

Name: _____

AP Calculus BC

Date: _____

Summer Assignment 2026

Important Note: As AP Calculus BC students who have already taken AP Calculus AB, you will be expected to have mastered the content of Units 1-3 from AP Calculus AB. The following problems give a sampling of this content, but they do not cover every topic. We will spend the first few weeks reviewing this material in the fall, but you should also study it over the summer.

Problem 1. Find the value of the following limits. DO NOT use L'Hospital's Rule, even if it applies.

(a) $\lim_{x \rightarrow 0} \frac{x^2 + 3x + 2}{\cos(5x)}$

(b) $\lim_{x \rightarrow -2} \frac{(x + 5)^2 - 9}{x + 2}$

Problem 2. Find the value of the following limits. DO NOT use L'Hospital's Rule, even if it applies.

(a) $\lim_{x \rightarrow 5} \frac{x^2 - 25}{\sqrt{x} - \sqrt{5}}$

(b) $\lim_{x \rightarrow -3} \frac{\frac{1}{3} + \frac{1}{x}}{3 + x}$

(c) $\lim_{\theta \rightarrow 0} \frac{\sin(8\theta)}{5\theta}$

Problem 3. Find the value of the following limits. DO NOT use L'Hospital's Rule, even if it applies.

(a) $\lim_{x \rightarrow 4^-} \frac{-7x + 1}{16 - x^2}$

(b) $\lim_{x \rightarrow -\infty} \frac{-5x^7 + x - 1}{x^3 + 7x^2 - 8x - 1}$

Problem 4. Prove that $\lim_{x \rightarrow 0} 3x^2 \cos\left(\frac{100\pi}{x}\right) = 0$.

Problem 5. Prove that $\lim_{x \rightarrow 4} \frac{2|x-4|}{x-4}$ does not exist.

Problem 6. Suppose that f is a continuous function on the interval $[1, 8]$, that $f(1) = 15$, and that $f(8) = 7$. Answer "YES," "NO," or "MAYBE" to each of the following questions, and justify your answers.

(a) Does there exist c such that $1 < c < 8$ and $f(c) = 2$?

(b) Does there exist c such that $1 < c < 8$ and $f(c) = 9$?

Problem 7. Using the definition of the derivative, find $f'(x)$ if $f(x) = 5x^2 - 3x + 2$.

Problem 8. Differentiate the following functions.

(a) $f(x) = 7x^9 - 4x^6 + x^3 + 2e^2 - 1$

(b) $y = \frac{9x^4 - 3x^2 + 8}{x^3}$

Problem 9. Find equations for the tangent line and the normal line to $y = x^3 - 3x + \sqrt{x} + 3$ at $x = 4$.

Problem 10. Find the derivatives of each of the following functions. You do not have to simplify your answers.

(a) $y = 2 \sin x - 3 \cos x + 2^x + 6e^x - \ln x + 7 \log_3 x$

(b) $f(x) = 2 \sec x + 3 \tan x - 8 \csc x$

(c) $f(\theta) = (2\theta^3 + 4\theta^2 + 8) \sin \theta$

(d) $g(t) = t^3 e^t \cos t$

(e) $y = \frac{\tan x}{x^3 + 2x}$

(f) $f(x) = \frac{x^2 \cos x}{\ln x}$

Problem 11. Differentiate each of the following functions. You do not have to simplify.

(a) $f(x) = \sec(5e^x)$

(b) $y = \sqrt{\sin(8x^2 + 3x + 7)}$

Problem 12. If $F(x) = f(g(x))$, where $f(7) = 8$, $f'(7) = 11$, $f(3) = -6$, $f'(3) = 4$, $g(7) = 3$, and $g'(7) = -5$, find $F'(7)$.

Problem 13. Find an equation of the tangent line to the curve $x^5 + 3x^2y^2 + y^5 = 5$ at the point $(1, 1)$.

Problem 14. Differentiate each of the following functions. You do not have to simplify.

(a) $g(t) = \sin^{-1}(t^3 + 8)$

(b) $y = \arctan(\ln x)$

Problem 15. Find the derivative of $y = \left(\frac{e^{2x} \sin^3 x}{(5x^2 + 6x + 7)^2} \right)^9$. [Hint: Rather than trying to take the derivative of the function directly as it is written, it is easier to use logarithmic differentiation.]