Math 140 **Tutorial 13**
April 12 - 13

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1. For the following exercises you are given $\frac{df}{dx}$. Can you come up with some function $f(x)$ such that its derivative is the given $\frac{df}{dx}$

   (a) $\dfrac{df}{dx} = x^3 + x + 1$

   (b) $\dfrac{df}{dx} = \sin x$

   (c) $\dfrac{df}{dx} = e^{x+2} + \dfrac{x}{2}$

2. Find the most general antiderivative.

   (a) $f(x) = 0$

   (b) $f(x) = 3x^3 + 2x^2 + x + 1$

   (c) $h(y) = 17e^{-2y} + 123\sec^2 x$

   (d) $y(\theta) = \cos(\theta) - \sin(\theta)$

   (e) $f(x) = 5e^x - 3\cosh x$

   (f) $g(t) = \sin t + 2\sinh t$

3. Find a function f which satisfies the given conditions.

   (a) $f''(x) = 6x + 12x^2$

   (b) $f''(x) = 2e^t + 3\sin t$ with $f(0) = f(\pi) = 0$

   Parts (c) and (d) are more difficult that usual, and are certainly more difficult than questions to come on the final exam.

   (c) $f'(x) = f(x)$ with $f(0) = 1$

   $\Big[$*hint: Try to re-write this equation in terms of the function* $g(x) = e^{-x}f(x)$*)*$\Big]$

   (d) $f''(x) = f(x)$ with $f(0) = 2$ and $f'(0) = 0$

   $\Big[$*Try writing* $g(x) = e^x f(x)$ *and show that* g *satisfies the equation*

   $$g''(x) = 2g'(x)$$

   Then write an equation in terms of the function $h(x) = e^{-2x}g'(x)$$\Big]$