1. thus the rotation is through an angle of . C



2. . B



3. The 17th roots are of the form for . Since and then we have that the values of in the second quadrant are 5,6,7,8. So there are 4 roots in the second quadrant. D



4. . C



5. Since the cube of any number  is ,  will be real iff  for some n. Since 2 and K are positive, then  is in the first quadrant. Hence, for . If  the  and consequently on n=1 gives an angle within the given range. Thus there is only one value of K for which  will be real. A

6. Note that so we have that since De Moivre’s theorem preserves the periodicity of the trigonometric functions. B



7. To find one root, we write -512 as . Thus the other roots have magnitude 2 and angles that differ by . Since we want a>0 we must have that . The corresponding roots are then . The product is 16. A

8. All of these numbers are complex. E

9. Suppose . Then and thus which reduces to which is a parabola. D



10. We expand each product to obtain and thus the sum is and . B



11. The nth roots of unity make a regular n-gon in the argand plane. Thus the roots of form a regular dodecagon. D



12. Rearranging and factoring the given equation gives . Since is imaginary we have that . Thus and from which we have . D



13. If  then . From here it is easy to see that  and .

Thus . C

14. Given two complex numbers we have that  so that . B

15. B



16. We have . The product of the roots is then . A



(Changed to B at Convention)

17. We must expand the product so we have



C.

18. To determine the number of zeros at the end of 2012! we divide by powers of 5 and keep the whole parts adding them together so .



Thus . A



19.. C



20. . B



21. Writing and we have that and . Thus . Furthermore, we know that and therefore . So the product of the roots is . B



22. Evaluating the determinant using Laplace expansions yields



But we know that so . A



23. Since and are roots we have and from which it follows that and . Using we have . B



24. Given the first term a = 1 and common ratio , , the sum of our geometric series is given by . C



25. Domain of logarithm is such that the argument must be greater than zero. Thus we have that so that which only has solutions on the interval . D



26. This is an application of the discriminant. The imaginary solutions will occur when the discriminant is negative thus we set . Rearranging gives . C



27. By the cyclic nature of the imaginary unit, in evaluating the sum there will be 503 sets of four terms that repeat, namely Thus the sum reduces to from the hint. D



28. Let  from which it follows that  since the radical is positive. D

29. From Euler’s Identity we have that from which we have that . B



30.  so by properties of De Moivre’s Theorem we have that . C