For all questions the answer choice E. means “none of the answers are correct”,** and**.

**Given, then,, and.** Good luck and have fun!

**For Questions 1-2 a Fermat Prime can be written in the form of a Fermat Number,  given is a non negative integer**

1. Gauss used complex numbers to determine which regular polygons could be constructed with a straight edge and a compass. He concluded that a regular N sided polygon can be constructed with a compass and a straight edge if  given  and independent of the Fermat Primes. Find  if  represents the value of  in the smallest sided polygon that can be constructed with a compass and a straight edge according to this particular conclusion by Gauss.
2. 
3. 
4. 
5. 
6. NOTA
7. Consider the set of complex numbers,  where  represents the pth Fermat Number. Find the probability that the product of any two numbers within the set is greater than 
8. 
9. 
10. 
11. 
12. NOTA
13. Which of the following represents  in polar form?
14. 
15. 
16. 
17. 
18. NOTA
19. Complex numbers, with imaginary terms, cannot be represented, as points, on which of the following planes?
20. Gauss Plane
21. Argand Plane
22. Euler Plane
23. Complex Plane
24. NOTA
25. Evaluate  in rectangular form
26. 
27. 
28. 
29. 
30. NOTA
31. Find the sum of the infinite series 
32. 
33. 
34. 
35. 
36. NOTA
37. Consider the triangle formed by the points  ,  , and  . Find the area bounded by the triangle ABC on the complex plane. *(Disregard units)*
38. 
39. 
40. 
41. 
42. NOTA
43. Niels Henrik Abel’s Manuscript detailed that a complex number could be represented as a  matrix written such that, otherwise known as the Cayley-Dickson construction. Given that one such matrix  is represented by, evaluate 
44. 32
45. 8
46. 16
47. 2
48. NOTA
49. Find the norm of 
50. 
51. 
52. 
53. 
54. NOTA
55. Consider a shape formed by a locus of points defined by on the Cartesian plane. If the shape has an area and eccentricity of  . Evaluate
56. 
57. 
58. 
59. 
60. NOTA
61. A number  has a magnitude of 15. If q is positive and of p , then find 
62. 

1. 
2. 
3. 
4. NOTA
5. Find the sum of the reciprocal and conjugate of 
6. 
7. 
8. 
9. 
10. NOTA
11. A quadratic equation with non zero real coefficients has imaginary roots if the discriminant is which of the following listed below
12. Positive
13. Negative
14. Zero
15. Imaginary
16. NOTA
17. A Hermitian Matrix is a square matrix with complex entries equal to that of its conjugate transpose such that a  Hermitian matrix can be represented as  , where  are all constants since the diagonal elements must be real. If ,  , and the constants are all one; classify the determinant of the subsequent Hermitian matrix as one of the following listed below.
18. Whole Number
19. Imaginary
20. Negative Integer
21. Rational but not necessarily an integer
22. NOTA
23. Solve for  in terms of y given
24. 
25. 
26. 
27. 
28. NOTA
29. Let  , where  is the number of sides of an octagon and  is the measure of an interior angle within the octagon. Evaluate 
30. 
31. 
32. 
33. 
34. NOTA
35. Which of the following represents  in exponential form?
36. 
37. 
38. 
39. 

E. NOTA

1. Consider a particle traveling in two-space according to the equation  and a second particle traveling according to the path  . Evaluate  if  represents the time  at which the particles collide and  represents the time  at which the particles collide.
2. 
3. 
4. 
5. 
6. NOTA

For questions 19-21 use Euler’s Identity 

1. Find 
2. 
3. 
4. 
5. 
6. NOTA
7. Which of the following represents in polar form if and?
8. 
9. 
10. 
11. 
12. NOTA
13. Ryan is running a 5k race and begins at the point  . The objective of the race is to reach a series of points consecutively the fastest before heading back to the start. In preparation Ryan attempts to calculate the minimum distance he can run from point to point assuming a linear path. Ryan must reach the rendezvous points in this exact order: , ,, and last  . Assuming Ryan overestimates the distance he must travel by , what is the distance Ryan calculated? *(Disregard Units)*
14. 42
15. 69
16. 52
17. 59
18. NOTA
19. Andre’s specialty is probability. Ryan, knowing this, then dares him to solve the following problem. Consider $b$ to be the area of the region bounded by the inequalities and; and consider q to be the area of the region bounded by and . Let p equal , find.
20. 
21. 
22. 
23. 
24. NOTA
25. Find the fourth roots of unity
26. 
27. 
28. 
29. 
30. NOTA
31. Simplify 
32. 
33. 
34. 
35. 
36. NOTA
37. If  , then find 
38. 
39. 
40. 
41. 
42. NOTA
43. Joy is investigating the applications of Descartes’ Rule’s of Signs with the equation

 . Joy is told the equation has complex roots and uses the rule to determine how many complex roots exist for the equation. Assuming Joy knows how to correctly apply and or use Descartes’ Rule’s of Signs, what is Joy’s answer?

1. 0
2. 2
3. 1
4. 3
5. NOTA

1. Find the area of the conic with the equation 
2. 
3. 
4. 
5. 
6. NOTA

1. The roots of  can be used in conjunction with unit circle to generate n-sided regular polygons. The perimeter of these polygons can be expressed as which of the following?
2. 
3. 
4. 
5. 
6. NOTA

1. Consider the  matrix  in which  represents a constant. Find the product of the values of  which makes the matrix singular.
2. 1
3. 
4. 
5. 
6. NOTA
7. Consider a complex number  for which the modulus of  is  and the argument is  . Find the value of  when  is rewritten in the form  .
8. 
9. 
10. 
11. 
12. NOTA