AP Calculus Summer Assignment

Read selected sections of *The Cartoon Guide To Calculus*
Use the book and the web if necessary to find answer the questions.

Chapter -1 : Speed, Velocity, Change

1. Calculus is the Mathematics of ______________
2. What did Isaac Newton do in life besides help "discover" calculus?
3. What did Gottfried Leibniz do in life besides help "discover" calculus? How do you pronounce his name?
4. What's the difference between *speed* and *velocity*?
5. What is *instantaneous velocity* and how did Newton and Leibniz approximate it?
6. What does the word *infinitesimal* mean?
7. Why did Newton call his method for exactly determining instantaneous velocity *fluxions* ?

Chapter 0 : Meet The Functions

You can skip the bottom half of page 26, and all of 27-28, 52

8. How do you find the domain of a function?
9. Another way to write the absolute value function is $|x| = \sqrt{x^2}$. (Try it, it works). How is this related to the distance formula from geometry, $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$?

10. List each of the “families” of elementary functions. For each family, list its most famous member and describe the kinds of real-world phenomena which can be explained or modeled by that family.

11. What are the various ways we can combine two functions to construct a new function?

12. What is a *one-to-one* function?

13. How are e^x and $\ln x$ related?

14. How are the graphs of a function and its inverse related?

15. What does the input of a trig function represent? What does the output of a trig function represent?

16. What does the input of an inverse trig function represent? What does the output of an inverse trig function represent?

Chapter 1 : Limits

You can skip pages 59-69,76

17. How would you explain the concept of a *limit* to your grandma?

18. Do limits represent x-coordinates or y-coordinates?

19. What is an *infinite limit?*

20. What is a *limit at infinity?*

21. Why doesn't $\sin x$ have a limit as x approaches ∞ ?

Chapter 2 : The Derivative

You can skip pages 84-87, 94-100

22. If a function represents the position of an object, then the derivative of that function represents the object's _______________

23. How is the definition of the derivative on page 83 related to the slope formula, $m = \frac{y_2 - y_1}{x_2 - x_1}$ from algebra?

24. What is "Leibniz-style" notation for the derivative and why is it useful?

Chapter 3 : Chain, Chain, Chain

You can skip this chapter

Chapter 4 : Using Derivatives, Part 1 : Related Rates

Read only pages 117-118

25. Why do they call the problem described here a "Related Rates" problem?

26. Describe a real-life Related Rates problem you have encountered in the real world. Be sure to express the units of the two rates involved in the problem

Chapter 5 : Using Derivatives, Part 2 : Optimization
Read only pages 125-128

27. Why is optimization important to living things? What kinds of things do we try to maximize? What kinds of things do we try to minimize?

28. If a function has a local maximum or minimum at a point, what is the value of the derivative at that point?

Chapter 6 : Acting Locally
Read only pages 145 through the top third of 148, 153

29. What use is approximation? Why not just always calculate an exact answer?

30. Give four uses of the derivative with a short description of the importance of each

Chapter 7: The Mean Value Theorem
You can skip this chapter

Chapter 8: Introducing Integration
Read only pages 161-167

31. How area the meanings of and summation symbol Σ and the integration symbol $\int dx$ similar? How are they different?

32. For objects moving in a straight line, the derivative helped us figure out instantaneous velocity when given the position of an object. What does integration help us figure out for objects moving in a straight line?

Chapter 9: Antiderivatives
Read only pages 169-172

33. Why can a function have more than one antiderivative?

34. Why is integration sometimes "messier" or more difficult than differentiation (finding the derivative)?

Chapter 10: The Definite Integral
Read only pages 177-top of 180, 182,185

35. Why do we need integration to compute area? Aren't the formulas we learned in geometry enough?

36. How is the limiting process necessary for us to understand what a definite integral is?

Chapter 11: Fundamentally…..
Read only pages 187-188

37. The Fundamental Theorem of Calculus is the "mother of all area formulas". Why?

Chapter 12: Shape-Shifting Integrals
You can skip this chapter

Chapter 13: Using Integrals
Read only pages 205-208, 220-226

38. Besides being useful for calculating areas and volumes, what else are definite integrals useful for?

39. What is a probability density function? What is a random variable?

Chapter 14: What's Next?
Read pages 229-232

40. What makes a differential equation a differential equation?