

WASTED TALENT.

WE ARE THE ENGINEERS



by
Angela
Melick

WASTED TALENT.

**WE ARE THE
ENGINEERS**

by Angela Melick

THE ENGINEERS

(Mechanical Engineering Students)



Jam (Angela)



Lucky



Red



Ainaz

OTHER FINE FOLK...



Trevor: Computer guy, geek. Jam's boyfriend, and room-mate since 3rd year.



Kyle: Physics student, and Jam's room-mate in 2nd year.



Elise: Computer Science student, and Jam's room-mate in 1st year.

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INTRODUCTION

I moved to Vancouver to study Mechanical Engineering in 2002. Sometime around my second year of studies, I began drawing silly comics about my experiences on spare sheets of loose leaf paper.

The comics were just quick pen scratches - but they made my friends laugh at times when we really needed to. Eventually, the "comics" section of my notebook began crowding out the actual notes that I needed, and with Trevor's help, the comics made their way to the internet sometime in 2004. I named the comic "Wasted Talent"... because it was the story of my life.

We all made it through University, somehow, and by the time I'd graduated, my comics had found an audience online.

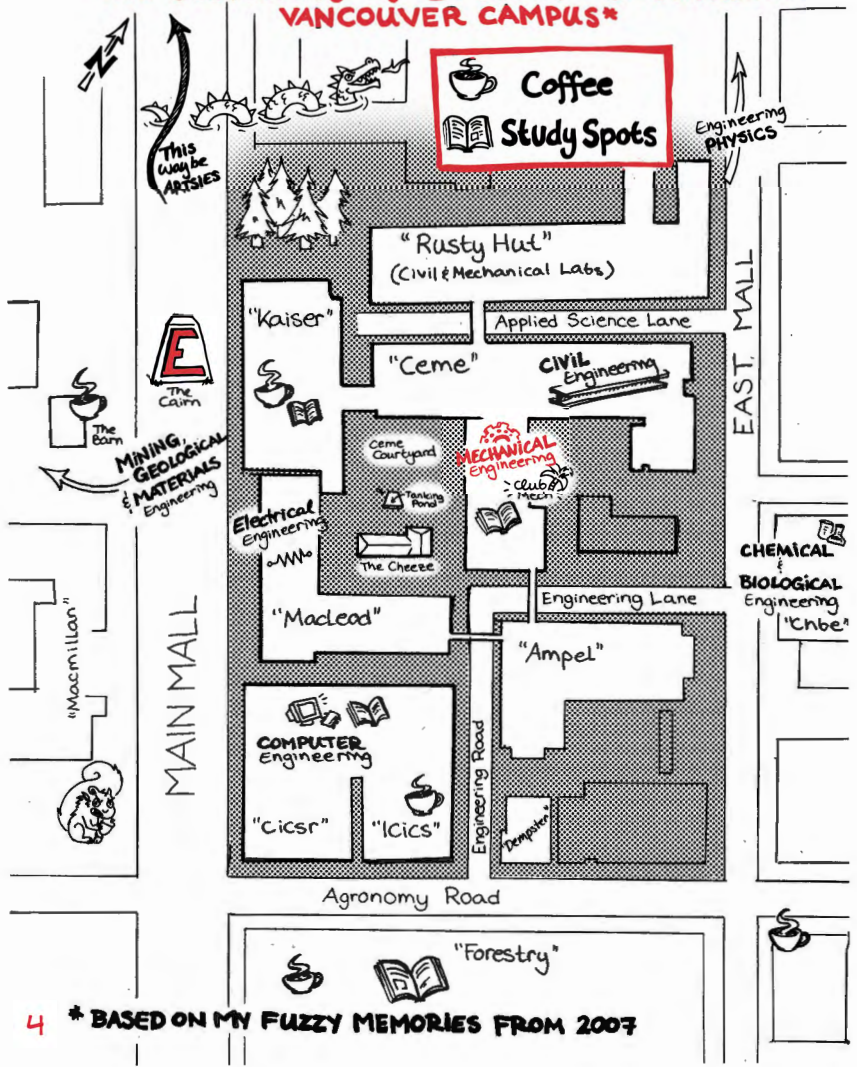
The book you are holding now is a collection of comics that I've re-drawn from my years at the University of British Columbia. All the stories are true, and the characters are real people: my friends. I consider this to be a "best of" collection, and I am immensely proud of it. Redrawing the comics was a lot of work, but I feel the stories contained within deserved it.

Thanks very much for reading,
I hope you enjoy my
Wasted Talent!

--- *Angela Melick*



The University of British Columbia VANCOUVER CAMPUS*



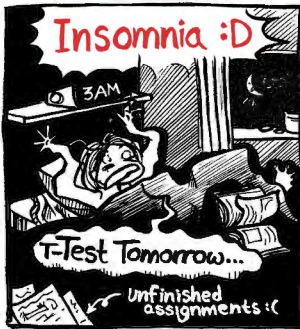
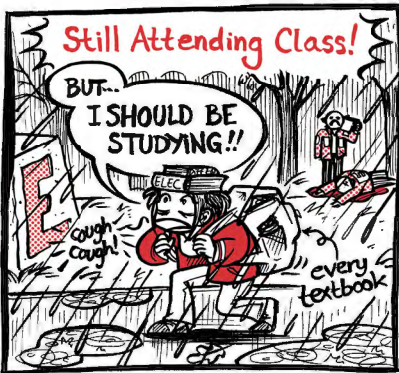
4 * BASED ON MY FUZZY MEMORIES FROM 2007

For my Father,
who encouraged me to pursue engineering,
and my Mother,
who wouldn't let me quit drawing.

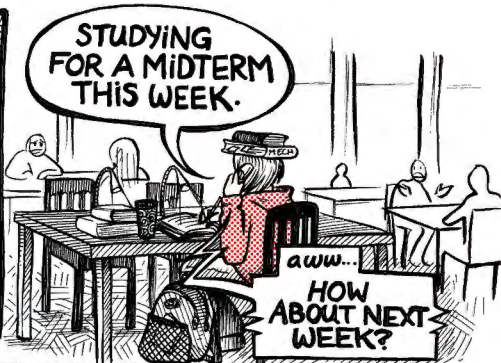


The LIFE of a 2nd yr MECH!

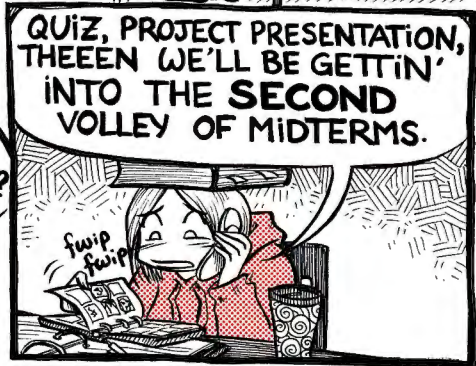






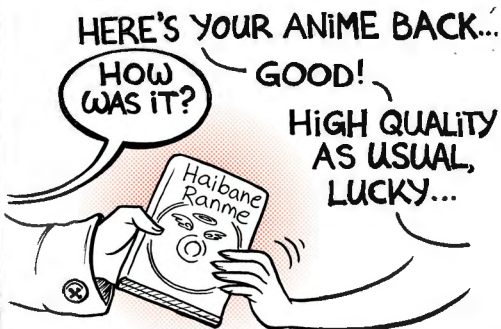


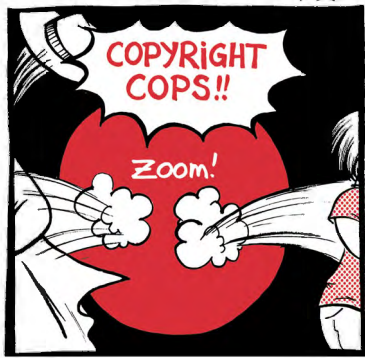
TWO MIDTERMS NEXT
WEEK, PLUS A QUIZ.



