*For all questions, answer choice (E) NOTA means that none of the given answers is correct. Good Luck!*

1. Meit has a cow, Mr. Gautama, which he keeps tied to his house. Meit's house is a rectangle, with a length of 13 feet, and a width of 37 feet. If Mr. Gautama is tied to a corner of Meit's house with a rope that is 16 feet long, what is the area of the space he has to roam and graze? Assume the rope and Mr. Gautama have negligible thickness.
   (A) $\dfrac{777\pi}{4}$ (B) 169π (C) $\dfrac{371\pi}{2}$ (D) $\dfrac{825\pi}{4}$ (E) NOTA

2. The logo for *voat.co* is a lowercase *v*, which can be modeled by the equation: $y = |x|$. What is the volume of the space bound by the line $y = 5$, and the rotation of $y = |x|$ about the *y*-axis?
   (A) 25π (B) 64π (C) $\dfrac{125\pi}{3}$ (D) $\dfrac{64\pi}{3}$ (E) NOTA

3. An equilateral triangle is inscribed inside a circle. Next, this circle is inscribed in a square with a side length of 12. What is the area of the triangle?
   (A) $36\sqrt{3}$ (B) $18\sqrt{2}$ (C) $27\sqrt{3}$ (D) $54\sqrt{2}$ (E) NOTA

4. Kyle and Josue are playing leap frog! Its Kyle's turn, so he jumps over Josue. Kyle looks down while in midair and sees Josue's sombrero from an aerial view. The sombrero viewed from above looks like a donut, or two concentric circles. What is the area of the annulus of the sombrero, if the length of a chord of the larger circle that is tangent to the inner circle is 8?


   (A) 8π (B) 16π (C) 2π (D) 4π (E) NOTA
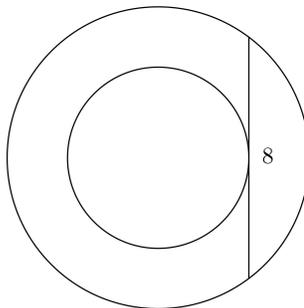
5. What is the supplement of the complement of the supplement of the supplement of the complement of 80°?
   (A) $100°$ (B) $80°$ (C) $10°$ (D) $170°$ (E) NOTA

6. What is the contrapositive of the following statement: If Shardul shaves his beard, then it will grow back in 5 hours.
   (A) If Shardul's beard grew back in 5 hours, then Shardul shaved his beard.
   (B) If Shardul doesn't shave his beard, then it doesn't grow back in 5 hours.
   (C) If Shardul shaves his beard, then it doesn't grow back for 5 hours.
   (D) If Shardul's beard doesn't grow back in 5 hours, then Shardul didn't shave his beard.
   (E) NOTA

   Use the following information to answer questions 7 and 8: A triangle's vertices are located at the following points: (5,2), (-3,6), and (4,1).

7. What is the area of the triangle?
   (A) 12   (B) 6   (C) 8   (D) $\dfrac{15}{2}$ (E) NOTA

8. What are the coordinates of the triangle's centroid?

   (A) $(3, \frac{9}{2})$ (B) $(6, 9)$ (C) $(3, 3)$ (D) $(2, 3)$ (E) NOTA

9. Roehl is eating a popsicle, which happens to be a perfect right cylinder with a hemisphere on top of the cylinder. The cylinder has a height of 8 inches, and a radius of 3 inches. Roehl eats the popsicle at a rate of 4π inches^3 per minute. It's a hot summer day, however, so the popsicle is also melting at a rate of 2π inches^3 per minute. After how long will Roehl stop eating the popsicle if he never eats the melted parts? All answers are given in minutes.

   (A) 15   (B) 18   (C) $\frac{32}{3}$ (D) 12   (E) NOTA

10. Regular octagon $MALPHITE$ has a side length of 8. What is the area of polygon $LITE$?

    (A) $16 + 32\sqrt{3}$ (B) $32 + 32\sqrt{2}$ (C) $48 + 64\sqrt{3}$ (D) $64 + 64\sqrt{2}$ (E) NOTA

11. A certain 3D figure has 305 faces, and 678 edges. How many vertices does it have?

    (A) 226   (B) 375   (C) 506   (D) 981   (E) NOTA

12. Aditya stayed up late playing Megawalls, and was starting to hallucinate from the sleep deprivation. He looked at the clock and almost had a heart attack! For a second he thought it said 6:09 and that his parents were going to kill him. However, after taking a second look, he realized it said 12:34, and breathed a sigh of relief. What is the absolute value of the difference in the measure of the smaller angle between the hands of the first time he saw, and the measure of the larger angle between the hands of the second time he saw? Assume all answers are in degrees.

