) $45°$

(c) $54°$

(d) $60°$

(e) $63°$

5. A calculus class at OSU has 33 students. What is the probability that at least two of them were born on the same day of the month?

(a) $\dfrac{33}{31}$

(b) $\dfrac{31}{33}$

(c) $\dfrac{2}{33}$

(d) 1

(e) $\dfrac{1}{31}$

6. The lengths of the sides of a (non-degenerate) scalene triangle are prime numbers. What is its smallest possible perimeter?

(a) 10

(b) 12

(c) 14

(d) 15

(e) 23

7. A farmer sells organic free-range eggs at the Farmer's Market for \$2.00 each. The first customer buys half of her eggs plus half an egg. The second customer buys half of her remaining eggs plus half an egg. Three more customers, in sequence, each buy half of her remaining eggs plus half an egg. Having sold all her eggs to these five customers, she returns home. How much money did she make from selling the eggs?

   (a) \$10
   (b) \$62
   (c) \$86
   (d) \$114
   (e) \$128

8. Simplify $(2+3i)^4$. (Recall that i is the square root of -1.)

   (a) $313+312i$
   (b) $-119-120i$
   (c) 97
   (d) $16+81i$
   (e) $56-65i$

9. Arthur wants to use a 6cm$\times$10cm$\times$13cm block of cheese, together with some bread, protein, and vegetables, to craft the perfect sandwich. He makes ten slices, each exactly one half-centimeter thick, along the sides of the cheese block (notably, he cut along more than one side), arranges some of those slices to precisely cover his bread, and eats the others. What is the largest possible volume for the remainder of the cheese block after Arthur has assembled his sandwich?

   (a) 480 cm^3
   (b) 486 cm^3
   (c) 498 cm^3
   (d) 512 cm^3
   (e) 525 cm^3

10. A college student spends the entire class period staring at the clock in the back of the room instead of paying attention to class. Assuming the clock is accurate, how many times does the second hand move across the minute hand between the start of class at 2:30:00 and the end of class at 3:20:00?

    (a) 47
    (b) 48
    (c) 49
    (d) 50
    (e) 51

11. Three positive integers x, y, z form both an arithmetic sequence (with common difference d) and a geometric sequence (with common ratio r). Assuming $d \geq 0$, find r.

    (a) $\frac{3}{4}$
    (b) 1
    (c) $\frac{4}{3}$
    (d) $\frac{5}{4}$
    (e) 2

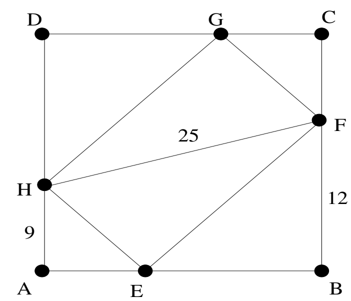
12. An equilateral triangle is circumscribed about a circle of radius 1. Find its perimeter.

    (a) $8\sqrt{2}$
    (b) π^2
    (c) $6\sqrt{3}$
    (d) 12
    (e) $3\sqrt{3}$

13. The equation $x^4 + 4x^3 + 6x^2 - 4x + 1 = 8$ has two real roots. Find their sum.

(a) -4
(b) 0
(c) 4
(d) 6
(e) 7

14. Rectangle $EFGH$ is inscribed in rectangle $ABCD$. Given that $AH = 9$, $BF = 12$, and $HF = 25$, find the area of $ABCD$.



(a) 441
(b) $42\sqrt{154}$
(c) $70\sqrt{66}$
(d) 588
(e) $375\sqrt{6}$

15. Set $x = \ln(3)$, $y = \ln(4)$, and $z = \ln(5)$. a, b, and c are integers such that $\ln(2025) = ax + by + cz$. Find $a + b + c$.

(a) 2
(b) 3
(c) 4
(d) 5
(e) 6

16. Polygon P has vertices at $(0,0)$, $(2,0)$, $(2,5)$, $(1,5)$, $(1,7)$, and $(0,7)$. The line $y = mx$ divides P into two regions of equal area. Write $m = \frac{a}{b}$ as a fraction in lowest terms. Find $a + b$.

    (a) 29
    (b) 30
    (c) 31
    (d) 32
    (e) 33

17. Which of these polynomials has $\sqrt[3]{2} + \sqrt[3]{4}$ as a root?

    (a) $x^3 - 6x - 6$
    (b) $x^3 + 3x^2 - 6x - 6$
    (c) $x^2 + 2x - 2$
    (d) $x^3 + 3x^2 - 6x$
    (e) $x^3 + 3x^2 - 6$

18. For a positive integer n, let $S(n)$ be the sum of the positive divisors of n. (So $S(4) = 1 + 2 + 4 = 7$ and $S(6) = 1 + 2 + 3 + 6 = 12$, for example.) We can compute $S(2025) = 3751$, which is an odd number. What is the next year N such that $S(N)$ is odd?