HOW CAN THEY CALL 'EM
"MIDTERMS" IF THEY'RE WAAAAAY
LONGER THAN MID TERM!?

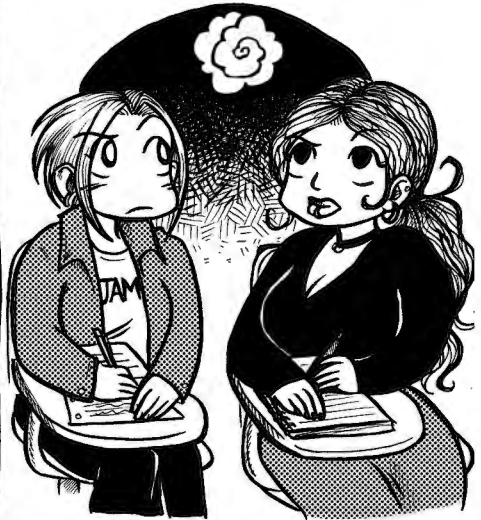






ANIME:
THE NEW
CRACK.





Jam.

written by Red!

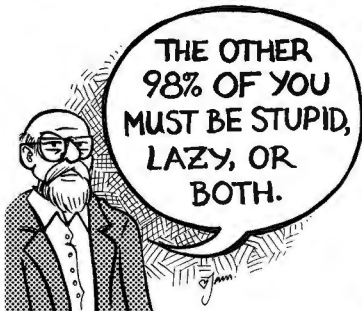
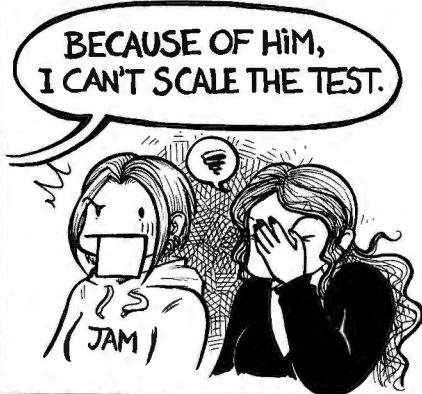
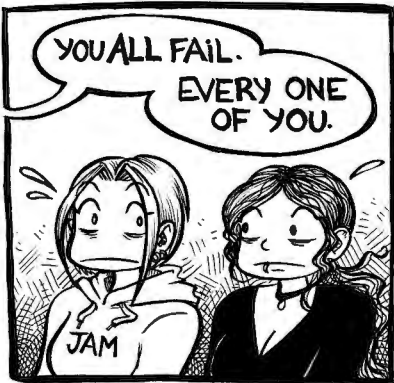






Ooooh
Yeaah!





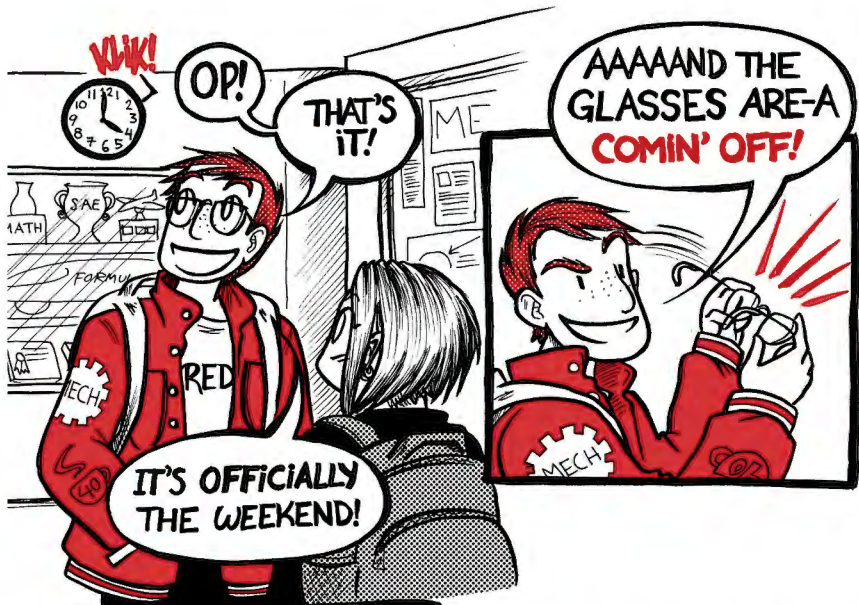
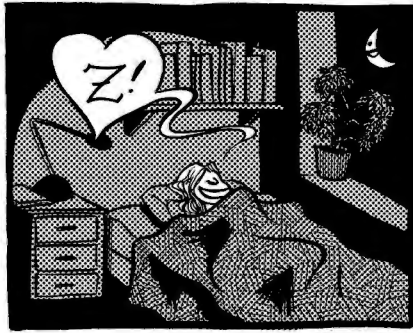


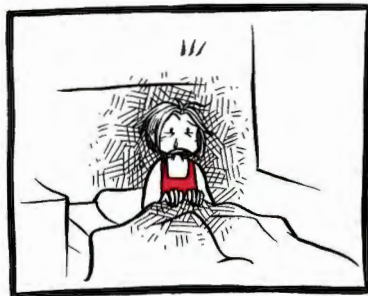
FIGURE 1: THE CAIRN

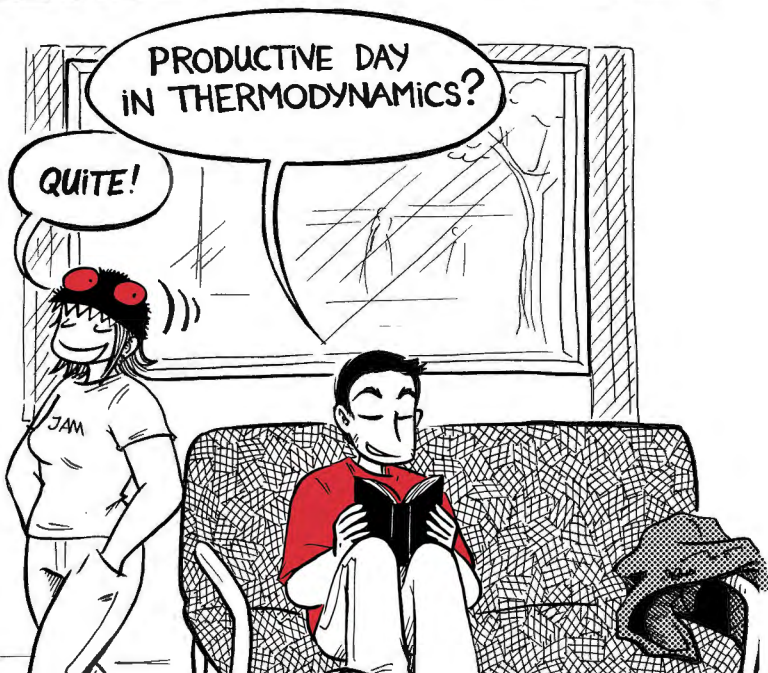
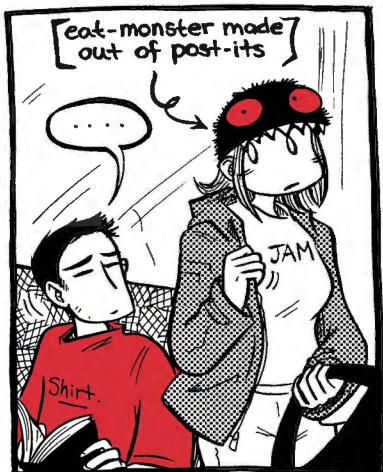


