SOLUTIONS:

**1. D** *e* is an irrational number with a nonterminating decimal. Therefore, .

**2. D** 

**3. A** 

**4. B** Group the 2’s and 5’s and rewrite as . This number has 14 digits.

**5. C** From the graph, we recognize that the function is asymptotic to y=1. Also, it passes through the points (0,3) and (-1,5). Looking at choice C, , , and . Also, it has the shape of the exponential function flipped over the y-axis, shifted right one unit, and shifted up one unit. Therefore, choice C is correct.

**6. D** 



**7. A**  Because , 

**8. E**  Therefore, 

**9. B** Statements C, D, H, and J are true. All the other statements are false.

**10. B** We can rewrite the first three terms of the sequence as , , . The difference between terms 1 and 2 is , and the difference between terms 2 and 3 is . Because the sequence is arithmetic, we can set the two differences equal:  Substituting back in, the sequence becomes , , . Clearly, the common difference is . Therefore, the eighth term in the sequence is .

**11. B** Setting the exponent equal to 0, we find that is a possible solution. Evaluating the base at , we get 4, so  works as a solution (if we ended up with  on the left side of the equation,  would not have worked). Setting the base equal to 1, we end up with . Making a substitution , we see that gives no real solutions. Setting the base equal to -1, we end up with , which also has no real solutions. Therefore, is the only real solution.

**12. B** is the only other value possible by changing the order of exponentiation.

**13. A** 

**14. D** 

**15. B** 



Solving the system of equations, we find that  and . 



**16. A** We can rewrite the series as Thus, the exponents form the infinite series Solving The right side can be easily evaluated using the infinite geometric series formula:  Thus,  Therefore, the series simplified to exponential form is .

**17. C** 

Since has the domain , only first quadrant solutions work (and  must both be positive). We can evaluate and  using the tangent half angle formula: . Plugging in: and . Therefore, .

**18. A** Rewrite as  From here, we can use difference of perfect squares to factor and simplify:





**19. C**  prime factorizes to , so there are factors of .

Writing out the logarithms of the factors we see:

 Each factor of 2 and each factor of 5 appears 8 times (there are 64 total factors). Therefore, 10 appears 8 times. so our answer ends up becoming 

**20. D** Plugging in into the velocity equation, we find that ft/s.

**21. C** The velocity function is clearly asymptotic to  so ft/s.

 Plugging in, we find that



**22. E** 



**23. C** Because an octave is divided into intervals based on a logarithmic scale, we can see that the notes follow the following pattern: Solving the last equation, we find that the multiplier (indicating the size of a semitone) is . 384Hz is 3/2 times the starting frequency of 256 Hz. Thus we can use to solve for *k,* the number of notes we need to count up from the starting frequency to reach the desired frequency. Because , we need to count up 7 semitones from C. We arrive at G.

**24. E**  Also, we can determine…



**25. A** Rewrite as  and recognize that the denominator is a geometric sequence that can be evaluated with . Plugging in, . Thus, the original expression becomes .

**26. C** The trick is to recognize that you can apply your favorite formula  to consolidate the angles within the innermost parentheses: 





**27. A** Don’t overthink it! From the description provided, log-polar coordinates are the same as polar coordinates except . The circle provided in polar form is . Therefore, the circle in log-polar form is .

**28. C** 



**29. C** The only positive integers that work are 3, 9, 27, and 729. Therefore, the answer is 4.

**30. D** 