For this test, use 22/7 as an approximation for pi. Figures are not necessarily drawn to scale, and unless otherwise noted please ignore units. You will have exactly 60 minutes to work on this test. Good luck!

1) Suppose a square has side length *s* and diagonal *d*. What is  ?

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

2) If a regular *n-*gon has *k* diagonals, what is ? Remember, if  as a triangle, a line, and a point have no diagonals. For your answer, assume .

**A)  B) 2π C)  D)  E) NOTA**

3) *“A closed, four-sided figure such that opposite sides are congruent.”* What does this sentence NOT describe?

**A) Square B) Rectangle C) Parallelogram D) Kite E) NOTA**

4) Two lines intersect such that the smallest angle spanned by the lines is  What is the complement of one-third of the larger angle?

**A) 39° B) 49° C) 51° D) 152° E) NOTA**

5) Jamie drives along a circular track. If he drives at a constant rate of 20 mph and it takes him 45 minutes to make one complete lap, what is the radius of the circle?

**A) mi B) 7π mi C)  mi D)  mi E) NOTA**

6) Yay! Your first Fourth of July question! Nicholas is replicating the American Flag on a piece of paper, but he can’t remember what the correct number of red stripes is. He remembers though that it is the length of the shortest leg of a right triangle with hypotenuse 25 and other leg 24. How many red stripes are there?

**A) 6 B) 7 C) 13 D) 49 E) NOTA**

7) Now Nicholas is replicating the American Flag on a much larger scale. 52 feet tall and 104 feet wide, in fact. If the blue rectangle is 28 feet tall by 36 feet wide, what is the area that Nicholas must paint red?

**A) 834 ft2 B) 1000 ft2 C) 1668 ft2 D) 2336 ft2 E) NOTA**

8) In order to scale a right triangle’s area by a factor of *k* while maintaining similarity to the original, each side must be scaled by a factor of

**A)  B)  C) *k* D) k2 E) NOTA**

9) In order to scale the area of a 3-4-5 triangle up to 216 you must multiply by

**A) 6 B) 12 C) 36 D) 72 E) NOTA**

As everyone knows, cookouts are a big part of Independence Day here in America. Celebrate our freedom from our British overlords by consuming burgers! The next few questions are about cookouts.

10) Jason is having a cookout. To get two burgers, you must answer the following geometry trivia question: The number faces of an icosahedron minus the number of edges per face on an icosahedron is what?

**A) 3 B) 10 C) 17 D) 20 E) NOTA**

11) There are 30 people at Jason’s cookout. Some of them eat one burger, the rest eat two. A total of 39 burgers are consumed over the course of the cookout. The number of people who ate one burger is *a* and the number of people who ate two burgers is *b*. Find the distance to the point  from the point .

**A) 5 B) 10 C) 15 D) 39 E) NOTA**

12) Jason serves patties that are in the shape of a square with side length 1 and must cook 81 of them. He wants to cook them all in one batch. What is the difference between the maximum and minimum areas that his grill could be, assuming there is no empty space on the grill?

**A) 3 B) 9 C) 27 D) 81 E) NOTA**

13) A flat, round burger with diameter 10 inches has approximately how much more area than a flat square burger with diagonal 10 inches? (round to the nearest inch)

**A) 0 in.2 B) 29 in.2 C) 50 in.2 D) 79 in.2 E) NOTA**

14) If a sphere has radius , what is the ratio of its volume to its surface area?

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

15) A cube with side length 10 is painted such that one set of opposite faces is red, another is white, and the third pair is blue. It is then cut into 1000 cubelets of side length 1. How many cubelets have red paint or white paint BUT NOT BOTH?

**A) 320 B) 360 C) 400 D) 500 E) NOTA**

16) In the situation described in problem 15, how many cubelets are not patriotic? That is, how many cubes have no paint on them at all?

**A) 1000 B) 729 C) 512 D) 343 E) NOTA**

17) In the situation described in problem 15, how many cubelets have exactly two colors of paint on them?

