Math125 Midterm 2
Nov. 5, 2001
Show your work/reasoning/computations.

1.(30 pts) Differentiate the following functions.
a)

$$(2x+1)^3(3x+1)^2.$$

.
b)

$$\left(1-\frac{1}{x}\right)^3.$$

c)

$$\ln(\ln x).$$

.

d)

$$x^x.$$

.

e)

$$\frac{\sin x}{x}.$$

.

f)

$$\arctan(x^2 + x)$$

.

2.(10 pts) **a)** Express the limit as a derivative of a function and thus evaluate it.

$$\lim_{x \to \pi/3} \frac{\cos\theta - 1/2}{\theta - \pi/3}$$

.

b) Express the limit as a derivative of a function and thus evaluate it.

$$\lim_{x \to 0} \frac{\ln(1+x)}{x}$$

3.(10 pts) The figure shows the graphs of f, f' and f''. Identify each curve, and explain your reasoning.

4.(25 pts) **a)** Draw the set of points satisfying $x^2 + y^2 = 25$ and plot the point $(4, 3)$ on it.

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b) Find an equation of the tangent line to the set $x^2 + y^2 = 25$ at $(4, 3)$

c) Find points on the set $x^2 + y^2 = 25$ where the slope of the tangent line is 2.

5.(25 pts) **a)** Find the linear approximation $L_f(x)$ of the function $f(x) = \tan x$ at $x = \pi/4$.

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b) Find the linear approximation $L_g(x)$ of the function $g(x) = x^2$ at $x = f(\pi/4)$.

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c) Find the linear approximation $L_h(x)$ of the composite function $h(x) = (g \circ f)(x)$ at $x = \pi/4$.

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d) Comparing $L_h(x)$ and $(L_g \circ L_f)(x)$, what do you notice?