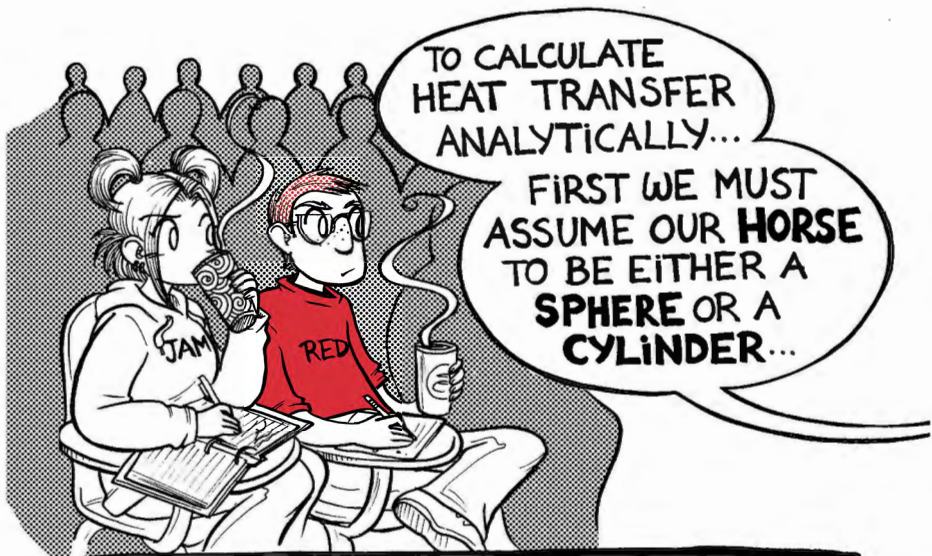
Figure 1: On Main Mall, outside the engineering buildings, sits the Cairn: a concrete monument to the engineer's spirit. Its origin is the stuff of legends. A PP is assigned to keep it painted bright red and white because other faculties and groups often jealously repaint it in their own colours.

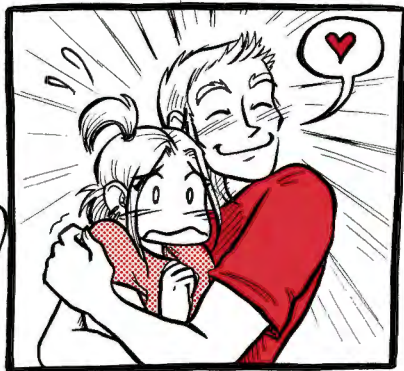


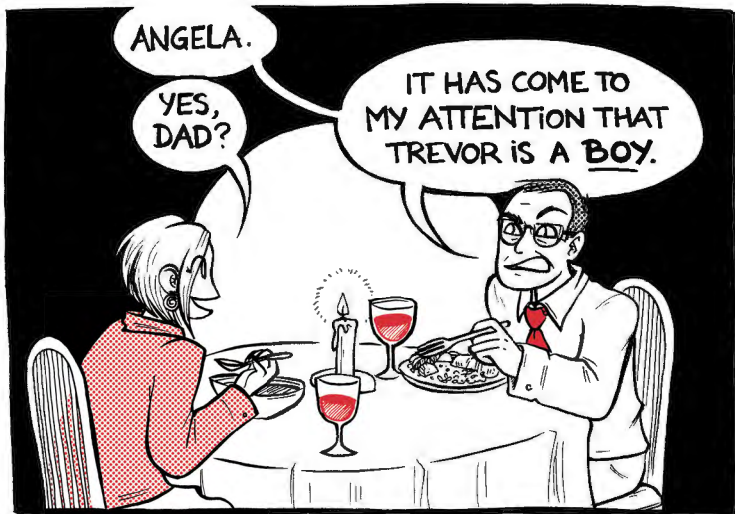
The next morning...













HE'S JUST AFRAID YOU'LL KICK ME OUT AND I'LL HAFTA LIVE IN A PIZZA BOX.



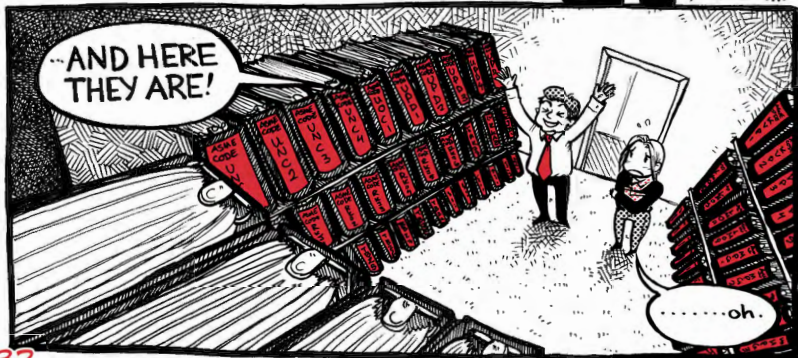
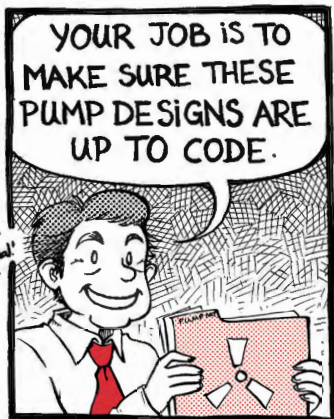
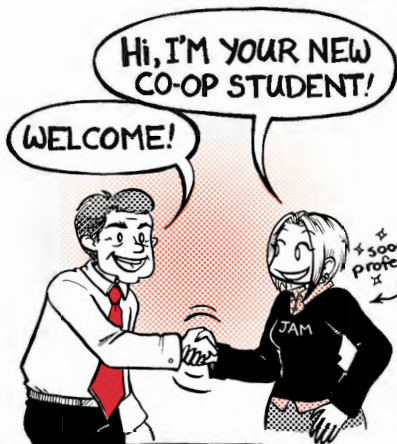
BECAUSE THIS IS WHY:

YOU KNOW HOW CATS SIT IN BOXES THAT ARE TOO SMALL FOR THEM??



IT WOULD BE THE SAME IF I HAD'TA LIVE IN A PIZZA BOX!!





PRESSURE VESSELS:
All pressure vessels
of type III shall be
in accordance with
chapter UNC3-7J



The CODE

Ch: UNC3-7J:
Wall thickness shall
not exceed 2(F).

