

MATH 121 FINAL EXAM

SHOW ALL WORK

- 1) For the expressions below, find the critical points (or find y' implicitly).
 - a) $f_1(x) = \sqrt{x} + \sqrt{4-x}$
 - b) $f_2(x) = \frac{x}{x^2+1}$
 - c) $f_3(x) = \ln(x)$
 - e) $f_4(x) = \sqrt{2x^2+3}$
 - f) $f_5(x) = \frac{\sqrt{1+2x^4}}{x^2}$
 - g) $f_6(x) = |x|$
 - h) $y\sqrt{y/a} = x/a$,
 - i) $x - y = x/y$
- 2) Which of the above functions is/are continuous everywhere? What are the points of discontinuity of those that are not? Give the domains and ranges of the functions $f_1 \dots f_6$. Invert those functions for which it is possible.
- 3) Referring to the functions above, find the limits
 - i) $\lim_{x \rightarrow 4^-} f_1(x)$
 - ii) $\lim_{x \rightarrow 0^+} f_5(x)$
 - iii) $\lim_{t \rightarrow 0} \frac{f_3(x+t) - f_3(x)}{t}$
 - iv) $\lim_{x \rightarrow \pm\infty} f_2(x)$
- 4) Given $f(x) = \sqrt{x+3}$ and $g(x) = \frac{x}{x-1}$ find the composition $f(g(x))$, its domain and range, its derivative and its limits at infinity. Graph it.
- 5) Graph the function $f(x) = x^4 - 10x^2$ labeling all important points.
- 6) Find the equation of the line tangent to $f(x) = \frac{(2x^2-1)\ln(x)}{x}$ at the point $(1,0)$.
- 7) Find the dimensions of the rectangle with area equal 1000 m^2 having the smallest possible perimeter.

Function	Critical Points $x =$ if any	f_k^{-1} if it exists	Points of Disc if any	Domain f_k	Range f_k
f_1					
f_2					
f_3					
f_4					
f_5					
f_6					

Problem	Correct Solution
1 h)	
1 i)	
3 <i>i</i>	
3 <i>ii</i>	
3 <i>iii</i>	
3 <i>iv</i>	
4	
6	
7	