

Calculus I Optional Take-Home Test 2

Directions: Solve each of the following problems using separate paper, while clearly indicating each problem number when solving. Irrelevant work will detract from your score, while answers without work shown will be awarded no credit. Answers with partially correct work will receive partial credit. Each problem is worth 10 points. You must work alone, but you may use a graphing calculator as a supplement to your own work if you indicate the steps used. You may not use computational intelligence or AI.

1. The number of students in Tuohy Hall t hours after midnight is $n = f(t)$. What is the meaning of the derivative $f'(9)$? What are its units?
2. Find $\frac{dy}{dx}$ if $y = 9x^{100} + 3x^{80} + 2x^{60} + x^{40} - x^{20} + 10$.
3. Find $f'(x)$ if $f(x) = 2\sqrt[3]{x^2} + 3\sqrt{x^5} - \frac{9}{x^3} + \frac{16}{x^4}$.
4. Let $h(x) = 8f(x) - 6g(x) + 2$. Use the table below to find $h'(-1)$.

x	$f(x)$	$g(x)$	$f'(x)$	$g'(x)$
-1	3	4	-1	5

5. Write an equation of the line tangent to the graph of $f(x) = x^5 + 8x^4 - 6x^3 + 2$ at the point where $x = 1$.
6. Use the table below to find the average rate of change of f from $x = 2$ to $x = 4$ and the instantaneous rate of change of f at $x = 3$.

x	0	1	2	3	4
$f(x)$	3	3	5	8	13
$f'(x)$	0	1.5	3	3.5	5

7. A particle's position after t seconds is given by the equation $s = 3t^3 - 8t^2 + 9t - 12$ where s is in feet. Find the particle's acceleration after 2 seconds.
8. Differentiate $y = (x^3 + e^x)\sqrt{x}$.
9. Differentiate $y = \frac{3e^x}{x^e}$.
10. Find $\lim_{h \rightarrow 0} \frac{\sqrt[4]{16+h} - 2}{h}$.