WHAT'S
"F"?



'F' is defined in
chapter X7P9-7B.

sigh



'Q' is a non-dimensional
factor defined as:

$$Q = XZ^3 t F_L$$

$$\sqrt{\frac{37B^2 G}{2t d}}$$

$$X = VXT5-9F$$

$$Z = TVX2-1C$$

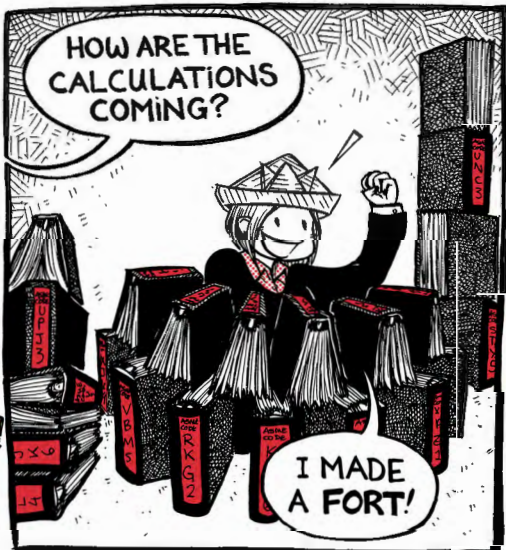
$$t = PLK6-5P$$

$$F_i = BTV4-8T$$

AAAGH!!



HOW ARE THE
CALCULATIONS
COMING?



I MADE
A FORT!



meanwhile, in the shop...

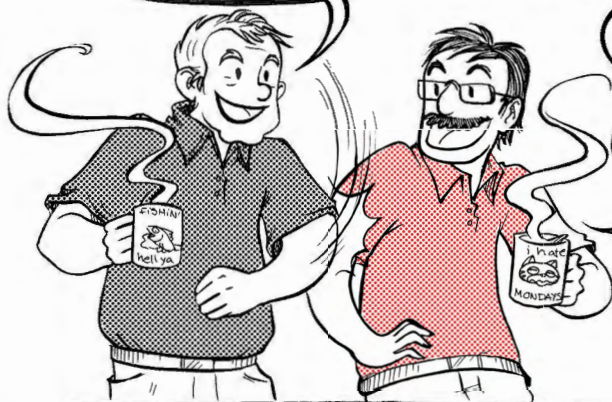


Oh boy, Oh boy IT'S CASUAL FRIDAY, JIM, ARE YA EXCITED?

Oh YOU KNOW IT! I'M WEARING JEANS AND SNEAKERS!

IN THE OFFICE!!

HOW MISCHIEVOUS!



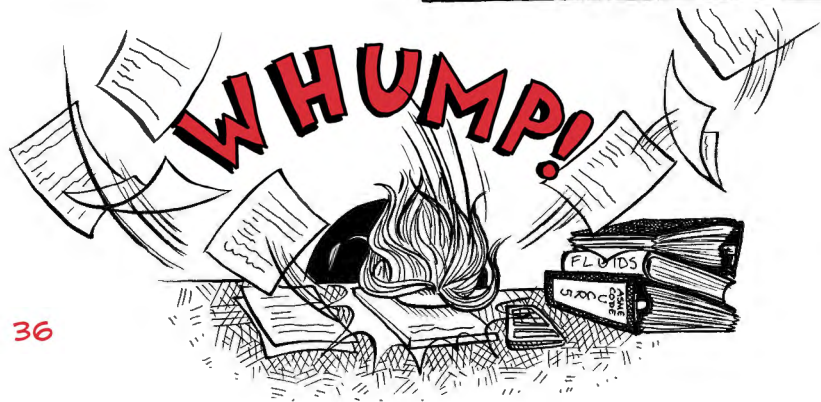
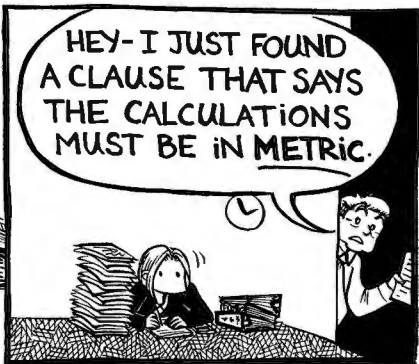
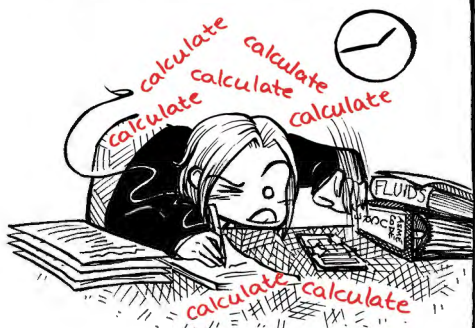
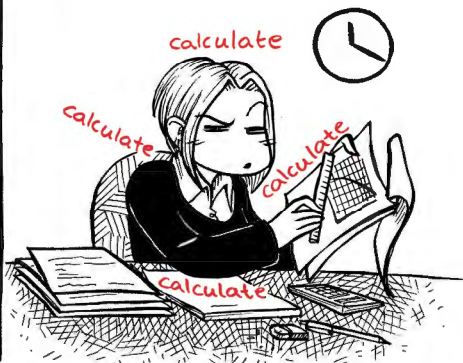
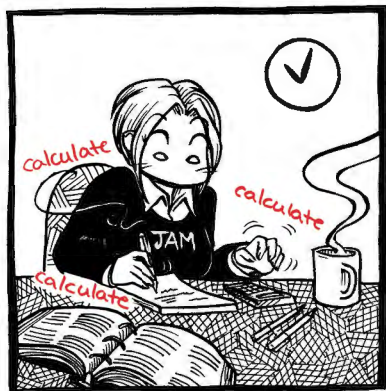


FIGURE 2: THE CHEEZE



Figure 2: One of the oldest buildings on campus (built in 1919), "the Cheeze" (sic) was once an actual cheese factory. Since 1981 it has served as the headquarters for the Engineering Undergraduate Society, as well as a place for engineering students to meet, work on projects, play the Puzzle Fighter Arcade game, or play a quick game of cards between classes.



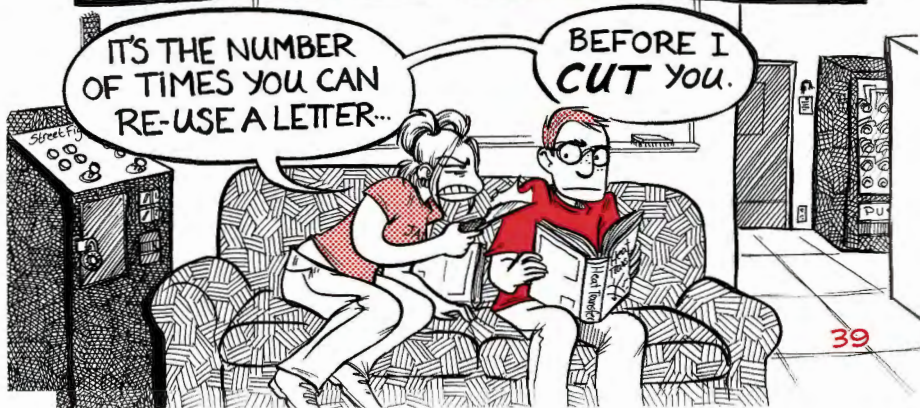
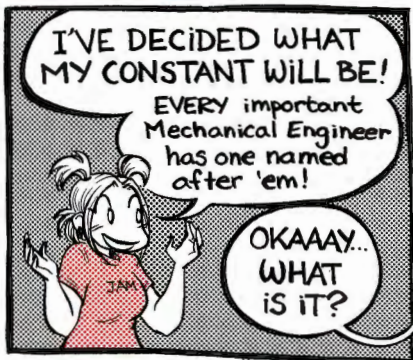
Here, 'u' is used for volume because 'v' is for velocity.



