

1	2	3	4	5
6	7	8	9	10

Total _____

NAME(print) _____

Soc.Sec.No. _____

Section (circle)	Ih 8AM	Liu 11AM	Smith 9AM	Tschinkel 12PM	Glasner 10AM				
	Ih 9AM	Liu12PM	Culler 1PM	Tschinkel 3PM					
Discussion (circle)	8	9	10	11	12	12	1	2	3

1. There are 10 problems on the exam, each worth 20 points.
2. You must show your work to get credit.
3. Return this exam copy with your exam booklet.
4. Write your solutions in your exam booklet.

1. Find the derivatives of the following functions: (Do not simplify)

$$f(x) = \ln(x + \cos(x)) \quad g(x) = \tan\left(\frac{1}{x^2}\right) \quad h(x) = \sin(\sin(\sin(x)))$$

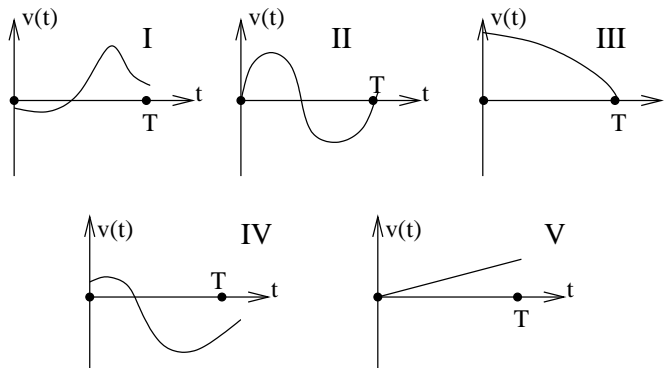
2. Consider the curve given by the equation $y^3 + xy^2 + 2xy = 7$
 - (a) Find $\frac{dy}{dx}$ by implicit differentiation.
 - (b) Find the equation of the tangent line to the curve at the point $(x, y) = (2, 1)$.
3. Let $f(x) = \frac{1}{x}$, find the formula for the derivative function $f'(x)$ algebraically. (You must use the definition of the derivative as the limit of difference quotients to get credit for this question).
4. Evaluate the following limits:

$$\text{a) } \lim_{x \rightarrow 0} \frac{\tan(x)}{x} \quad \text{b) } \lim_{x \rightarrow 0} \frac{x^3}{e^x}$$

5. Consider the region bounded by the parabola $y = 12 - 3x^2$ and the x -axis.
 - (a) Express the area of this region as an integral.
 - (b) Use left and right sums with 4 subintervals to estimate this area.
 - (c) Use the Fundamental Theorem of Calculus to find the area exactly. (You need to find an anti-derivative of $12 - 3x^2$)
6. Suppose that f is differentiable for all real numbers x . Let $g(x) = f(2x^2)$. Given that $f(2) = 1$ and that $f'(2) = 3$,
 - (a) Use the chain rule to find $g'(1)$.
 - (b) Find the equation of the tangent line approximation to $g(x)$ near $x = 1$.
7. The following graphs represent the velocity, as a function of time, of a particle moving along a straight track, from time 0 to time T . A positive velocity means movement to the right, negative to the left. The vertical and horizontal scales of all graphs are the same. For which graph does the particle

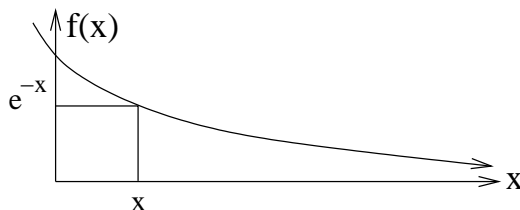
- (a) have a constant acceleration?;
- (b) end up (at time T) farthest to the left of the place where it started?;
- (c) end up (at time T) the farthest from its starting point?;
- (d) experience the greatest initial acceleration?

For full credit, explain briefly (one sentence) your answer to each part



8. Let $f(x) = x^3 - 3x + 2$.

- (a) Find the x -coordinates of all local maxima, local minima, and inflection points of f . You should indicate clearly which is a local minimum, which is a local maximum and which is an inflection point.
 - (b) Sketch the graph of $f(x)$, showing the location of the critical points and inflection points on the graph.
9. Tom wants to draw a rectangle of maximal area under the graph of $y = e^{-x}$ with base on the x -axis and left side on the y -axis. Find the maximum area and the value of x where the maximum is attained.



10. The graph of a derivative $f'(x)$ is shown in the figure. Fill in the table of values for $f(x)$ given that $f(0) = 1$

x	0	1	2	3	4	5
$f(x)$	1					