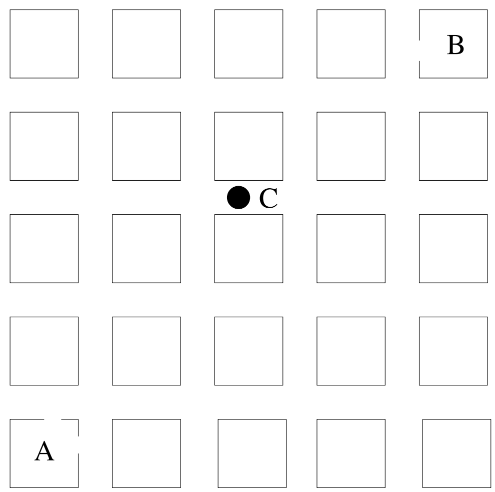
    (a) 2035
    (b) 2040
    (c) 2048
    (d) 2116
    (e) 2209

19. A pole slides down a vertical wall in such a way that one end of the pole always touches the wall and the other always touches the (horizontal) ground. As the pole slides, its midpoint traces out a path. What is the shape of that path?

   (a) An arc of a circle.
   (b) An arc of a parabola.
   (c) An arc of a hyperbola.
   (d) An arc of an ellipse, but not of a circle.
   (e) None of the above.

20. A college student has ten minutes to walk from his English class in Building A below to his History class in Building B. He has learned by trial and error that it is less efficient to go through any of the other campus buildings than it is to walk on the sidewalks between them. In order to get to his History class on time, he must travel only northward or eastward along the sidewalks. Building A has exits on both the north and the east, and building B has an entrance on the west but not the south.

    Every time he reaches an intersection between two sidewalks, our student chooses to proceed either North or East with equal probability, unless one choice would take him farther North or East than the entrance to building B (in which case he chooses the other direction with probability 1). What is the probability that his path takes him through point C?



(a) $\frac{1}{4}$

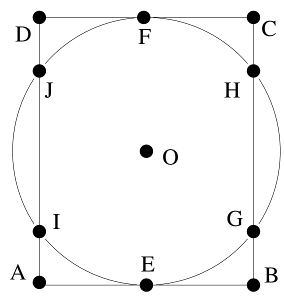
(b) $\frac{1}{2}$

(c) $\frac{1}{6}$

(d) $\frac{3}{16}$

(e) $\frac{3}{10}$

21. Rectangle $ABCD$ is tangent to circle O at points E and F on sides AB and CD, respectively. Side BC intersects circle O at G and H, and side AD intersects circle O at I and J. If G, O, and J are collinear, $BG = 20$, and $DI = 25$, find the area of $ABCD$.



(a) $225\sqrt{77}$

(b) $225\sqrt{78}$

(c) $225\sqrt{79}$

(d) $900\sqrt{5}$

(e) 2025

22. 2025 identical small cubes are assembled into nine cubes of distinct sizes, which are then displayed inside a glass case so that viewers can see all six faces of each large cube. We say that one of the small cubes is **visible** if it can be seen from somewhere outside the case. (Thus, for example, in a $3 \times 3 \times 3$ cube, 26 of the 27 smaller cubes are visible; only the one in the interior cannot be seen.)

If all the small cubes are either orange or black, what is the smallest number of black cubes that will guarantee at least one of the visible cubes is black?

(a) 10

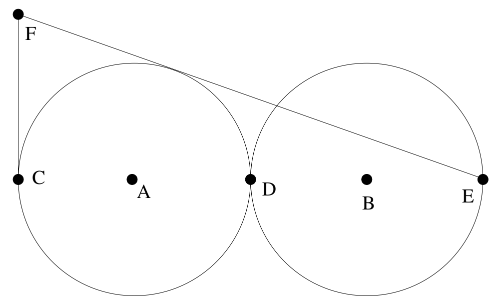
(b) 785

(c) 843

(d) 1171

(e) 1296

23. Circles A and B have the same radius, and are tangent at point D with diameters CD and DE, respectively. Segments CF and EF are both tangent to circle A. If $CF = 45$, find the area of $\triangle CEF$.



(a) $\dfrac{2025}{\sqrt{2}}$

(b) 2025

(c) $\dfrac{2025\sqrt{3}}{\sqrt{2}}$

(d) $2025\sqrt{2}$

(e) $\dfrac{2025\sqrt{5}}{\sqrt{2}}$

24. Suppose the continuous function $f(x)$ satisfies the rule $f(\dfrac{x}{1-x}) = \dfrac{1}{1-x}$ for all $x \neq 1$. Which of the following is equal to $f(\sin\theta)$?

(a) $\dfrac{\sin 2\theta}{\cos^2\theta - \sin^2\theta}$

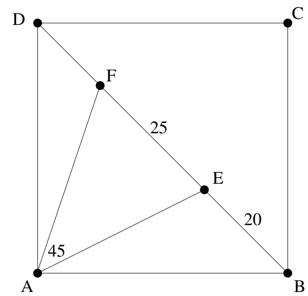
(b) $\dfrac{1}{\csc^2\theta - \csc\theta\ \cot\theta}$

(c) $\dfrac{1}{\sec^2\theta - \sec\theta\ \tan\theta}$

(d) 1

(e) $\dfrac{1}{\sin\theta\ \cos\theta - \sec\theta\ \csc\theta}$

25. In square $ABCD$, points E and F are on diagonal BD. If $BE = 20$, $EF = 25$, and $\angle EAF = 45°$, find the area of $ABCD$.



(a) 1800

(b) $\dfrac{3721}{2}$

(c) 2025

(d) $\dfrac{2313 + 540\sqrt{2}}{2}$

(e) $\dfrac{4225}{2}$