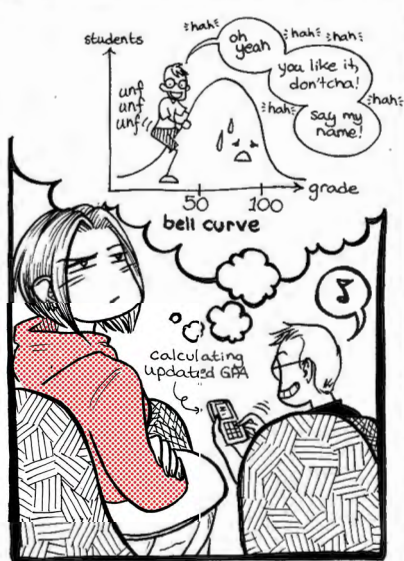
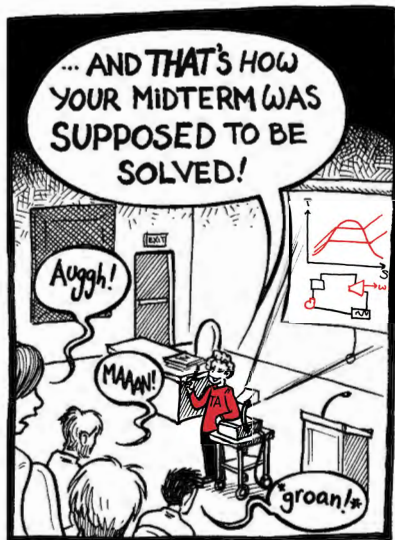
Here, 'j' is used for the imaginary plane notation because 'i' is for current, silly!



Now, 'i' is used for enthalpy because 'h' is the convective heat transfer coefficient—







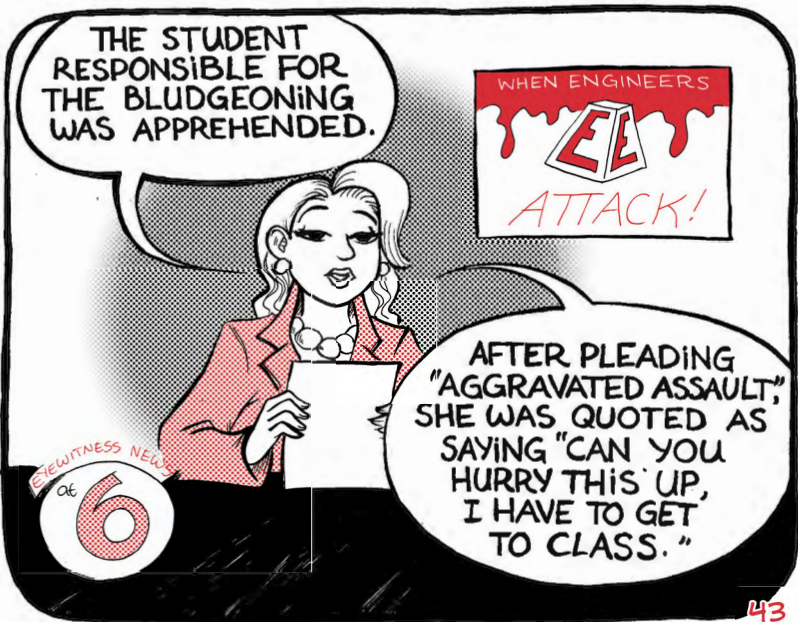


I NEED SOMETHING... **QUICK!**

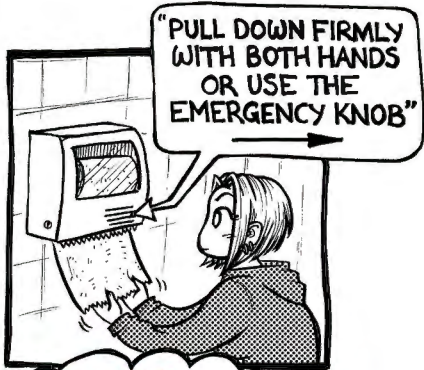
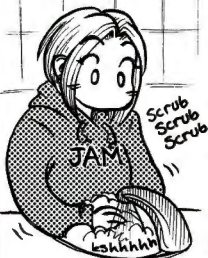
c'mon
c'monnn

PIZZA →

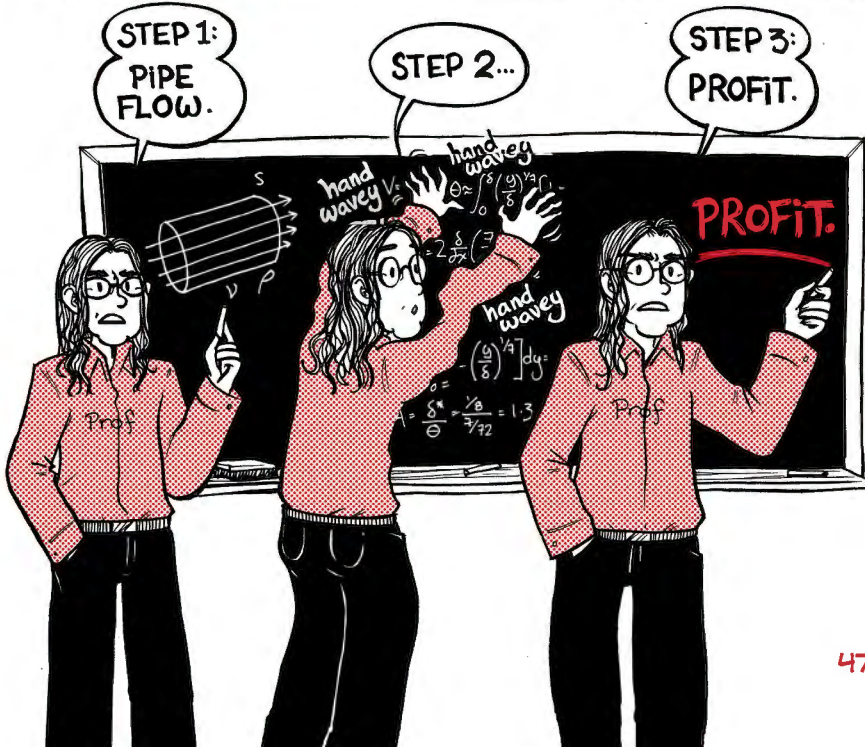
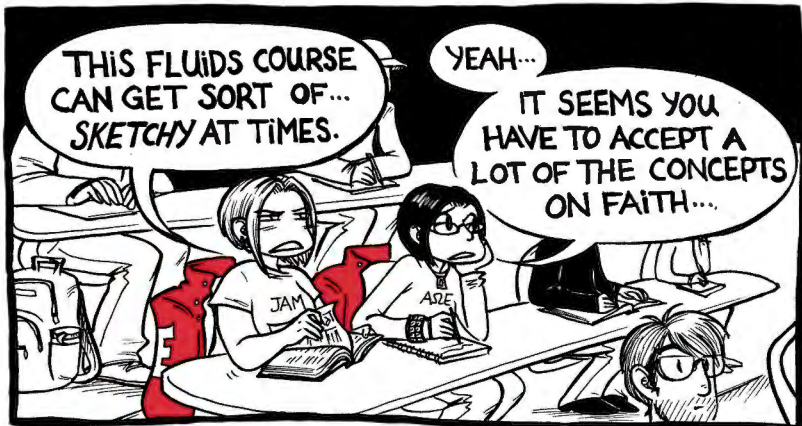
REALLY? YOU
HAVE CLASSES IN
A **ROW?**



