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) $\lim_{x\to 4^-} f_1(x)$
   ii) $\lim_{x\to 0^+} f_5(x)$
   iii) $\lim_{t\to 0} \dfrac{f_3(x+t) - f_3(x)}{t}$
   iv) $\lim_{x\to \pm\infty} f_2(x)$

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*	
3 *ii*	
3 *iii*	
3 *iv*	
4	
6	
7	