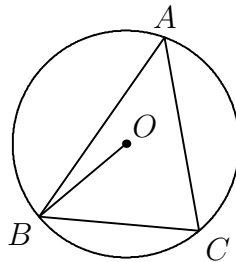


- If  $(0.67)^x = 0.5$ , then find the value of  $16 \cdot (0.67)^{3x}$ .  
(A) 2      (B) 8      (C) 16      (D) 64      (E) 128
- A man who is 2 meters tall is standing 5 meters away from a lamppost that is 6 meters high. How long is the man's shadow cast by the lamppost, in meters?  
(A) 2      (B)  $\frac{7}{3}$       (C)  $\frac{5}{2}$       (D) 4      (E)  $\frac{5}{3}$
- Two standard six-sided dice are tossed. What is the probability that the sum of the numbers is greater than 7?  
(A) 1      (B)  $\frac{5}{12}$       (C)  $\frac{2}{3}$       (D)  $\frac{4}{9}$       (E)  $\frac{7}{36}$
- What is the imaginary part of the complex number  $\frac{-4 + 7i}{1 + 2i}$ ?  
(A)  $-\frac{1}{2}$       (B) 2      (C) 3      (D)  $\frac{7}{2}$       (E)  $-\frac{18}{5}$
- In triangle  $ABC$ ,  $\angle BAC = 15^\circ$ . The circumcenter  $O$  of triangle  $ABC$  lies in its interior. Find  $\angle OBC$ .



- (A)  $30^\circ$       (B)  $75^\circ$       (C)  $45^\circ$       (D)  $60^\circ$       (E)  $15^\circ$
- Luna and Sam have access to a windowsill with three plants. On the morning of January 1, 2011, the plants were sitting in the order of cactus, dieffenbachia, and orchid, from left to right. Every afternoon, when Luna waters the plants, she swaps the two plants sitting on the left and in the center. Every evening, when Sam waters the plants, he swaps the two plants sitting on the right and in the center. What was the order of the plants on the morning of January 1, 2012, 365 days later, from left to right?  
(A) cactus, orchid, dieffenbachia      (B) dieffenbachia, cactus, orchid  
(C) dieffenbachia, orchid, cactus      (D) orchid, dieffenbachia, cactus  
(E) orchid, cactus, dieffenbachia
  - The line that is tangent to the circle  $x^2 + y^2 = 25$  at the point  $(3, 4)$  intersects the  $x$ -axis at  $(k, 0)$ . What is  $k$ ?  
(A)  $\frac{25}{4}$       (B)  $\frac{19}{3}$       (C) 25      (D)  $\frac{25}{3}$       (E)  $-\frac{7}{3}$
  - In a certain base  $b$  (different from 10),  $57_b^2 = 2721_b$ . What is  $17_b^2$  in this base?  
(A)  $201_b$       (B)  $261_b$       (C)  $281_b$       (D)  $289_b$       (E)  $341_b$

9. The graph of the equation  $x^3 - 2x^2y + xy^2 - 2y^3 = 0$  is the same as the graph of  
(A)  $x^2 + y^2 = 0$       (B)  $x = y$       (C)  $y = 2x^2 - x$       (D)  $x = y^3$       (E)  $x = 2y$
10. Let  $X = \{1, 2, 3, 4, 5, 6\}$ . How many non-empty subsets of  $X$  do not contain two consecutive integers?  
(A) 16      (B) 18      (C) 20      (D) 21      (E) 24
11. Eight points are equally spaced around a circle of radius  $r$ . If we draw a circle of radius 1 centered at each of the eight points, then each of these circles will be tangent to two of the other eight circles that are next to it. If  $r^2 = a + b\sqrt{2}$ , where  $a$  and  $b$  are integers, then what is  $a + b$ ?  
(A) 3      (B) 4      (C) 5      (D) 6      (E) 7
12. Kate multiplied all the integers from 1 to her age and got 1,307,674,368,000. How old is Kate?  
(A) 14      (B) 15      (C) 16      (D) 17      (E) 18
13. The number of solutions, in real numbers  $a$ ,  $b$ , and  $c$ , to the system of equations
- $$\begin{aligned}a + bc &= 1, \\b + ac &= 1, \\c + ab &= 1,\end{aligned}$$
- is  
(A) 3      (B) 4      (C) 5      (D) more than 5, but finitely many  
(E) infinitely many
14. How many numbers among 1, 2,  $\dots$ , 2012 have a positive divisor that is a cube other than 1?  
(A) 346      (B) 336      (C) 347      (D) 251      (E) 393
15. Let  $(1 + \sqrt{2})^{2012} = a + b\sqrt{2}$ , where  $a$  and  $b$  are integers. The greatest common divisor of  $b$  and 81 is  
(A) 1      (B) 3      (C) 9      (D) 27      (E) 81