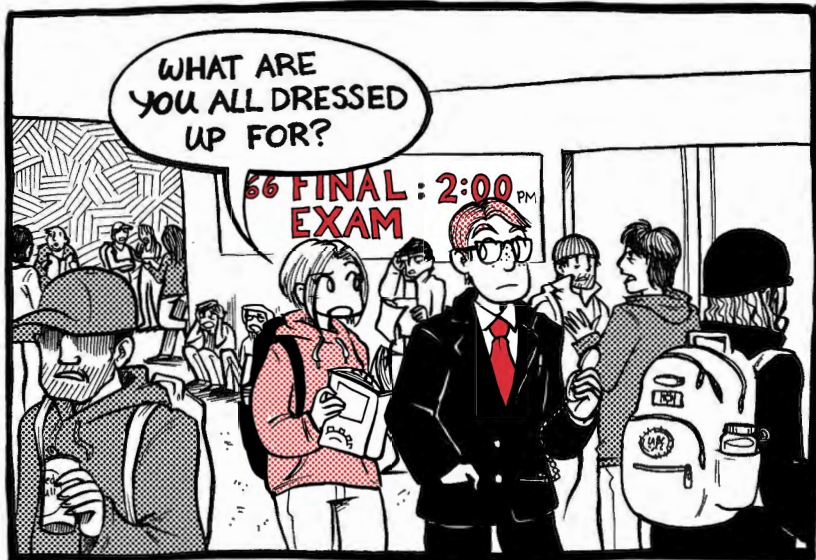














Oh SORRY-

I COMPULSIVELY ORGANIZE THINGS...

-BUT I STILL NEED TO LEARN THE INDUSTRY TERMINOLOGY.

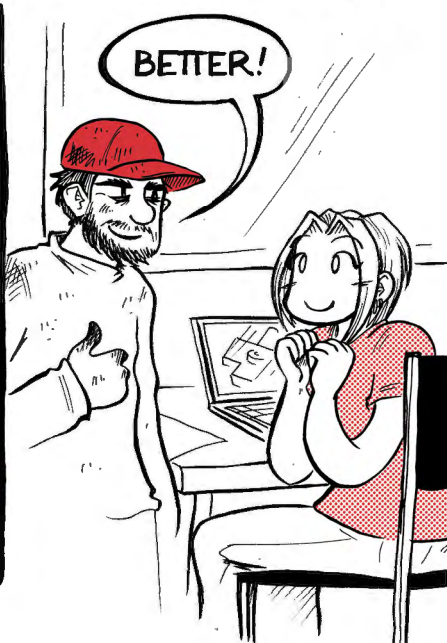
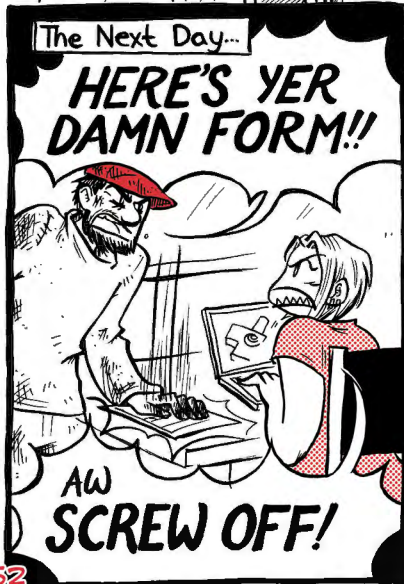
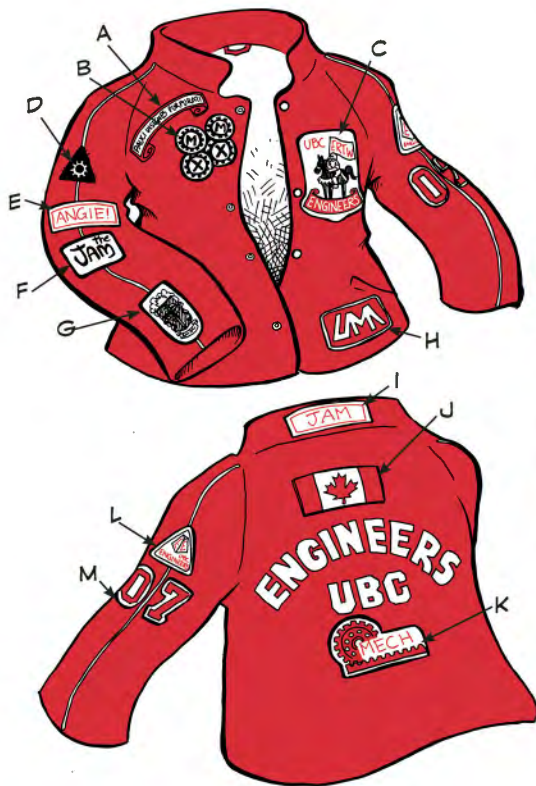
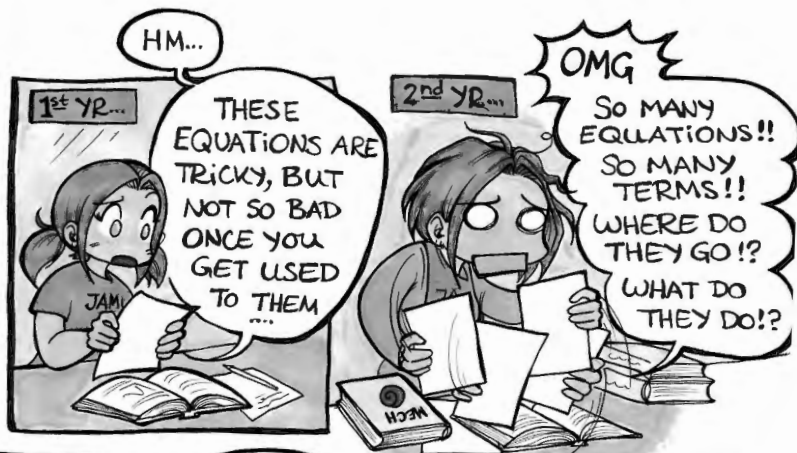


FIGURE 3: THE RED



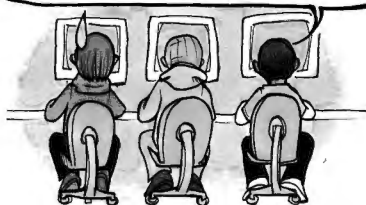
- A. This is a patch I got from Queen's University. Their Engineers wear Purple Leather coats. The patch reads: "The Few, The Proud, The Purple"
- B. Club Mech Executive and Ex-Officio patches
- C. "Knight" patch. ERTW means "Engineers Rule The World."
- D. WWII Engineer patch (my grandfather was one)
- E. Name Bar
- F. There was a band called "The Jam", apparently.
- G. Alpha Omega Epsilon Sorority patch
- H. Larceny and Mayhem patch. Can't talk about it.
- I. Nickname bar
- J. Canada Flag
- K. Mech patch
- L. UBC Engineering Patch
- M. Class of 2007

Figure 3: An engineer will usually buy their red jacket (or "red") as a PP. Throughout the years, they will adorn it with patches that are either earned or selected for personal reasons. Every engineer's red is unique. This is mine, by my last year of university.



