1. **B** - The ratio of the volume of the smaller puck to the volume of the larger puck is , and since they are similar, we can find the scale factor by which the solids are similar to by cube rooting it, getting , which simplifies to . We then find the ratio of the surface areas by squaring this, getting . Since the surface area of the larger puck is 324, we can multiply it by to get C) 81.

2. **A** – Drop an altitude from the top (75-degree angle). This creates a 30-60-90 triangle and lets us find the measure of part of the bottom as 5 ( half of 10) and the altitude . The altitude also creates a 45-45-90 triangle where the legs are both and the hypotenuse is . The perimeter is the sum of the sides.

3. **A** - The largest triangle that can fit within a circle is an equilateral triangle where its three vertices lie on the circumference of the circle. By drawing a figure of this (a rough sketch will do), we can see that by connecting a vertex of the triangle to the center of the circle, and then drawing a perpendicular segment from the center to one of the adjacent sides, we can create a smaller 30-60-90 triangle within the equilateral triangle with a hypotenuse of 5, the radius of the circle. By using the properties of this special triangle, we see that the shorter leg is equal to 5/2, which makes the longer leg , which is also half the side length of the equilateral triangle, making its side length 5. The area of an equilateral triangle given its side length *s* is equal to . Plugging in the side length of the equilateral triangle within the pizza, we get A) .

4. **C**

5. **B** - The height h of the intersection between the two wires is found using the equation  where a and b are the two heights of the poles. (See if you can prove this yourself! Hint: the height h is the same even if the two wires go to the bottoms of the other poles.) Plugging in 80 and 50 into this equation, we get B)

6. **D** - CE appears to be tangent to the circle, and this is confirmed by the fact that CO is perpendicular to it. Since there is a secant and a chord originating from the same point E, we can use power of a point to find the length of ED, since the length of the tangent squared is equal to the length of the segment of the secant outside of the circle times the length of the entire secant. Plugging this into the circle we have, we get . Solving for ED we get D) 18.

7. **E** - Let points X and Y be the midpoints of chords AC and BD, respectively. Draw segments OX and OY, and note that they bisect their respective chords. Then, draw radius OD, creating right triangle OYD, where the radius is the hypotenuse. To find the radius, all we need to do is apply the pythagorean theorem to this right triangle. To find OY, note that it is the same length as line segment XE, which we can find easily by subtracting the length of half the chord from the length of AE, which is 13. The entire chord has length 13+5=18, so half of it is 9, making XE=OY=4 (XE=OY since XE shifted down would be OY). YD is just half of the length of chord BD, since the radius of the circle bisects the chord at point Y. However, we need to find the length of BE in order to find the length of the entire chord. This can be done easily using power of a point, making 13\*5=15\*BE. Therefore, BE = . This makes the entire chord have length , so OY=. Finally, using Pythagorean Theorem, , which makes r = E) .

8. **D** - This question can be done using simple Pythagorean and basic understanding of congruent triangles. Using Pythagorean, we find that BC=. Since DBC and DEC are both right angles, and DBC and DEC are congruent, BC = EC = D) 12.

9. **B** – If the area is 36 and one side is 12 then there must exist an altitude of 3. This creates a right triangle with hypotenuse of 6 and the leg opposite of A of 3, therefore the sine of A must be . The sine of is

10. **D** - We can find the center of the graph by completing the squares for the x and y values. Doing this, we get Note that this is the graph of the circle. Knowing the equation, we now know that the center of the graph is (6,5). We can find the slope of the line from the center to the points (0,15) using the difference of y’s over the difference of x’s, which gives us . Usually, we would now use point slope to find the equation, but since the point given is on the y axis, it is the y intercept of the equation, which makes it easy for us, making the equation of the graph D) **.**

11) **B -** The area of the shaded region is the difference of the area between the rectangle and the hexagon. The rectangle has side lengths of 4 and 2h. The value h is just the height of a 30-60-90 triangle and thus is is . The formula for the area of a regular hexagon is . With all of this in mind, the area of the shaded region is .

12) **C**  Since the formula for number of diagonals is n(n-3)/2, n(n-3)/2= Therefore, and the solution to this is n=7 since the other solution -2 is extraneous.

13) **D** Measures of arc angles are equivalent to the angle measures of their respective sectors. The measure of the sector angle is equivalent to the measure of Angle O. Angle O is the last angle in a quadrilateral with the sum of the 3 other angle measuring . This means Angle O and x=.

14). **D** Drawing perpendicular straight down from the point P to four sides will make this question a lot easier. Let’s call the altitude from P to AB as X, P to BC as Y, P to CD as Z, and P to AD as W. 

We are trying to solve for  which can be solved by subtracting the 1st equation from 2nd equation and adding the 3rd equation. Therefore, the length of PD is

15) **B** The Law of Cosines is 

A dodecahedron has 12 pentagonal faces.

An icosahedron has 20 triangular faces.

Skew lines are located in different planes.

If the orthocenter and the centroid of a given triangle are the same point, then the triangle is equilateral.

Therefore, there were 2 statements that were true.

16) **A** To find the centroid of a triangle, the following formula has to be used.

(, ). (,) = (3,6)

17) **A** Using Shoelace Theorem, you will get [(3)(5)+(-2)(4)+(8)(9)]/2 - [(-2)(9)+(8)(5)+(3)(4)]/2 = 45/2

18) **B** The hour hand moves 6 degrees in 12 minutes and minute hand moves 72 degrees in 12 minutes, going back from 12 PM, they will be 72-6= 66 degrees apart since they will be going in the same direction.

19) **E** The simple formula for putting cake is  therefore plugging in 5 will give you 15+1=16

20) **D**  Once again, minimum distance between a line and a point can be solved using the formula (|ax_0+by_0+c|)/(sqrt(a^2+b^2)). Therefore, plugging into the formula it will give you 32/5 as the minimum distance between the line and the point.

21) **D** Double inverse of original statement is same as original statement. Therefore, converse of contrapositive of the statement is what matters in this question. Since contrapositive is inverse + converse, converse of contrapositive of the statement would be same as double converse and inverse. Just like double inverse, double converse will also cancel itself out. So, the answer would be just inverse of the statement.

22) **D** If the point is on the line, it will not define a plane.

23) **A** Possibilities are 8, 9, 12; 8, 9, 20; 8, 12; 20, and 9, 12, 20. But the sum of two sides must be greater than the 3rd. 8, 9, 12 and 9, 12, 20 are the only ones that work.

24) **C** If segment AC is 32 inches, then AB will be 128 inches. BC is simply AB - AC therefore 128 – 32 = 96.

25) **C** The area of the original hockey puck is 10\*10\* and the new area will be 8\*8\*. The original area- new area is 36 pi which is 36% of original hockey puck.

26) **C** Pythagorean Theorem simplifies to the quadratic and the Quadratic Formula yields x = 4 ± 2 . Since it asks for possible length of the shortest leg, it will be 2+4.

27) **A** Constructing a square with side length of 12+12 around the octagon will make this question very simple. The area of the octagon is the area of the square - 4 right triangles at the corners. Therefore the area is - (4)(0.5)= 288+288

28) **A**  The space diagonal, d, of the prism is the diameter of the sphere. d==25 The radius is 25/2. And the formula for surface area of a sphere is 4 therefore 625

29) **D**  Since volume is \* 12 \*12 \*12 =320 cubic inches 320=base \* height =64\*h. Therefore, h =5 inches

30) **C**  CPCTC stands for Corresponding Parts of Congruent Triangles are Congruent