Diagrams are not necessarily drawn to scale!

1. The endpoints of the diameter of a semicircle coincide with the endpoints of a leg of a right triangle, as shown in the diagram below. The leg of the right triangle adjacent to the semicircle measures 14, and the hypotenuse of the triangle measures 50. Find the distance around the resultant shape. Use the approximation $\pi = 22/7$.
   A) 108
   B) 120
   C) 142
   D) 173
   E) NOTA
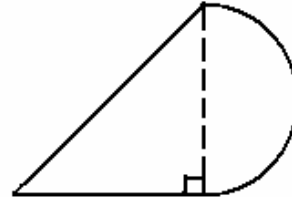
2. A wheel with a radius of $\dfrac{4}{\pi}$ meters rolls directly down a smooth 2^5-meter path. How many revolutions does the wheel make on the path?

   A) 1   B) 2   C) 4   D) 8   E) NOTA

3. A mini-dartboard is made of four concentric circles with radii (in inches) measuring 1, 2, 3, and 4. A dart thrown into the center circle scores 10 points, and a dart in a ring (from inner to outer) scores 7, 5, and 3 points, respectively. If the probability of scoring exactly 10 total points with two darts is $\dfrac{N}{256}$, find N. Assume each thrown dart hits the board in a completely random spot.

   A) 46   B) 47   C) 67   D) 92   E) NOTA

4. Which of the following features of a triangle does <u>not</u> necessarily lie on its Euler Line?

   A) centroid   B) circumcenter   C) incenter   D) orthocenter   E) NOTA

5. A square, a circle, and a regular hexagon all have the same radius. The square has perimeter **S**, the circle has circumference **C**, and the hexagon has perimeter **H**. Put the bolded letters in order from least to greatest.

   A) **S, C, H**   B) **C, H, S**   C) **C, S, H**   D) **S, H, C**   E) NOTA

6. What is the measure of the supplement of an exterior angle of a regular dodecagon?

   A) 30°   B) 60°   C) 120°   D) 150°   E) NOTA

7. A woman walks one mile to the north, then two miles to the east, then seven miles south, looking for her toy poodle. Let **W** be the total distance she walks, and let **D** be her distance from her starting point. Find the value of $\left(\dfrac{D}{W}\right)^2$.

A) $\dfrac{1}{2}$ 　　　　 B) $\dfrac{2}{5}$ 　　　　 C) $\dfrac{17}{25}$ 　　　　 D) $\dfrac{53}{100}$ 　　　　 E) NOTA

8. The sides of a triangle measure 3, 3, and 4. Find the area of the triangle.

A) $\dfrac{9}{2}$ 　　　　 B) $\dfrac{13}{2}$ 　　　　 C) $\sqrt{15}$ 　　　　 D) $2\sqrt{5}$ 　　　　 E) NOTA

9. Cylinder **A** has twice the volume, and five times the radius, of cylinder **B**. If cylinder **A** has height h, then find the height of cylinder **B**.

A) $0.04h$ 　　　　 B) $0.32h$ 　　　　 C) $0.625h$ 　　　　 D) $2.5h$ 　　　　 E) NOTA

10. Let it be true that the quadrilateral *ABCD* is a parallelogram. Which of the following statements is <u>not</u> sufficient to guarantee that *ABCD* is also a rectangle?

A) $\overline{AC} \cong \overline{BD}$ 　　　 B) $\overline{AC} \cong \overline{BC}$ 　　　 C) $m\angle A = 90°$ 　　　 D) $\angle A \cong \angle D$ 　　　 E) NOTA

11. In triangle *RGT*, $m\angle T = 90°$ and $\cos(R) = \dfrac{1}{3}$. If $GR = 6$, then find *RT*.

A) 2 　　　　 B) $4\sqrt{2}$ 　　　　 C) 8 　　　　 D) $12\sqrt{2}$ 　　　　 E) NOTA

12. Square *ABCD* with area x^2 lies within equilateral triangle *JKL* in such a way that $\overline{AB}$ is coincident with side $\overline{JK}$ of the triangle, and one vertex of the square lies on each of the other two sides of the triangle, as shown in the diagram. If triangle *JKL* has perimeter 30, and the height of triangle *JKL* measures h, then find $\dfrac{h}{x}$.

A) $\dfrac{3}{2}$ 　　　　 B) $\dfrac{3+\sqrt{3}}{2}$

C) $\dfrac{2+\sqrt{3}}{2}$ 　　　 D) $\dfrac{6-\sqrt{3}}{2}$ 　　　 E) NOTA
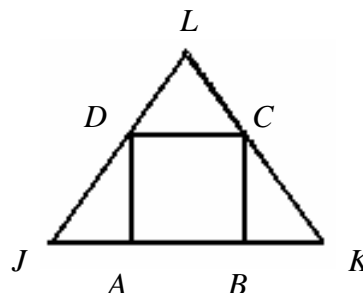
13. A convex solid has 12 faces and 20 vertices. How many edges does it have?

   A) 6   B) 10   C) 30   D) 34   E) NOTA

14. Three terms are universally accepted as the "undefined terms of Geometry," although Euclid, among others, gave these terms trivial descriptions and marked them as definitions. What are these three terms?

   A) line, point, & space   B) angle, line, & space
   C) infinity, line, & space   D) line, point, & plane   E) NOTA

15. The sides of a non-degenerate triangle measure $(3x)$, $(2y)$, and $(x+y)$, respectively. Which of the following inequalities is <u>not</u> necessarily true?