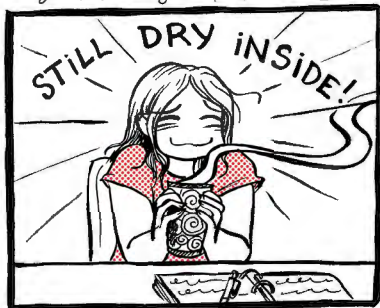


...I SEND STUFF TO MYSELF ALL THE TIME!















**STOP STUDYING AND
GO TO BED.**

aww c'mon
3 more pages in
this chapter...

NOW.

GO WAN HOME NOW

mrrr!

GIT!

... same
time
tomorrow
then...?

NOW BACK TO...
Cooking
WITH
STEELS

WELCOME
BACK!

SO NEXT WE
NEED TO POUR
OUR STEEL BEFORE
IT CROSSES THE
LIQUIDUS TO
FORM AUSTENITE.

GOOD

AND INTO THE
OVEN IT GOES!

NOW, WE CAN'T LET IT COOL
TOO FAST OR IT'LL FORM BRITTLE-
BRITTLE MARTENSITE...

TOO SLOW AND WE'LL
GET COARSE PEARLITE!

TODAY WE'RE MAKING
BAINITE, SO CHILL
TO 250°C AND BAKE
FOR ABOUT A DAY.



boop
boop
boop

I made one
yesterday in
the interest
of time ♡



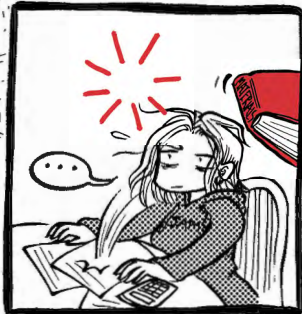
CLUNK.



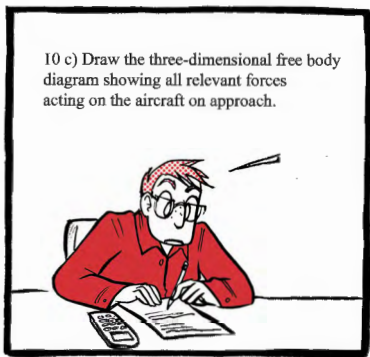
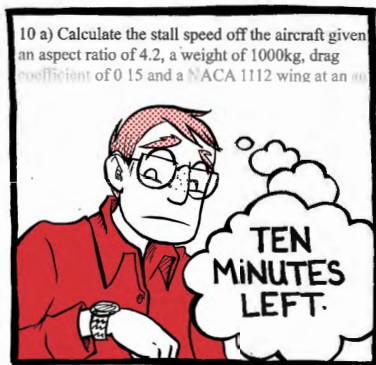
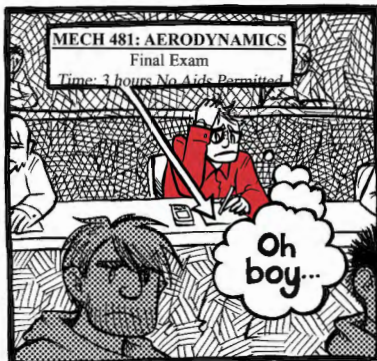
clap! clap!
clap!
clap!
clap!
clap!
clap!

LOOK AT THAT
CHEWY MICROSTRUCTURE!

THE KIDS
WILL LOVE IT!









WOW...

The University of British
Columbia
The Chancellor of The U
with the approval of the
of the Faculty of
Applied Science
Mechanical Engineer
Angela Renee
IA witness and by
May 2007
JAM

I CAN'T
BELIEVE IT!

I DID IT!
I'M FREE!



WAIT-

NOW WHAT
DO I DO!?

Thanks for
Reading
Jam!

THE STORY DOESN'T END HERE!
Jam still updates the comic every week!
Pick up right where the story left off:

WWW.WASTEDTALENT.CA/EIT

Appendix A:

BONUS MATERIAL



THE ENGINEER'S HYMN

(sung to the tune of "Glory Glory Hallelujah" or, shouted drunkenly in response to WHO THE HELL ARE WE?)

We are, we are

We are the Engineers!

We can, we can

Demolish forty beers!

Drink rum! (*Drink rum!*)

Drink rum! (*Drink rum!*)

Drink rum and follow us

For we don't give a damn

For any old man

Who doesn't give a damn

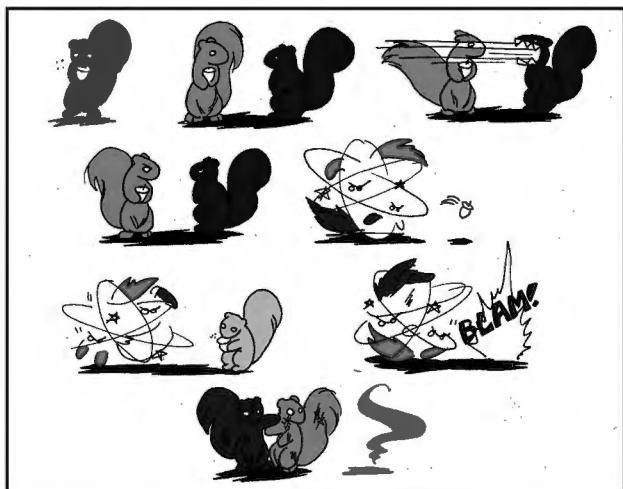
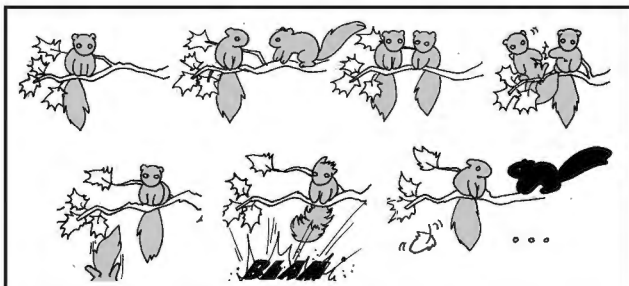
For us!

(*Hey!*)



EXPLODING SQUIRREL COMICS

I drew these comics during first year. I suppose you could say this is the "origin" of the psychotic squirrel that shows up in my comics every so often.



