**Answer Key: CAACDACDCADBDAACDECCDDAEBABCBB**

1. **C.** 
2. **A.** Can use substitution or knowing that  is  periodic yields **0**.
3. **A.** Use integration by parts. Setting and 
4. **C.** Use L’Hopital’s Rule: 
5. **D.** Sketches help to illustrate the point.
6. **A.** Hence, the Riemann integral or Riemann sum.
7. **C.** Newton didn’t develop a notation for integration.
8. **D.**  and  intersect at . For , , so . Likewise, for , so . Adding together gives 
9. **C.** Disk method: . Making the u-substitution  changes the integral to . Using the double-angle identity, we have 
10. **A.** Shell method: . Use integration by parts setting  and , 
11. **D.** Does NOT approximate quartic polynomials perfectly! . Apply the formula on the partition: 
12. **B.** u-substitution. Let . Then  and . This gives us 
13. **D.** Another u-substitution. Let  and , . So 
14. **A.** Apply the power rule. 
15. **A.** Derivative of a constant is zero.
16. **C.** By u-substitution or memory, 
17. **D.** Tricky, but the two integrals could be equal.
18. **E.** Apply a trig substitution .  and . Apply the substitution to get .
19. **C.** Use partial fraction decomposition to break down the larger rational function. Factoring the denominator gives . With the irreducible quadratic, we have . Setting up the system yields that and . Thus, 
20. **C.** Area of a semicircle given diameter: . 
21. **D.** Disk method with annulus: 
22. **D.** Separation of variables. . Integrate both sides to get . Applying the initial condition gives . Rearranging and solving for  gives . Applying the initial condition again gives that the sign is negative .
23. **A.** 
24. **E.**  
25. **B.** . Apply IC to get . Then . Apply IC to get . Then 
26. **A.** First, find the equilibrium point by setting  and substitute into either S(q) or D(q) to get .Then .
27. **B.** Separate first into . Here, you can differentiate the right side and get that and then integrate both sides: 
28. **C.** Differentiating erf(*x*) twice gives  which can be either positive or negative based on the value of *x* so A and B are out. Testing if odd is to show that . Thus, . Saying ,  and , we have 
29. **B.** The area element is , so . The bounds are clearly 0 cm and 1 cm for the radius of the colony. Then  million
30. **B.** First use Hooke’s law to calculate the spring constant. . Therefore,  N/m. Then integrate force over displacement to get work:  J