    (A) 20.5   (B) 44.5   (C) 56.5   (D) 78.5   (E) NOTA

13. The following figure shows two congruent circles intersecting at points E and D. What is the $mEBD$, if $mEFG$ is $100°$, arc GH is $30°$, and arc AEC is $310°$?
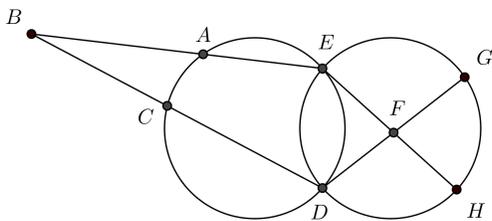
    (A) $40°$ (B) $20°$ (C) $10°$ (D) $5°$ (E) NOTA

14. Rhombus $BARD$ has diagonals BR and AD. What is the area of the rhombus if line RD has length 17, and diagonal BR has length 30?

    (A) 510   (B) 375   (C) 255   (D) 240   (E) NOTA

15. What is the equation of the perpendicular bisector of the line segment that starts at $(5, 6)$ and ends at $(1, 4)$?

    (A) $y = 2x + 11$ (B) $y = 2x - 11$ (C) $y = -2x + 1$ (D) $y = -2x - 1$ (E) NOTA

16. Which of the following polygons are orthogonal quadrilaterals?

    I. Square   II. Rectangle   III. Rhombus   IV. Trapezoid   V. Kite

    (A) I, II   (B) III, V   (C) I
   (D) All of the listed polygons   (E) NOTA

17. Let:
    F = The number of diagonals in a regular octagon
    N = The sum of the interior angles of a pentagon
    C = The sum of the exterior angles of a dodecagon.
    What is $\dfrac{FN}{C}$?

    (A) 34   (B) 17   (C) $\sqrt{255}$ (D) $\dfrac{\sqrt{255}}{4}$ (E) NOTA

18. Ms. Walden is trying to teach her cats the Pythagorean Formula. "Now remember Mr. Mittens, if the triangle is a right triangle, it's $a^2 + b^2 = c^2$!" she says. Mr. Mittens finds a triangle with side lengths 5, 10, and 15; what type of triangle is that?
    (A) Isosceles   (B) Right   (C) Acute   (D) Obtuse   (E) NOTA

19. In the following figure, assume lines l and m are parallel. What is the value of x, in degrees?
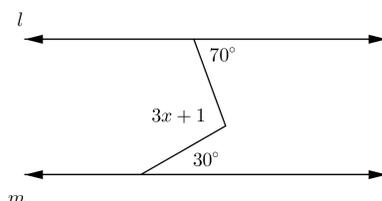
    (A) 33   (B) 46   (C) 79   (D) 100   (E) NOTA

20. Kyle and Aditya are still trying to find girlfriends. After a year of failure, they decided to sign up for dating classes. Their dating instructor says that eye contact is one of the most important qualities to have, as it conveys confidence. Kyle and Aditya begin to ponder about girls' eyes, and decide to do some math. Kyle calculates the volume of an eye that's a perfect sphere with radius 2, and Aditya calculates the surface area of the same eye. This is probably why they don't have girlfriends. What is the ratio of Kyle's answer to Aditya's answer?
    (A) $\dfrac{1}{3}$ (B) $\dfrac{2}{3}$ (C) $\dfrac{4}{3}$ (D) $\dfrac{8}{3}$ (E) NOTA

21. A triangle has side lengths 4, 13, and 15. What is its area?
    (A) 24   (B) 26   (C) 30   (D) 44   (E) NOTA

22. Kyle, Meit, and RJ are walking down the street, when Kyle pulls out three chocolate bars. Kyle says "Look what I've got!" as he hands out one chocolate bar to each of his friends. "RECTANGLES!" screams Meit. Meit hastily grabs a chocolate bar, which is a perfect rectangle, and breaks the chocolate bar into 3 pieces, making 2 cuts that trisect one of the corners of the chocolate bar. One of these trisections also happens to be a diagonal of the chocolate bar. Meit gives the smallest piece to Kyle, keeps the biggest piece for himself, and gives the last piece to RJ. Let M = the volume of chocolate Meit has, K = the volume of chocolate Kyle has, and R = the volume of chocolate RJ has. If all the chocolate bars have a length of 6, and a height of 1, what is $K \times (R - M)$? Keep in mind that Kyle and RJ still have 1 full chocolate bar.
    (A) 286   (B) 336   (C) 420   (D) 693   (E) NOTA

