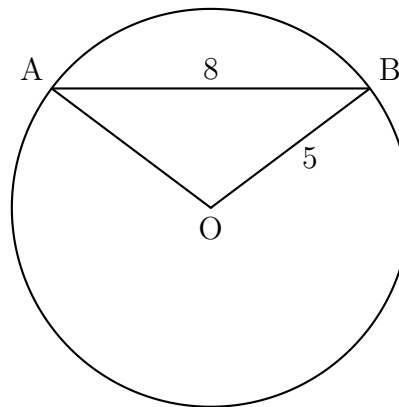


- 1) Evaluate $\frac{2016!}{2015!\sqrt{16}} + 2016$.
 (A) 504 (B) 2142 (C) 2520 (D) 2600 (E) 2650
-
- 2) In how many ways can the letters in the word "sleepy" be arranged? The two letter "e"s are not considered distinct.
 (A) 6 (B) 35 (C) 120 (D) 140 (E) 360
-
- 3) Suzie Q is buying a car. Car A costs \$5000 initially, and \$50 per month. Car B costs \$2000 initially, and \$100 per month. After how many years will the two cars cost the same amount?
 (A) 3 (B) 4 (C) 5 (D) 6 (E) 7
-
- 4) A fish tank contains a positive integer number of fish. Exactly $\frac{3}{4}$ of the fish are shiny, and exactly $\frac{1}{2}$ of the fish are blue. What is the smallest possible percentage of the fish which are both shiny and blue?
 (A) 10% (B) 20% (C) 25% (D) 50% (E) 75%
-
- 5) A scientist is making a formula with A grams of one chemical, B grams of a second chemical, and C grams of a third chemical, such that $A : B : C = 1 : 3 : 7$. If there are currently 2 grams of chemical A , 3 grams of chemical B , and 6 grams of chemical C in the solution, what is the minimum number of total grams which must be added to the solution to obtain the correct ratio?
 (A) 11 (B) 14 (C) 19 (D) 21 (E) 22
-
- 6) I have a pitcher that holds 70 ounces of water and a glass that holds 12 ounces of water. Every day, I pour as many ounces from the pitcher to the glass as I can without overfilling, then I drink the water from the glass. One day, I can't fill the glass up all the way. How much water can I pour into the glass on that day?
 Assume that water does not evaporate between days.
 (A) 8 oz. (B) 10 oz. (C) 15 oz. (D) 20 oz. (E) 24 oz.

- 7) January 1st, 2016, is a Friday. What is the next year that January 1st will be a Friday?
- (A) 2017 (B) 2019 (C) 2020 (D) 2021 (E) 2022

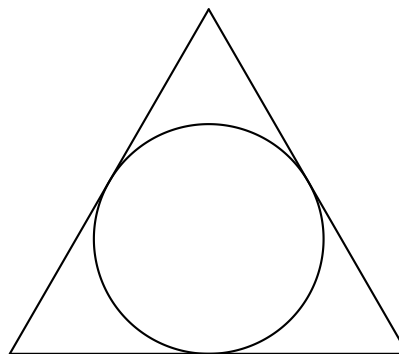
- 8) A circle with center O has radius 5 and chord AB has length 8. What is the area of triangle ABO ?



- (A) $\frac{15}{2}$ (B) 12 (C) 15 (D) 20 (E) 40

- 9) How many factors of 10800 are perfect cubes?
- (A) 1 (B) 2 (C) 3 (D) 4 (E) 5

- 10) A circle is inscribed in an equilateral triangle. What is the ratio of the area of the circle to the area of the triangle?



(A) $\frac{\pi\sqrt{3}}{9}$ (B) $\frac{2\pi}{9}$ (C) $\frac{\pi}{3}$ (D) 2 (E) $\frac{\pi\sqrt{3}}{2}$

– 11) How many positive integers less than 72 are relatively prime to 72?

(A) 20 (B) 24 (C) 29 (D) 36 (E) 37

– 12) What is the area of the region formed by $y \geq 2|x|$ and $y \leq -2|x| + 6$, where $|x|$ denotes the absolute value of x ?

(A) 6 (B) $\frac{15}{2}$ (C) $\frac{25}{3}$ (D) 9 (E) 12

– 13) I have a box of balls and frisbees. My friend catches frisbees with probability $\frac{1}{2}$, and balls with probability $\frac{1}{4}$. Also, $\frac{1}{3}$ of the items in my box are frisbees, and $\frac{2}{3}$ are balls. If I randomly throw an item from my box, and my friend catches it, what is the probability that I threw a frisbee?

(A) $\frac{1}{4}$ (B) $\frac{1}{3}$ (C) $\frac{1}{2}$ (D) $\frac{2}{3}$ (E) $\frac{7}{8}$

– 14) Let ABC be a triangle. Let D be on side AB with $\overline{AD} : \overline{DB} = 2 : 1$, and let E be on side AC with $\overline{AE} : \overline{EC} = 1 : 3$. What is the value of $\frac{[ADE]}{[DBCE]}$? Square brackets denote area.

