The Process of Psetting by Joel G. '18

And the technicals of technicals

The imperative of an Admissions Blogger is to write about life and culture at MIT. So, since my entire life in recent memory (also known as the last four whole days) has been consumed by psets, it seems only appropriate to blog about their culture.

Q: *What is a pset, and how to do you spell it?*

A: A "pset" is short for "problem set", and it is the most common unit of homework assigned here at MIT. Excellent, in-depth high-caliber pset profiles can be found here (https://mitadmissions.org/blogs/entry/harbinger_of_doom_despair_and) and here (https://mitadmissions.org/blogs/entry/a-love-letter-to-psets), but while all of these reputable sources agree on the definition of a pset, there is high variance regarding the proper exact

spelling of the word. Are they psets, Psets, PSets, p-sets, P-sets, or P-Sets?

pSETS?

pSeTs?

PSETS?
PESTS? (yes, according to my smartphone's autocorrect. It's not wrong.)

Just like literally every other contested grammatical nuance, the world will probably never agree. However, for the purposes of this blog and my future ones, I will follow what appears to be a consensus of bloggers before me and adhere to (and advocate for universal acceptance of) the "pset" standard, unless I am particularly emotional, in which case I will resort to "PSET" or "[redacted] PSET".

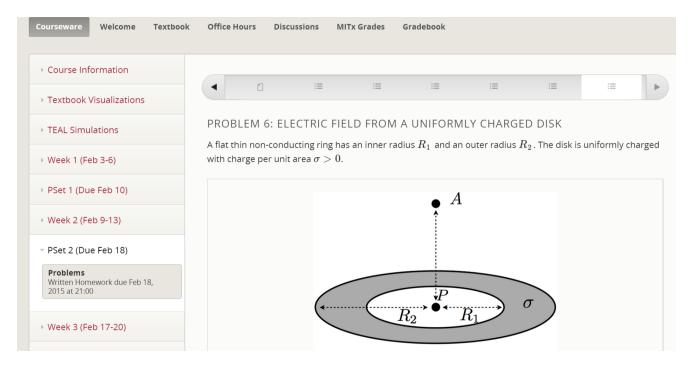Q: *How will you capitalize the word at the beginning of sentences?*

A: I don't know. I'll probably just take great care to avoid that scenario, even if it looks aesthetically awkward to reorganize my sentence around it. Sometimes the best solution is to just dodge the problem, although I wouldn't recommend this strategy on exams. Anyways, let's move on.

Contrary to popular prefrosh belief, not every class at MIT assigns psets. Many classes occupy our time in other ways, whether essays, reports, projects, or presentations. Classes that assign psets are generally technical subjects that lend themselves well to asking specific questions that have singular, objective answers, such as Physics, Math, Biology, or Chemistry courses, with many more and many exceptions. Last fall, 3 of my 4 classes assigned psets. This semester, only 8.02 (Physics II) and 18.06 (Linear Algebra) do, while all my other classes have projects or online
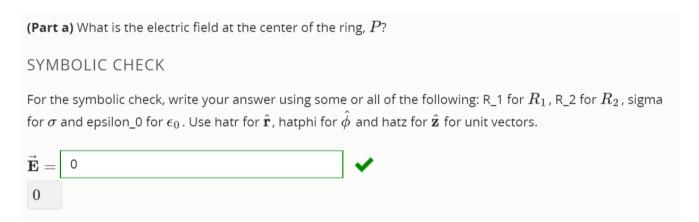
design labs.

Even between subjects, psets vary greatly in format, length, and difficulty. For 8.01 and 8.02, weekly psets are posted online on the MITx platform, which is MIT's online learning environment, built on <u>edX</u> <u>(https:/</u>/<u>www.edx.org/)</u>. Many classes use MITx to post course content, like lecture videos, gradebooks, and syllabi (syllabuses? syllabose? syllabeese?), and several use it for online homework as well. Here's a snippet from my most recent 8.02 pset.

MITx also includes an incredibly useful answer checking function – on my Physics psets, each problem lets you enter solutions for true/false feedback. It'll never give you the answer itself, and you still have to hand in a written copy showing your work, but at least you can know when you've solved it. Other classes (like 7.012 Biology) just post a PDF of questions online that we submit blind, without knowing whether they're even right! Those psets are scary.

Q: *Doesn't that facilitate trial-by-error or guess-and-check? Can't you just plug in all the permutations of the variables and get the answer by luck?*

A: Sometimes!

But not usually.

(Part b) What is the magnitude of the electric field at point A which is a distance z above the point P, where the line AP is perpendicular to the plane of the ring?

SYMBOLIC CHECK

For the symbolic check, write your answer using some or all of the following: z, R_1 for R_1, R_2 for R_2, sigma for σ and epsilon_0 for ϵ_0. Use hatr for $\hat{\mathbf{r}}$, hatphi for $\hat{\phi}$ and hatz for $\hat{\mathbf{z}}$ for unit vectors, and use sqrt() for the square root function.

$$\vec{\mathbf{E}} = \boxed{\text{1/(2*epsilon\_0)*sigma*z*(1/sqrt(z\^2+R\_1\^2)-1/sqrt(z\^2+R\_2\^2))*h}} \quad \checkmark$$

$$\frac{1}{2 \cdot \varepsilon_0} \cdot \sigma \cdot z \cdot \left(\frac{1}{\sqrt{z^2 + R_1^2}} - \frac{1}{\sqrt{z^2 + R_2^2}} \right) \cdot \hat{z}$$

