Math 21A Fall 2014 Practice Midterm 2, November.
Please do not use any calculators, cell phones or books. You need not simplify your answers.

Basic derivatives:

1. $\frac{d}{dx}(c) = 0$
2. $\frac{d}{dx}(x^n) = nx^{n-1}$
3. $\frac{d}{dx}(e^x) = e^x$
4. $\frac{d}{dx}(a^x) = \ln(a)a^x$
5. $\frac{d}{dx}(\ln|x|) = \frac{1}{x}$
6. $\frac{d}{dx}(\log_a(x)) = \frac{1}{\ln(a)x}$
7. $\frac{d}{dx}(\sin(x)) = \cos(x)$
8. $\frac{d}{dx}(\cos(x)) = -\sin(x)$
9. $\frac{d}{dx}(\tan(x)) = \sec^2(x)$
10. $\frac{d}{dx}(\sec(x)) = \sec(x)\tan(x)$
11. $\frac{d}{dx}(\csc(x)) = -\csc(x)\cot(x)$
12. $\frac{d}{dx}(\cot(x)) = -\csc^2(x)$
13. $\frac{d}{dx}(\sin^{-1}(x)) = \frac{1}{\sqrt{1-x^2}}$
14. $\frac{d}{dx}(\cos^{-1}(x)) = -\frac{1}{\sqrt{1-x^2}}$
15. $\frac{d}{dx}(\tan^{-1}(x)) = \frac{1}{1+x^2}$
16. $\frac{d}{dx}(\sec^{-1}(x)) = \frac{1}{\|x|sqrtx^2-1}$
17. $\frac{d}{dx}(\csc^{-1}(x)) = -\frac{1}{\|x|sqrtx^2-1}$
18. $\frac{d}{dx}(\cot^{-1}(x)) = -\frac{1}{1+x^2}$
19. $[f+g]' = f' + g'$
20. $[fg]' = f'g + g'f$
21. $[\frac{f}{g}]' = \frac{f'g-g'f}{g^2}$
22. $[f(g(x))]' = g'(x)f'(g(x))$
23. $[f^{-1}]'(x) = \frac{1}{f'(f^{-1}(x))}$

1. (4 points)Find $\frac{dy}{dx}$ for each of the following:

   (a) $y = (x^2 - 2)^{20}$

   (b) $y = \frac{x+2}{x^2-1}$

   (c) $y = x^{\sin(x)}$

2. (4 points)

(a) Find $\frac{dy}{dx}$ at the point with $x = 0$ if $y = \ln(e^x + x)$.

(b) Find $\frac{dy}{dx}$ at the point with $x = 2$ if $y = \tan^{-1}(x^2)$.

(c) Find $\frac{dy}{dx}$ at the point with $x = \sqrt{\pi}$ and $y = \sqrt{\pi}$ if $1 + \cos(xy) = \sin(x^2 + y^2)$.

3. (3 points) Find $g'(3)$ for each of the following if f is an invertible function with $f'(2) = 4$ and $f(2) = 3$ (so $f^{-1}(3) = 2$).

   (a) $g(x) = f(x^2 - 7)$

   (b) $g(x) = f^{-1}(x)$

4. (3 points) Do only one of the following:

   (a) Find the absolute maximum and absolute minimum for the function $f(x) = x + x^{-1}$ in the interval $[\frac{1}{2}, 2]$.

   (b) Use a linearization at an integer to estimate $(8.1)^{\frac{1}{3}}$.

5. (4 points) The height of a rocket t seconds after liftoff is t^2 feet. You are standing 100 feet from the liftoff point. Find the rate of change of the angle you must look up to see the rocket at the time when that angle is $\frac{\pi}{4}$ radians.