(A) $\frac{1}{6}$ (B) $\frac{1}{5}$ (C) $\frac{4}{5}$ (D) 1 (E) $\frac{5}{3}$

– 15) Let $\sqrt{a+b}$ and $\sqrt{b+c}$ be the roots of the polynomial $x^2 - 9x + 20$, where $\sqrt{a+b} > \sqrt{b+c}$. Let the monic polynomial with roots $5b^2$ and $a^2 + 2ab + 8bc + 4c^2$ be $P = x^2 + mx + n$. Find the value of m .

(A) -1649 (B) -874 (C) -64 (D) 0 (E) 116

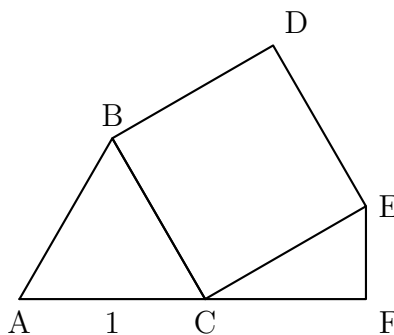
– 16) I can complete a job in 10 hours, and my friend can complete it in 6 hours. Another person can complete the job in 4 hours. My friend and I work on one half of the job, while the other person works on the other half. Who finishes first, and by how long?

(A) The other person, by 10 minutes (B) The other person, by 6 minutes
(C) We will tie (D) My friend and I, by 5 minutes
(E) My friend and I, by 7.5 minutes

- 17) What is the maximum positive integer n for which 2016^n divides $2016!$?
 (A) 1 (B) 64 (C) 250 (D) 334 (E) 502

- 18) Ryan flips a fair coin nine times. If the coin lands on heads, he writes down the digit 3. If the coin lands on tails, he writes down the digit 4. He then makes a base-ten integer out of his flips - for example, if he flips nine heads, his number would be 333333333. What is the probability his number is divisible by 3?
 (A) $\frac{1}{4}$ (B) $\frac{21}{64}$ (C) $\frac{85}{256}$ (D) $\frac{1}{3}$ (E) $\frac{23}{64}$

- 19) Let ABC be an equilateral triangle with side length 1, and $BDEC$ be a square with side length 1. Let F be constructed so that $\angle EFA = 90^\circ$. Find the area of $\triangle EFA$.



- (A) $\frac{2 + \sqrt{3}}{8}$ (B) $\frac{1}{2}$ (C) $\frac{3}{5}$ (D) $\frac{2\sqrt{3} - 1}{4}$ (E) $\frac{\sqrt{3}}{3}$

- 20) Kaitlin has three apples, three pears, and three oranges. Two fruits of the same type are indistinguishable. She randomly arranges them in a circle. What is the probability that no two oranges are adjacent?

- (A) $\frac{1}{56}$ (B) $\frac{1}{10}$ (C) $\frac{3}{28}$ (D) $\frac{5}{28}$ (E) $\frac{5}{14}$

- 21) A teacher does not know the names of any of her 10 students. Each of these students has completed a homework assignment, and 3 of the students have the same name and answers, so their assignments are identical. If the

teacher hands back each of the assignments to a random student, what is the expected number of students who don't receive their own papers?

- (A) $\frac{15}{2}$ (B) $\frac{47}{6}$ (C) $\frac{953}{120}$ (D) 8 (E) $\frac{42}{5}$

- 22) A convex pentagon has 4 dots marked on one side, 2 dots marked on another, and 3 dots marked on the last 3 sides. Every possible line connecting 2 dots is drawn. What is the maximum number of possible points of intersection of these lines in the pentagon?

- (A) 1200 (B) 1284 (C) 1362 (D) 1364 (E) 1365

- 23) In triangle ABC , $AB = 8$, $AC = 10$ and $BC = 12$. A circle is inscribed in ABC , and a line tangent to the circle and parallel to BC is drawn. It intersects AB at D and AC at E . Another circle is inscribed in triangle ADE . What is the ratio of the area of the second circle to the first?

- (A) $\frac{1}{100}$ (B) $\frac{1}{30}$ (C) $\frac{1}{25}$ (D) $\frac{12 - 3\sqrt{7}}{97}$ (E) $\frac{163 - 60\sqrt{7}}{63}$

- 24) Josh flips a fair coin 12 times. What is the probability that, at some point after the first flip, he has flipped an equal number of heads and tails?

- (A) $\frac{1365}{2048}$ (B) $\frac{3}{4}$ (C) $\frac{793}{1024}$ (D) $\frac{803}{1024}$ (E) $\frac{4}{5}$

- 25) 10 people want to line up in the following manner: First, the shortest person will face either north or south. Then, for each remaining person, the shortest person not in the line will be put just to the right of the line facing either north or south, such that after that person joins the line, no more than $\frac{2}{3}$ of the people will be facing in either of the directions. In how many ways can these 10 people line up?

- (A) 168 (B) 182 (C) 512 (D) 750 (E) 1024