

**AP Calculus AB
Summer Packet**

Name _____

Directions: Please complete this Summer Packet and be ready to discuss or turn in on the first day of school. Please show work for all questions.

Evaluate the following limits algebraically without using a calculator. Show all work.

1. $\lim_{x \rightarrow -2} \frac{3x^2 + 2x - 8}{x + 2}$

2. $\lim_{x \rightarrow 2} \frac{x^4 - 16}{x - 2}$

3. $\lim_{x \rightarrow -1} \frac{x^4 + 3x^3 - x^2 + x + 4}{x + 1}$

4. $\lim_{x \rightarrow 0} \frac{\sqrt{x+4} - 6}{x}$

$$5. \lim_{x \rightarrow 3} \frac{\sqrt{x+6}-x}{x-3}$$

$$6. \lim_{x \rightarrow -2} \frac{\frac{1}{2} + \frac{1}{x}}{x+2}$$

$$7. \lim_{x \rightarrow \frac{1}{2}} \frac{x^{-1}-2}{x-\frac{1}{2}}$$

$$8. \lim_{x \rightarrow 3} \frac{\frac{1}{x^2}-\frac{1}{9}}{x-3}$$

$$9. \lim_{x \rightarrow 0} \frac{|x+2|-2}{|x|}$$

10. $\lim_{x \rightarrow 3} \frac{|x^2 - 9|}{|x - 3|}$

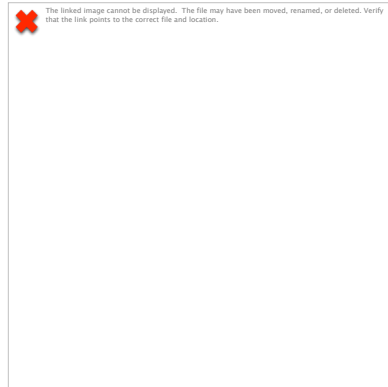
11. The graph of the function $f(x)$ is shown below.



Use the graph of the function to find the following limit.

$$\lim_{x \rightarrow 1} f(x)$$

12. Identify the asymptotes of the following function.



13. Find the limit of the following function

$$\lim_{x \rightarrow 2} \begin{cases} x + 1, & x < 2 \\ 2x, & x \geq 2 \end{cases}$$

14. Calculate the following limit: $\lim_{x \rightarrow \frac{1}{2}^-} \frac{x+7}{2x^2+11x-6}$

15. Find the derivative of the following function:

$$f(x) = 4x^{-4} - 5\cot(4x^5)$$

16. Find the equation of the tangent line to the given function at $X = 3$.

$$f(x) = \sqrt[3]{9x}$$

17. Find the derivative of the function.

$$f(x) = \frac{5x - 6}{3x^6 + 2}$$

18. Find the fourth derivative of the following function.

$$f(x) = x \sin(7x)$$

19. Find the second derivative of the following function.

$$g(x) = \sqrt{x + 21}$$

20. A ladder 13 feet long is leaning against a wall. If the bottom of the ladder slides away from the wall at 12 feet per minute, how fast is the top of the ladder sliding down the wall when the bottom of the ladder is 5 feet from the wall? Be Sure to Include a Diagram.

21. Find the derivative of the following function.

$$h(x) = \csc(9x^4 - 2x^3)$$

22. Find the derivative with respect to x of the following using implicit differentiation.

$$x^4y^4 + x^3 \sin(y) = 17$$

23. A baseball is thrown vertically upward with the velocity of 13 meters per second. The height of the ball after t seconds is represented by the following function. What is the velocity of the ball after 3 seconds?

$$s(t) = 49t - 4t^2$$

24. Find the derivative with respect to x of the following using implicit differentiation.

$$\sqrt{x + y} = x^4 y^4 + 11$$

25. Find the derivative of the following function.

$$h(x) = 8x^3 - \frac{8}{\sqrt[9]{x}} - \frac{1}{x^4}$$

26. A gas barrel has the shape of a right cylinder with a radius of 5 feet and the height of 15 feet. If gas is being pumped into the barrel at the rate of 3 cubic feet per minute, find the rate at which the gas is rising when the gas is 8 feet deep. Be sure to include a diagram.

27. Find the derivative of the following function.

$$g(x) = \tan(8x^3) + \sqrt{x}$$

28. Find the derivative of the following function.

$$f(x) = \frac{\cot(x)}{8x^4 + 5x^3}$$

29. Find the equation of the tangent line to the function when $X = 2$.

$$g(x) = 5x^4 + 3x^3 - 2x + 8$$

30. Differentiate each function with respect to x .

$$y = \ln(\ln 7x^5)$$

31. Differentiate each function with respect to x .

$$y = \ln 5x^3(-2x^3 - 3)$$

32. Find the derivative of the function.

$$f(x) = x^3 7^x$$

33. Use logarithmic differentiation to differentiate each function with respect to x .

$$y = (4x^4 + 7)^3 (\sqrt{5x^3 + 7})$$

34. Use logarithmic differentiation to differentiate each function with respect to x .

$$y = 7x^{4x}$$

35. Find $\frac{d^2y}{dx^2}$ in terms of x and y .

$$x^2 y^2 - 2x = 3$$