Show Answer

Length also varies wildly from pset to pset, although this is primarily a function of the difficulty of the class. Since I have limited experience in anything except introductory classes, I took a quick lap around my floor and surveyed everyone awake about their psetting habits. Unsurprisingly, upperclassmen tend to spend significantly longer working on any given pset than freshmen do: Natalie '18 estimated a balmy four hours per pset, while Jenn '16 gave me a depressing "fifteen", accompanied by a forlorn, empty stare. From my highly scientific and rigorous sample pool of 16, people tend to average 6.4 hours per pset across all grades, with an incredibly high standard deviation. For those of you interested in real data, there is a fascinating *Tech* survey available here (http://tech.mit.edu/V132/N59/pressure/breakdown/year/index.htm) that asks similar questions, but whose results are actually credible.
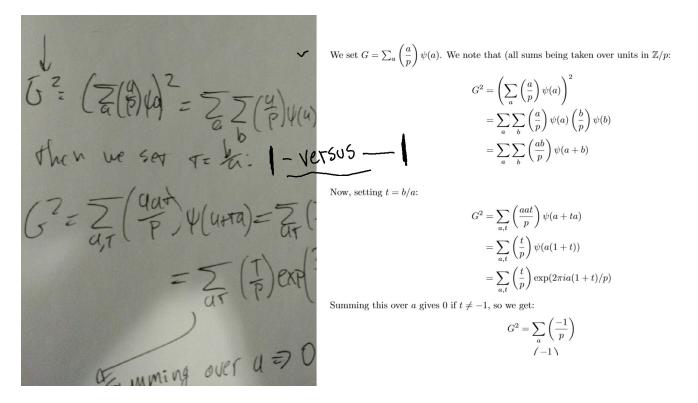
Speaking of credibility, you can tell a lot about an MIT student from the state of their psets. A hastily penciled, tattered sheet of 70-cent notebook paper with scattered eraser burns and coffee spills is a relic of a recent caffeinated, panic-stricken deadline, but neatly redrawn solutions with boxed answers and legible subscripts is the mark of marginally smarter time management. Personally, I do my work with a digital stylus on my Surface tablet, which lets me erase and rearrange at organizational will. Then I just print out a paper copy to hand in while the file is saved forever in the cloud, to haunt me far into my academic future.

Now, you may think that drafting homework problem sets on a $1000 tablet with a Wacom digitizer just so that I can both save a PDF to my digital Dropbox and print a hard copy for the other dropbox is going a bit overboard, even with the broad technological acceptability license afforded to MIT students. You may think that it couldn't get any nerdier.

And you are wrong.

The true overachievers – the hardcore perfectionists that really care about attention to detail – or even the occasional underachiever in desperate need of a credibility boost – use LaTeX (https://en.wikipedia.org/wiki/LaTeX). LaTeX (pronounced with a 'k', not an 'x') is a document markup language that converts ugly mathematics text with asterisks, caret symbols, unintelligible division slashes, and the generally atrocious plain-text formatting into beautifully typeset equations, perfectly spaced and centered in a clean, professional-looking pset worthy of

a picture frame. LaTeX makes everything more believable: if you need to do a proof and you need to really prove it, LaTeX it. Otherwise it's only half proven.

We set $G = \sum_a \left(\frac{a}{p}\right) \psi(a)$. We note that (all sums being taken over units in $\mathbb{Z}/p$:

$$G^2 = \left(\sum_a \left(\frac{a}{p}\right)\psi(a)\right)^2$$
$$= \sum_a \sum_b \left(\frac{a}{p}\right)\psi(a)\left(\frac{b}{p}\right)\psi(b)$$
$$= \sum_a \sum_b \left(\frac{ab}{p}\right)\psi(a+b)$$

Now, setting $t = b/a$:

$$G^2 = \sum_{a,t} \left(\frac{aat}{p}\right)\psi(a+ta)$$
$$= \sum_{a,t} \left(\frac{t}{p}\right)\psi(a(1+t))$$
$$= \sum_{a,t} \left(\frac{t}{p}\right)\exp(2\pi ia(1+t)/p)$$

Summing this over a gives 0 if $t \neq -1$, so we get:

$$G^2 = \sum_a \left(\frac{-1}{p}\right)$$

Q: Is this entire question a self-referencial ploy to transition to talking about collaboration in psets?

A: Yes. In fact, one of the most prominent identifiable facets of MIT's culture is collaboration. Homework is typically thought of as an individual torture to be carried out in solitary confinement, but here, nothing could be further from the truth. Nearly all of the syllabi (I love that word now) emphasize that discussion and collaboration with other students is encouraged, provided that we each turn in our own work.

This means that psetting is often a social event – each semester starts with a flurry of organization that produces informal pset groups and study sessions. Every Sunday I work on 6.01 with my fraternity brothers at Zeta Psi, and on Monday nights are the weekly procrastination performances by the 8.02 crew of Conner 3, typically followed by an encore of a movie in the floor lounge. Thursday nights on my floor feature a 10pm "study break", catered with various desserts, snacks, and various incarnations of the caffeine molecule. Group pset parties not only make the homework easier, but also build camaraderie, staying up late into the night working together to defeat enemies we all despise equally, like Maxwell's Equations or Gaussian Elimination.

Q: *Do you mean to say that psetting is fun?*

A: No. But sometimes, if you can manage to share your misery with enough friends at the same time, you can learn as much from the teamwork as you can from the lecture notes.

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About Joel G. '18

Hi! I'm Joel, from the frozen tundra of Duluth, Minnesota. Actually, Duluth is neither perpetually frozen nor technically tundra, but it sometimes feels like that, especially in "winter", which is a season that we Minnesotans have that consists of all 364 days that are not the Fourth of July. In …

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