23. A right cone has a height of 12, and a radius of 6. This cone is truncated by a plane that is parallel to the cone's base, 8 units above the base. What is the volume of the small cone formed by the plane of truncation from the original cone?
    (A) 12π (B) $\dfrac{14\pi}{3}$ (C) $\dfrac{16\pi}{3}$ (D) $\dfrac{64\pi}{3}$ (E) NOTA

24. Rida left her house, which is located at the point (4, 1), to go the gym, located at (-6, 9). However, as soon as she stepped out of her house, she realized that she forgot to add water to her protein shake, which is the secret to her strength. Instead of going back to her house, she chooses to stop by a river that runs along $y = 0$. What is the shortest distance that Rida can travel from her house to the gym, if she must stop at the river to collect some water for her protein shake?
(A) $10\sqrt{2}$ (B) $1 + \sqrt{181}$ (C) $\sqrt{106} + \sqrt{26}$ (D) $9 + \sqrt{101}$ (E) NOTA

25. Ryan and Kyle are ripping each other to practice their insults. "Boy, your edge looks like the bottom of a Batman Symbol, and you're bad at pool!" Ryan says. "Oh yeah, well your edge looks like a 72° arc with a length of 56π!" Kyle retorts. "Did you say pie? I love pie! Anyway, I bet you don't know the radius of the circle you just made up." Ryan says mockingly. What should Kyle say so that Ryan doesn't one up him and make him look stupid?
(A) 70   (B) 140   (C) $2\sqrt{70}$ (D) 280   (E) NOTA

26. Triangle KAT has an angle bisector AP, with point P lying on side KT. If AK has a length of 12, AT has a length of 6, and KT has a length of 9, then what is the length of KP?
(A) 3   (B) 4   (C) 5   (D) 6   (E) NOTA

27. Mr. Cullen plans to attend "The 8th Annual Nick Saban Worshippers and Lovers Festival" in Tuscaloosa, Alabama. He's packing his things into his custom-made suitcase, which has "Alabama BCS National Champions 2010, 2012, and 2013" embroidered on it, while throwing darts at a picture of Urban Meyer. Mr. Cullen wants to bring his "Roll Tide" flag and flagpole to get Nick Saban to sign them, but he's afraid there's not enough space in his suitcase. Assuming his suitcase is a rectangular prism with dimensions $5 \times 7 \times 12$, what is the longest flagpole that he can fit into his suitcase? Assume the flagpole has negligible thickness, and that there's nothing else in his suitcase (because Crimson Tide Pride is all you need).
(A) 12   (B) $\sqrt{218}$ (C) $\sqrt{193}$ (D) $\sqrt{74}$ (E) NOTA

28. A regular tetrahedron with a side length of 18 has 4 smaller regular tetrahedrons, each with side length 6, cut off from its vertices, so that the figure that remains is an Archimedean Solid. What is its surface area?
(A) $108\sqrt{3}$ (B) $186\sqrt{3}$ (C) $252\sqrt{3}$ (D) $336\sqrt{3}$ (E) NOTA

29. There exists a point in every non-equilateral triangle that is equidistant from every side of the triangle, and is the intersection of all of the triangle's angle bisectors. What is the name of this point?
(A) Circumcenter   (B) Centroid   (C) Orthocenter   (D) Incenter   (E) NOTA

30. Kyle got a job at the shoe factory; his job is to make sure the conveyer belt works properly, so the assembly line can function. The conveyer belt is made of two externally tangent wheels, one with a radius of 6, and the other with a radius of 9, and a belt is looped around these two wheels. One day however, the belt breaks, so Jasmine, Kyle's boss, orders him to find a belt to fix the conveyer belt. Kyle goes to Home Depot, but there are many different lengths of belts he can buy. Help Kyle find the exact length of belt that is necessary to completely wrap around the two wheels, without overlapping, so that Jasmine won't fire him.
(A) $15\pi + 12\sqrt{6}$ (B) $30\pi + 12\sqrt{6}$ (C) $15\pi + 6\sqrt{26}$ (D) $30\pi + 6\sqrt{26}$ (E) NOTA