

Final

Calculus 1

Professor
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Question:	1	2	3	4	5	6	7	8	Total
Points:	10	10	10	10	10	10	10	10	80
Score:									

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Proctor:

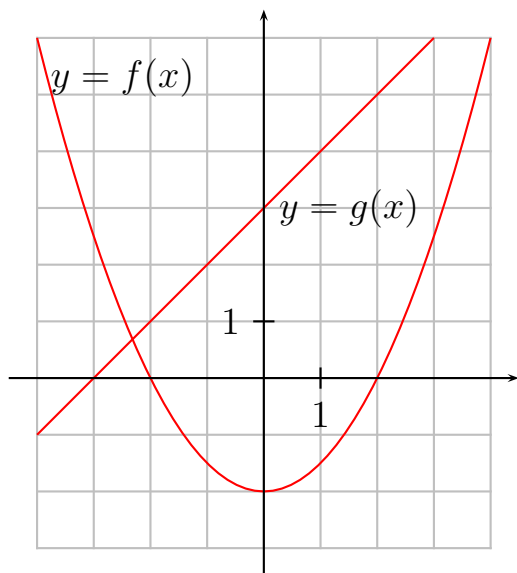
10 1. Use Limit Laws when appropriate to evaluate the following limits:

(a) $\lim_{x \rightarrow 3} x^3 - 2x + 1$

(b) $\lim_{n \rightarrow \infty} \frac{n-1}{n^2+1}$

(c) $\lim_{x \rightarrow 0} \frac{\sin(2x)}{x}$

(d) Estimate $f'(0)$ and $g'(0)$. Then calculate $\lim_{x \rightarrow 0} \frac{f(x)+2}{g(x)-3}$. If you use L'Hospital's Rule, explain why it is applicable.



- 10 2. (a) Write down the definition of the derivative of $f(x)$ at $x = a$. Find $f'(a)$ where $f(x) = x^2 - 1$ (here please use the definition of derivative).

- (b) Based on this table determine the average change of the function f on the interval $[3, 4]$. Then estimate $f'(4)$.

t	$f(t)$
3	9
3.5	8
3.8	7
3.99	6
4	6.5
4.1	5

10 3. Use Differentiation Rules to find

(a) $(x^3 e^x)' =$

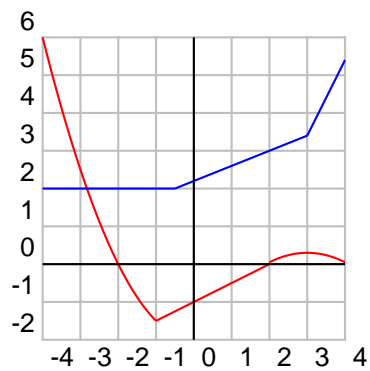
(b) $(\frac{\cos x}{x^2+2})' =$

(c) $\frac{d}{dt} \sin(\sqrt{t}) =$

(d) Graphs of $y = f(x)$ and $y = g(x)$ are given. Find (i) $(fg)'|_{x=2}$

(ii) $(f/g)'|_{x=2}$

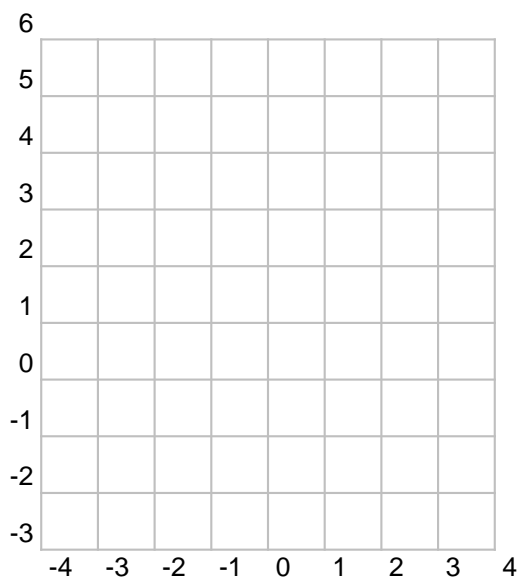
(iii) $(f(g))'|_{x=2}$



- 10 4. A particle is moving along the circle $x^2 + y^2 = 5$. At the point $(1, 2)$ its y -coordinate is rising at 2cm/s . How fast is the x coordinate changing at $(1, 2)$?

- 10 5. Let $f(x) = 2x^3 - 9x^2 + 12x - 4.5$.
- (a) Find $f'(x)$ and intervals on which f is increasing and intervals on which f is decreasing.
- (b) Find critical numbers of f and determine if they are local maxima or local minima.
- (c) Find intervals of concavities.
- (d) Determine the maximum and minimum value of $f(x)$ on the closed interval $[0, 3]$.
- (e) Sketch an approximate graph of $f(x)$.

- 10 6. Find the point on the line $y = 6x + 9$ that is closest to the point $(-3, 1)$. Clearly state the domain of the function that you optimize. Instead of minimizing the distance d , you may minimize d^2 as it is easier.
- 10 7. Sketch a graph of $y = -x^2 + 4$ by sketching appropriate rectangles, illustrate the Riemann Sum with three left-endpoint rectangles that approximates the area under the graph of $y = -x^2 + 4$ between $a = -1$ and $b = 2$. Calculate this summation and compare it to the exact value of $\int_{-1}^2 (-x^2 + 4) dx$.



- 10 8. Find the following integrals. Use the Fundamental Theorem of Calculus when appropriate.

(a) $\int_1^{-2} 3x^2 dx =$

(b) $\int \cos x + 2e^x dx =$

(c) $\int_1^e \frac{1}{x} dx =$

(d) $\frac{d}{dx} \int_8^x 2 \sin t dt =$

(e) $\frac{d}{dx} \int_x^{2x} (7t) dt =$