1. C 6. D 11. Out 16. D 21. D 26. B

2. A 7. B 12. B 17. B 22. A 27. Out

3. C 8. D 13. B 18. B 23. A 28. D

4. E 9. C 14. C 19. C 24. B 29. A

5. A 10. A 15. D 20. A 25. C 30. C

1. C. 

2. A. Divide by to obtain . Hence, .

3. C. . Factoring, . cannot be negative, hence .

4. E. The slope of some line perpendicular to the given line is . Now applying point-slope form, . The y-intercept is where . Thus, . So, the y-intercept is .

5. A. Connecting a line from one of the endpoints of the chord to the center of the circle, we see that it is the radius, . So half the length of the chord, from Pythagorean Theorem, is . The length of the chord is twice that, or .

6. D. For a quadratic to not have any real roots, the discriminant must be less than . Hence, .

7. B. From Euler’s Formula, . So, . Since there are ten faces, each of which having area three, the surface area of the object is .

8. D. , so .

9. C. The model for this variation is . Substituting given values, . So when the pressure is 36, 

10. A. The shortest distance between a point and a circle (assuming the point is not within the circle), is the distance from the point to the center of the circle, minus the radius. The given circle has center , so the distance from the point to the center is . The radius of the circle is . Hence, the shortest distance is .

11. D. From Binomial Theorem, .

12. B. Since is a root, . So, . Thus, .

13. B. Subtracting from both sides and obtaining a common denominator, .

Simplifying, . Testing points below , we see that all values come out negative. Similarly, all values above come out negative. So, the solution interval is . The only integer in this interval is , so there is only value.

14. C. We have the parabola . Since the base points are away from each other, this implies that they are each away from the axis of symmetry. Thus, . So, . For , the value of is .

15. D. Adding both equations together, we have . Completing the square for both variables yields , or . For the sum to be , both terms must be . Hence, , and .

16. D. A graph crosses the x-axis when . Setting , we have . Now there are two cases.

Case 1: . Converting this to exponential form yields .

Case 2: . Converting this to exponential form yields .

Hence, the graph crosses the x-axis times.

17. B. After trying a few examples, it is clear that . So, , and the sum of the entries is .

18. B. The only numbers which have an odd number of positive integral divisors are perfect squares. Since we don’t want the numbers to be even, we are looking for the number of odd squares less than . The greatest square less than is . So, the number of odd numbers less than or equal to  is .

19. C. For the first triangle, . For the second triangle, . The values which satisfy this are 8, 9, 10, 11, 12, 13, and 14. So, there are .

20. A. The sum of all roots of a function is , where is the leading coefficient, and is the coefficient of the term with degree one less than the leading term. Here, , and . Hence, 

21. D. To find the centroid, we simply average each coordinate. Hence, the centroid is . So, .

22. A.



23. A. Note that this triangle is right. Place the triangle on a coordinate plane with vertices

, , . The midpoint of the hypotenuse is , and is the circumcenter. The inradius is . So, the incenter is . Hence, the distance between the two points is .

24. B. Let denote the sum. We can write out the first few terms.



Dividing this sum by  yields:



Subtracting the two sums (subtract diagonally since diagonal elements will have a common denominator) yields:



The right hand side is now an infinite geometric series! So,

.

25. C. Let . Because , we can rewrite this as . Adding those two equations, we obtain . Hence, .

26. B. There are different ways in which Tien can win. He can win on the first try, or he and Yamcha can both “lose” on their first try, and then Tien wins on the next roll. And so on. Suppose Tien does win on the first roll. This has probability . If Tien doesn’t win on the first try, and Yamcha doesn’t win on his first try, then Tien wins on the next roll, this has probability . Similarly, the next situation in which Tien can win would have probability . This goes on forever, and the probability that Tien wins is the sum. So then, we see that the probability that Tien wins is actually an infinite geometric series with first term and a common ratio of . The sum, then, is .

27. E. Consider the binary expression of . If we were to compute the binary expression of , this would just add a to the end of the number. So, the number of ones stay the same, and . If we were to then find the binary expression of , this would have an extra one at the end. So, . Thus, .

28. D. .

29. A.  is isosceles, so .  since  and  are tangent. So . So  since  is a kite. 

30. C. The inverse of the converse of the inverse of the contrapositive is simply the inverse of the original statement. Hence, .