*No calculators are allowed on this test. Choice E, “NOTA”, denotes “None Of The Aforementioned”. Good luck and have fun! ☺*

1. Suppose . What is the value of ?

A.  B.  C.  D.  E. NOTA

2. Suppose . What is the value of ?

A.  B.  C.  D.  E. NOTA

3. How many sides are in a convex polygon that has diagonals?

A.  B.  C.  D.  E. NOTA

4. What is the y-intercept of the line perpendicular to  passing through the point

?

A.  B.  C.  D.  E. NOTA

5. In a circle with radius inches, a chord is inches from the center. What is the length of the

chord in inches?

A.  B.  C.  D.  E. NOTA

6. Determine the value(s) of so that has no real roots.

A.  B.  C.  D.  E. NOTA

7. A certain object has  vertices and edges. If the area of each face of the object is , compute

the surface area of the object assuming it’s a polyhedron.

A.  B.  C.  D.  E. NOTA

8. The great circle of a sphere has area . What is the volume of the sphere?

A.  B.  C.  D.  E. NOTA

9. In chemistry, Boyle’s Law says that the volume and pressure of an ideal gas are inversely

proportional. Suppose that air behaves as an ideal gas. The volume of air in a tank is cubic inches when the pressure is psi. Some air is then used to pump into a tire. The pressure is increased to 36 psi. What is the new volume, in cubic inches, of air in the tank?

A.  B.  C.  D.  E. NOTA

10. What is the shortest distance between the graph of  and?

A.  B.  C.  D.  E. NOTA

11. Find the coefficient of the term in the expansion of .

A.  B.  C.  D.  E. NOTA

12. Suppose is a root of . Determine the value of .

A.  B.  C.  D.  E. NOTA

13. How many integer values of make the inequality  true?

A.  B.  C.  D.  E. NOTA

14. A parabolic arch is feet high at its tallest point. The base points of the arch are feet apart. What is the height, in feet, at a horizontal distance of 10 feet from its axis of symmetry?

A.  B.  C.  D.  E. NOTA

15. If  and , what is the value of for real values *a* and *b*?

A.  B.  C.  D.  E. NOTA

16. How many times does the graph of cross the x-axis?

A.  B.  C.  D.  E. NOTA

17. Find the sum of the entries in if .

A.  B.  C.  D.  E. NOTA

18. How many natural numbers less than have an odd number of positive integral divisors,

where none of the divisors are even?

A.  B.  C.  D.  E. NOTA

19. The length of sides of a non-degenerate triangle are , where  is a positive integer. The lengths of the sides of another non-degenerate triangle are . How many values of  exist?

A.  B.  C.  D.  E. NOTA

20. What is the sum of all roots of ?

A.  B.  C.  D.  E. NOTA

*For questions 21-22, trianglehas vertices .*

21. The centroid of triangleis. Find .

A.  B.  C.  D.  E. NOTA

22. Compute the area of triangle .

A.  B.  C.  D.  E. NOTA

23. What is the distance between the incenter and circumcenter of a triangle with side lengths 5,

12, and 13?

A.  B.  C.  D.  E. NOTA

24. Evaluate .

A.  B.  C.  D.  E. NOTA

25. Evaluate the sum .

A.  B.  C.  D.  E. NOTA

26. Tien and Yamcha are playing a game. They have a five-sided, fair die labeled 1 through 5. If

Tien rolls a 1 or a 5, he wins. If Yamcha rolls a 2, he wins. The game continues until someone wins, and they take turns rolling the die. If Tien rolls the die first, what is the probability he wins the game?

A.  B.  C.  D.  E. NOTA

27. Let denote the number of ones that appear in the binary expression of the positive integer . What is ?

A.  B.  C.  D.  E. NOTA

28. Suppose Cramer’s Rule is used to solve a system of equations and the y-coordinate comes out to be  . What is the value of in the same system of equations?

A.  B.  C.  D.  E. NOTA

29.  and  are tangent to circle . If , find .

A.  B.  C.  D.  E. NOTA

30. Given the statement “If I don’t like history, then I pass science.”, what is the inverse of the converse of the inverse of the contrapositive of the statement?

A. If I don’t like history, then I pass science.

B. If I pass science, then I don’t like history.

C. If I like history, then I don’t pass science.

D. If I don’t pass science, then I like history.

E. NOTA