**A) 64 B) 81 C) 90 D) 96 E) NOTA**

18) Jeremy wants to distribute copies of the Declaration of Independence to his entire high school. If each copy fits on a 5 inch by 8 inch piece of paper and each piece of paper is 0.01 inches thick, what is the maximum number he can fit in a box with dimensions 10”x18”x8”?

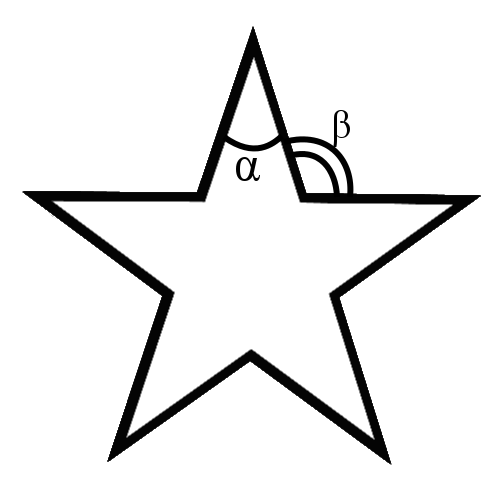
**A) 3200 B) 3600 C) 4000 D) 4900 E) NOTA**

19) Jeremy’s Declarations are printed on only one side of the paper. Exactly 25% of each printed side is covered in black ink. If it costs $5 to cover 10,000 square inches of paper with black ink, how much will it cost Jeremy to print 3600 declarations?

**A) $9 B) $18 C) $36 D) $72 E) NOTA**

20) Over the years, some talk has gone on about Puerto Rico joining the United States as a full-fledged state instead of a territory. The American Flag would then have *k* stars, where *k* is a multiple of 3. If we let *k*=3*t*, what is the ordered pair (*k*, *t*)?

**A) (50,10) B) (51,17) C) (51,3) D) (17,51) E) NOTA**

21) On the topic of stars, in the picture to the right what is  in degrees? Assume that this is a regular star, that is the 5 inner points form a regular pentagon and the extended sides form the points.

**A) 108° B) 90° C) 45° D) 36° E) NOTA**

22) Brian has a load of fireworks at his house and he plans to use them. The fireworks come in many different shapes, presumably so that they make different shapes when they explode. One model is a triangular prism with base area 7. If its surface area 49, what is its lateral area?

**A) 42 B) 35 C) 21 D) 14 E) NOTA**

23) One of Brian’s fireworks is a rectangular prism. Its bases are squares with side length 2. If the longest possible diagonal is , what is the height of the firework?

**A) 36 B) 25 C) 6 D) 5 E) NOTA**

24) Brian’s favorite firework is in the shape of an ice cream cone: it is half a sphere with a cone attached to the flat side. You may assume the radius of the base of the cone is the same as that of the hemisphere. The volume of the cone is , and the volume of the entire firework is . What is the height of the cone?

**A) 9 B) 4 C) 3 D) 2 E) NOTA**

25) How long will Brian’s longest fuse burn (in seconds) if it is the positive difference between the positive geometric mean of 32 and 128 and the arithmetic mean of 37 and 27?

**A) 128 s B) 64 s C) 32 s D) 16 s E) NOTA**

26) Brian shoots his firework off at an angle. It flies through the air in the shape of the parabola . At what value of *x* will it reach its maximum height?

**A) 0 B) 4 C) 8 D) 10 E) NOTA**

27) What is the length of the radius of a sphere whose volume is equal its surface area?

(Ignore units)

**A) 0 B) 1 C) 2 D) 3 E) NOTA**

28) How many books are in Euclid’s Elements? Alternatively, you may provide this number: the number of sides of the regular polygon which has exactly 65 diagonals.

**A) 10 B) 13 C) 65 D) 130 E) NOTA**

29) Jessie is making her dog a new playpen. It is in the shape of a rectangle with length 5 and width 7. What is the perimeter of the playpen?

**A) 12 B) 24 C) 36 D) 48 E) NOTA**

30) Here’s an easy one to finish off the test. What is the number of points with integer coordinates on a circle with radius 5 which is centered at the origin?

**A) 0 B) 5 C) 12 D) 25 E) NOTA**