

One Best Thing: Using Electronic Lecture Notes with the Notability App

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What:

- A pdf file of course lecture notes can be viewed with Notability, an iOS app for note-taking and annotation of pdf, doc and ppt files (Import from Google Drive or Dropbox, or directly from email; annotated files can be exported the same way.)
- Notes can be projected with AirPlay and Apple TV from an iPad display onto a whiteboard or screen in front of the class.
- Students can use the app to add their own notes to the pdf document and to solve problems during class and while studying, utilizing the features of the app:
 - Colored pens and highlighters
 - Graphing paper option, among other templates
 - Insert bookmarks, voice memos, photos, figures, web clips, and sticky notes



The screenshot shows a page from a PDF document titled "MTH 1218H Honors Calculus II Spring 2015" with the section "5.5: THE SUBSTITUTION RULE". The notes include:

- The Substitution Rule for integrals transforms a complicated integral into a simpler one that can be solved using direct integration.
- Substitution Rule:** If $u = g(x)$ is differentiable and f is continuous, then $du = g'(x)dx$ and

$$\int f(g(x))g'(x) dx = \int f(u) du = F(u) + C$$
- Example 1: $\int x^2 \cos(x^3) dx$. Handwritten work shows $u = x^3$, $du = 3x^2 dx \rightarrow \frac{1}{3} du = x^2 dx$. The integral becomes $\int \cos(u) \cdot \frac{1}{3} du = \frac{1}{3} \sin(u) + C = \frac{1}{3} \sin(x^3) + C$.
- Substitution Rule for definite integrals (make sure to change the limits!):**

$$\int_a^b f(g(x))g'(x) dx = \int_{g(a)}^{g(b)} f(u) du$$
- Example 2: $\int_0^\pi \pi \cos(x + \pi) dx$. Handwritten work shows $u = x + \pi$, $du = dx$. When $x = 0$, $u = \pi$; when $x = \pi$, $u = 2\pi$. The integral becomes $\int_\pi^{2\pi} \pi \cos(u) du = [\pi \sin(u)]_\pi^{2\pi} = \pi \sin(2\pi) - \pi \sin(\pi) = 0$. A pink note says: "Instead of changing limits, can evaluate as an indefinite integral and then plug in upper and lower bounds for x: $\int \pi \cos(u) du = \pi \sin(u) + C = \pi \sin(x + \pi) + C$. Then $[\pi \sin(x + \pi)]_0^\pi = 0$ ".
- Example 3: $\int_0^1 \frac{x}{1+x^2} dx$. Handwritten work shows $u = 1 + x^2$, $du = 2x dx \rightarrow \frac{1}{2} du = x dx$. When $x = 0$, $u = 1$; when $x = 1$, $u = 2$. The integral becomes $\int_1^2 \frac{1}{u} \cdot \frac{1}{2} du = \left[\frac{1}{2} \ln|u| \right]_1^2 = \frac{1}{2} \ln 2 - \frac{1}{2} \ln 1 = \frac{1}{2} \ln 2$.

Page 8

Why:

- Too much class time spent in silence simply copying down notes from the board.
- Allows for the delivery of course content despite classroom shortcomings (i.e. lack of board space).
- Easier to update notes from semester to semester and to prepare for each class.

The result:

- More class time was spent on problem solving and discussion, and a wider range of topics and problems were covered.
- Students appreciated having a complete set of notes available.
- Some students chose to take notes the traditional way, with paper and a notebook rather than with the iPad, but they all used the notes as a reference.

* A screenshot of a page of lecture notes viewed in the Notability app, with examples completed and marked up in the way a student might add their notes to the document.