**Directions: Choose the letter of the correct answer. In all cases, E) NOTA means “none of these answers”. Figures are not drawn to scale.**

**Please rationalize denominators. For this test, assume the fair takes place on a Cartesian Coordinate Plane, and that the Origin (0, 0) is where the main tent is located. Units are assumed. Figures are not drawn to scale. Good luck, and have fun!**

1) Nathan is getting ready to set up his Arts and Crafts booth at the fair. He has an empty box in the shape of a rectangular prism. It has dimensions 3, 4, and 5. What is the surface area of his box? (Assume it is a closed figure)

**A) 25 B) 64 C) 81 D) 94 E) NOTA**

2) Nicholas wishes to walk from Nathan's booth at  to Jimmy, who is standing at  then to Cecilia who is standing at  . The shortest distance Nicholas can travel is

**A) 1 B)  C) 2 D) 3 E) NOTA**

3) All Arts and Crafts booths are each placed on integer coordinates. How many Arts and Crafts booths are exactly 5 units away from Nathan's booth which is at ?

**A) 3 B) 4 C) 8 D) 12 E) NOTA**

4) While at Nathan's booth, Marshall made a regular cube out of origami paper. If Marshall calculated the surface area of the cube to be 12, what is the side length of one of the faces?

**A) 1 B)  C) 2 D)  E) NOTA**

5) Nick's circular booth is too large. He needs to reduce the size of the base of his booth to comply with the fair’s rules, so he halves the radius of his booth’s base. By what factor does the area of his booth’s base decrease?

**A)  B)  C) 2 D) 4 E) NOTA**

6) Nick's booth specializes in creating regular polygons out of string. If each side of a polygon takes 1 string to make, then how many pieces of string would it take to make a polygon whose exterior angles are 36° each?

**A) 8 B) 9 C) 10 D) 11 E) NOTA**

7) Nick's booth has a trivia question challenge, for which the prize is a large bag of candy. The question is “There are 13 people at a conference. They are seated at a circular table, but none of them like the people they are sitting next to. Assume that any given person only dislikes those next to him. At the intermission, everyone shakes hands with everyone they don't dislike. How many total handshakes occur?” Which of the following answers would net you a large bag of candy?

**A) 13 B) 45 C) 65 D) 66 E) NOTA**

8) Which of the following statements is logically equivalent to the statement: “If Wayne answers Nick's question correctly, then he will win a large bag of candy”?

**A) “Wayne will win a large bag of candy if he answers Nick's question correctly.”**

**B) “If Wayne wins the bag of candy, then he answered Nick's question correctly.”**

**C) “If Nick's question is hard, Wayne will not answer it correctly.”**

**D) “If Wayne is Nick's question, then the candy will answer itself.”**

**E) NOTA**

9) Jeffery is standing 26 units away from Nick's booth, but only 3 units away from Nathan's. Recalling that 25 units separate Nick's and Nathan's booths, what is the area of the triangle formed by the two booths and Jeffery?

**A) 24 B) 30 C) 36 D) 49 E) NOTA**

10) At Jamie’s booth, visitors are given a compass and straight-edge and are making geometric constructions using only those two things. Which of the following constructions is impossible?

**A) Given a circle with area *a*, construct a square with area *a*.**

**B) Given a segment of length 1, construct a segment of length .**

**C) Given a segment of length *a*, construct an equilateral triangle with side lengths *a*.**

**D) Construct a regular Heptadecagon (17 sides).**

**E) NOTA**

11) While it is impossible to trisect EVERY angle, there are some angles that can be trisected with ease. Which of the following angles can be trisected with only the tools at Jamie’s booth?

**A) 3° B) 27° C) 45° D) 60° E) NOTA**

12) While at Jamie’s booth, Sophie constructs a regular hexagon from a given segment such that the segment is one of the hexagon’s sides. How many lines of symmetry are there for her construction?

**A) 3 B) 6 C) 9 D) 12 E) NOTA**

13) Jamie’s trivia question is “Which of the following constructible polygons CANNOT be made into a tessellation with no gaps?”

**A) Equilateral Triangle B) Square**

**C) Regular Pentagon D) Regular Hexagon E) NOTA**

14) Sophie moseys on over to Chase’s booth which is all about circles. Chase has a challenge problem already set up which reads “Two concentric circles have radii 13 and 17. A chord is constructed inside the larger circle such that it is tangent to the smaller circle. What is the length of this chord?”

**A)  B)  C)  D)  E) NOTA**

15) Chase’s math skills are ridiculous. It only took him 20 seconds to compute (correctly) the volume of the cube which is circumscribed about a sphere of radius 1. What answer did he get?