   A) $x < -\dfrac{y}{2}$ B) $x < \dfrac{3}{2}y$ C) $y < 4x + |y|$ D) $0 < x$ E) NOTA

16. $\overline{XZ}$ is tangent to a circle at Z, and $\overline{WY}$ is tangent to the same circle at Y, as shown in the diagram. $m\angle W = 3(m\angle X)$. If $ZM = 24$ and $XM = 18$, then find the length of MY.
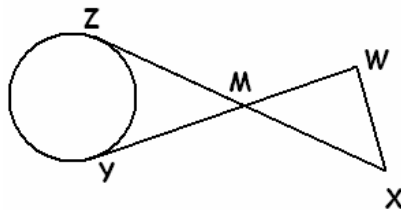
   A) 18   B) 24   C) 28   D) 32   E) NOTA

17. Let H be the number of diagonals in a convex hexagon. A rhombus with perimeter 60 has a diagonal measuring $2H$. Find the area of the rhombus.

   A) $10H$ B) $12H$ C) $15H$ D) $17H$ E) NOTA

18. Equilateral triangle EQL is inscribed in a circle with radius 1. Find the area of the segment of the circle bounded by $\overline{EQ}$ and minor arc $\overset{\frown}{EQ}$.

   A) $\dfrac{\pi - \sqrt{3}}{3}$ B) $\dfrac{2\pi - 3\sqrt{3}}{6}$ C) $\dfrac{4\pi - \sqrt{3}}{12}$ D) $\dfrac{4\pi - 3\sqrt{3}}{12}$ E) NOTA

19. One leg of a right triangle is twice as long as the other. The triangle's hypotenuse measures 15. Find the measure of the altitude to the hypotenuse.

    A) 6 B) $\dfrac{3\sqrt{3}}{2}$ C) $2\sqrt{5}$ D) $\dfrac{3\sqrt{5}}{2}$ E) NOTA

20. A ball of putty is rolled into a perfect sphere, and then sliced into two equal hemispheres, each of which has surface area measuring A square units, and volume measuring A cubic units. Find the radius of the original ball.

    A) 1.5 B) 3 C) 4 D) 4.5 E) NOTA

21. In isosceles triangle ISL, $IS = LI$ and $m\angle L = 50°$. Find the sum of the measures of the base angles of the triangle.

    A) 100° B) 115° C) 130° D) 180° E) NOTA

22. Isosceles trapezoid $ABCD$, where $m\angle A = m\angle D = 60°$, has perimeter 100. The point X lies on $\overline{AD}$, and the right triangle ABX, with right angle at X, has area $8\sqrt{3}$. Find BC.

    A) $100 - 12\sqrt{6}$ B) 17 C) $50 - 6\sqrt{6}$ D) 38 E) NOTA

23. In the pentagon $ABCDE$, $\angle A \cong \angle B \cong \angle C$. Angle D measures one-third the sum of the other angles, and angle E is a right angle. Find the measure of the largest angle in the pentagon.

    A) 108° B) 110° C) 114° D) 120° E) NOTA

24. A paper cup is a right circular cone and is upright (where the pointy part is the bottom of the cup). In it, $10\,\text{mL}$ of water sits perfectly still. The water fills the cup to one-half of its height. What is the capacity of the cup?

    A) 20 mL B) 30 mL C) 60 mL D) 80 mL E) NOTA

25. The following statement is true: "If I am dancing like a robot, then this test is over." Which of the following statements must also be true?

    A) If I am not dancing like a robot, then this test is not over.
    B) If this test is not over, then I am not dancing like a robot.
    C) If this test is over, then I am dancing like a robot.
    D) When this test is over, I am dancing like a robot.
    E) NOTA

26. Find the distance between the three-dimensional points $(1, 1, 1)$ and $(3, 3, 3)$.

 A) 2   B) $\sqrt{6}$ C) $2\sqrt{2}$ D) $2\sqrt{3}$ E) NOTA

27. A right rectangular prism's surface area is 30 square feet. Two of its edges measure 4 feet and 2 feet. What is the prism's volume, in cubic feet?
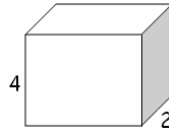
 A) $\dfrac{28}{3}$ B) 2   C) 40   D) $\dfrac{88}{3}$ E) NOTA

28. A statue's shadow measures 30 feet. A woman wearing a fabulous hat stands completely in the shadow of the statue in such a way that if she were to move forward at all, her fabulous hat would be in the light of the sun. If the woman is 6 feet tall (to the top of her fabulous hat), and she is standing 12 feet from the statue, then how tall is the statue?

 A) 9 feet   B) 10 feet   C) 18 feet   D) 24 feet   E) NOTA

29. When a transversal crosses a pair of parallel lines, eight angles are formed. The relationships between certain pairs of these angles have established names. Which relationship indicates that the angles paired are supplementary?

 A) alternate exterior   B) alternate interior   C) corresponding   D) vertical   E) NOTA

30. Three vertices of the kite *KITE* lie on a circle and its diagonals intersect at the center of the circle. The other vertex, *E*, lies outside of the circle. $\overline{EI}$ intersects the circle at point *X*. The area of the kite is 24, and $EX = 8$. When the product $(KI)(KE)$ is written in simplest radical form as $m\sqrt{n}$, find $(m+n)$.

 A) 11   B) 21   C) 36   D) 53   E) NOTA