## Lecture 20 Friday, February 14, 2025 5:04 AM

Linear differential equations of first order are differential equation of the form:

y' + p(x)y = q(x)

where p and q are given functions. Lazy style:

$$y' + py = q$$

There is a well-known trick to solve this equation called *integrating factor*. As its name suggests, integrating factor is something you multiply both sides of the equation by in order to integrate both sides.

u(y'+py) = uq

The only natural choice of u to make the left hand side an exact derivative is  $u = \exp(\int p dx)$ .

**Example:**  $y' + 3x^2y = 6x^2$ 

**Example:** y' + 2xy = 1

**Example:**  $x^2y' + xy = 1$ , y(1) = 2