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

16) Andy’s math skills are up there too. It took him precisely 17 seconds to solve a difficult problem. At this rate, how many difficult problems can he solve in 17 minutes?

**A) 17 B) 24 C) 51 C) 68 E) NOTA**

17) Chase’s hardest problem is this: There exist two circles that are externally tangent to each other, with centers *A* and *B* and radii 7 and 12, respectively. Connect with a line segment *A* and *B*, then draw the diameter of circle *B* perpendicular to segment AB, which will meet the edges of circle *B* at points *C* and *D*. What is the area of triangle *ACD*?

**A) 57 B) 114 C) 228 D) 456 E) NOTA**

18) Shiming is at Annie’s Booth, where 3D geometry is the main attraction. If Shiming wants to make one of the five platonic solids, but he only has 6 squares of cardboard (no scissors or folding), which one can he make?

**A) Tetrahedron B) Cube**

**C) Octahedron D) Icosahedron**

**E) NOTA**

19) A cube of side length 4 sits at Annie’s Booth. Nick, who is on break, walks over to Annie’s booth and has some string in his pocket. He wishes to attach a piece of string to opposite corners along the outside of the cube. What is the shortest length his string can be?

**A)  B)  C)  D)  E) NOTA**

20) A pyramid with a square base also sits on Annie’s booth. If *V* is the number of vertices it has, *E* is the number of edges, and *F* is the number of faces it has, compute .

**A) 2 B) 1 C) -1 D) -2 E) NOTA**

21) Allison is also at Annie’s Booth. A regular hexagonal prism has height 4 and volume 16. If the prism is squashed straight down such that all that remains is a (2D) hexagon, what is the side length of the hexagon?

**A)  B)  C)  D)  E) NOTA**

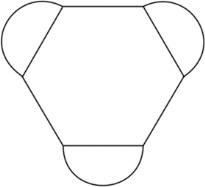
22) Annie’s trivia question reads “A hemisphere sits atop a right cylinder, and the total volume of the solid is . Given that the radii of the cylinder and the hemisphere are both 4, compute the height of the solid.”

**A) 7 B) 10 C) 11 D) 14 E) NOTA**

23) Jason’s booth is on the outskirts of the fair, and thus is about perimeter. If an equilateral triangle has perimeter 48, find its area.

**A)  B)  C)  D)  E) NOTA**

24) A hexagon of side length 2 is augmented with three circular arcs, each of radius 1, as shown in the picture below. Compute the perimeter of the figure.

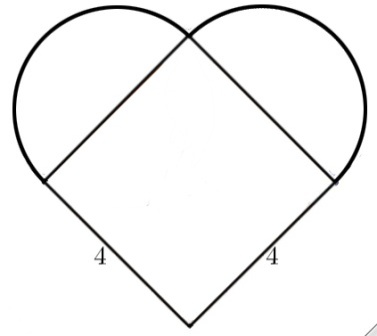


1. ** B)  C) 6 + 3π D) 3 + 6π E) NOTA**

25) A right circular cone sits at Jason’s booth. The perimeter of the base is *a*. The cone is then sliced parallel to the base precisely half-way up the cone and the bottom portion is removed. What is the perimeter of the new base?

**A)  B)  C) 2πa D) πa2 E) NOTA**

26) Jason’s booth is laid out in roughly the shape of a heart. It is a square of side length 4, and attached to two adjacent sides are circular arcs of radius 2, with the endpoints of the diameters of the arcs coinciding with the vertices of the square. A picture is provided. What is the perimeter of his booth?



1. ** B) 8 + 4π C) 16 + 4π D) 4 + 8π E) NOTA**

27) Jessie’s booth is all about lines, segments and angles. What is twice the supplement of the complement of 31°?

**A) 59° B) 121° C) 242° D) 343° E) NOTA**

28) Jessie has three distinct lines that all intersect at one point. If three consecutive angles have measures (2*x*+5)°, (*x*-1)°, and (2*x*+16)°, compute *x*.

**A) 27 B) 32 C) 34 D) 68 E) NOTA**

29) Niral is a mean person, but he’s fairly average. His booth is concerned with geometric means. If A is the geometric mean of 1 and 9, and B is the geometric mean of 1 and 4, compute .

**A) 4 B) 8 C) 9 D) 36 E) NOTA**

30) Free 5 Points! How many distinct booths are mentioned on this test?

**A) 12 B) 11 C) 10 D) 8 E) NOTA**