BONUS ART:

Other random scribblings from my University days



FIRST DAY ON THE CO-OP JOB

by Red

There is something comforting in knowing that the first day at every job is the same.

They are all a clusterfuck.

You show up all bright-eyed and bushy-tailed, ready to tackle the first assignment. And the forces beyond your control do their damndest to derail you. They are much better at their job than you ever will be.

The workspace. I've shown up to jobs where they looked furiously to find a place for me to sit. Sometimes you are shuffled off to a high-traffic cubicle. Sometimes your 'office' doubles as a janitor/supply closet. Sometimes you get a stall in the bathroom. But once you have a place to hang your head, you still aren't out of the woods.

The computer. Mother of all, giver of life. Your job will revolve around your computron. It will never work the first day. If it is in your station, it is a large paperweight until at least the second day. However, using it as such will attract strange stares and a reputation that you can do without. You will need a login/password that is as elusive as a 4-pointed unicorn. You can try to contact the IT department, but fixing computer problems isn't their job. I'm still not sure what their job is.

The phone. You might not get one. You might get one that can't receive calls. You might just get a can on a string that goes directly to someone's voice mail. Whatever the case, you might as well light it on fire and send smoke signals. Plastic makes great smoke signals.

And aside from your workstation, there is the workplace to deal with.

Introductions. You will meet a lot of people today. You will also forget all their names and job descriptions instantly. Most places have name plates at their cubicle/office entrance. You might also get a seating plan if you are lucky. If there is neither, you are fucked.

Coffee, oh coffee. Learn both the quickest route to it and the most scenic (read: the one that passes by the hottest office staff). You will spend more time at the coffee pot than at your desk. If you aren't a coffee drinker, fuck off. You aren't allowed to read my article.

Office supplies. It is never too early to start bogarting office supplies. Pens, paper, post-its and portfolios are the 4 P's of stealing stationary. Take small amounts on a regular basis and nobody's the wiser. If you can find a way to bring your computer home, you are a better man than I. If you have the chance to take a red stapler, it is worth getting fired over. Just remember to engrave 'Milton' on it.

Wasting time. Learn how to waste time while still appearing to be working. There is an art to it. Hopefully your second day will be smoother. But don't count on it.



BALL MODEL FIASCO

by Red



For Mech's E-Ball Model, we turned a refrigerator into a mini-hockey rink. It was a fun project that required savagely attacking a mouldy old fridge.

Inside the fridge was a plethora of sensors that I cut off. If there were wires that held on parts of the fridge, I cut them off. After my wire-snipping tirade, Wyatt read the wiring schematic to get the compressor to turn on. Much easier than my directly-connecting-the-motor plan.

I then installed a thermostat and cut more wires from the tangle. There was a long wire loop that was taped and awkward. So I cut it off. I cut the loop, and shortened many other random wires.

And when I plugged it in, it didn't turn on. Fuck.

I reconnected the two ends of the wire loop that I cut off and tried again....nothing. I disconnected the wires from the thermostat and directly connected them....I wish nothing happened.

Before the plug got all the way into the extension cord socket, something bad happened. Fire and smoke, to be more precise. Fire jetted out of the extension cord under a cloud of black smoke. There was a cartoon-y zapping sound and a lot of light. My first electrical fire.

I instantly dropped the cords and looked frantically for a way to stop the fire. I thought about unplugging it, but that would require me sticking my hands in the flame. I was on my way to unplug the other end of the extension cord when it stopped on its own. The current was large enough to melt the bronze plug.

With any calamity it is important to learn from your mistakes. Here's what I learned:

- the wire loop I cut out had a high resistance, it was a heating strip
- I made a short circuit
- I plugged a short circuit directly into the wall
- CEME has no circuit-breakers or fuses

The funniest thing is that almost every male in my family is an electrician. I must be adopted.



ASK CAPTAIN RED

A Regular Feature of the NEUSPayper in 2006

Ahoy Captain!

I am dealing with some exam stress. It seems that no matter how hard I study, I'm not retaining anything. I'm getting really worried. What can I do?

--Shaky Mike

Avast Mike!

Thar be nothin' worse than jitters before battle on the high seas. T'ere best option be to take some time and get some relaxant in ye. A flagon or two of some cheap grog and ye be ready to take on even the most Differential of Equations.

--Captain Red

Ahoy Captain,

A coworker of mine always checks his voicemail on speakerphone. The volume is set really loudly, and it's a constant disruption. How can I get him to stop this?

--Landlubber Lucy

Avast Lucy,

Yarr, thar be nothin' worse than the booming cannons of corporate jargon. T'ere best option be to board his cubicle and pillage. If ye can't raid his phone, stab the speaker with your cutlass. After that, the vile bilge rat be forced to lift the hook. Or if ye would rather fire a warning shot across the bow, enlist the help of a surly ruffian. For a couple dubloons, get him to call the scurvy dog and leave a message that be best not for other ears. Phrases like 'heaving bosom', 'salty breeze through your hair' or 'I want to ram my pegleg in your tight ass again' will stop him cold.

--Captain Red

Ahoy Captain,

I'm not sure if I should get a cat or a dog. Both are so cuddly cute that I can't decide. Also, what names would you suggest? I was thinking of something like Cottonball.

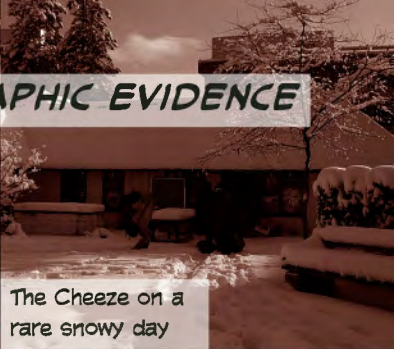
--First Mate Mike

Avast Mike,

It sounds like ye be snabbing the poop deck. Closer to a butt pirate than a sailing pirate ye be. Yarr, pirate shirts be white and bloody, yours be rainbow and fruity. For choosing a companion, ask which would survive the high seas. Would a cat follow ye off the plank? Would a cat board another ship with you? Would a cat tear into mutineers? A mongrel dog be the clear choice. And names for the mutt. A moniker for the pet be important. A rabid pitbull that goes by muff-muff be as fearsome as calm seas. A name like Neptune or Davey Jones be better.

--Captain Red

APPENDIX B - PHOTOGRAPHIC EVIDENCE



The Cheeze on a rare snowy day

Alternate Universe Friday: all the guys grew goatees, and I went as a "girly girl".



We didn't win the dodgeball trophy, but that didn't stop Red

I don't know what this is



Tanking!



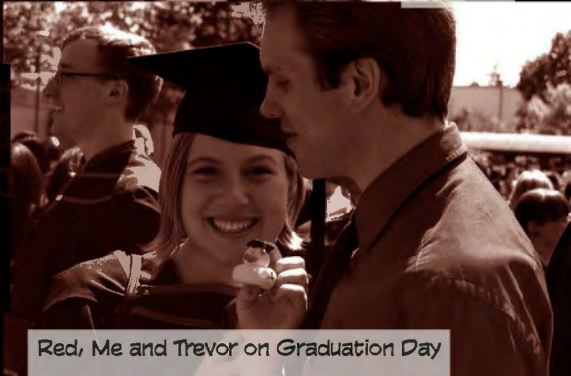
British Mike
on Skulk Night



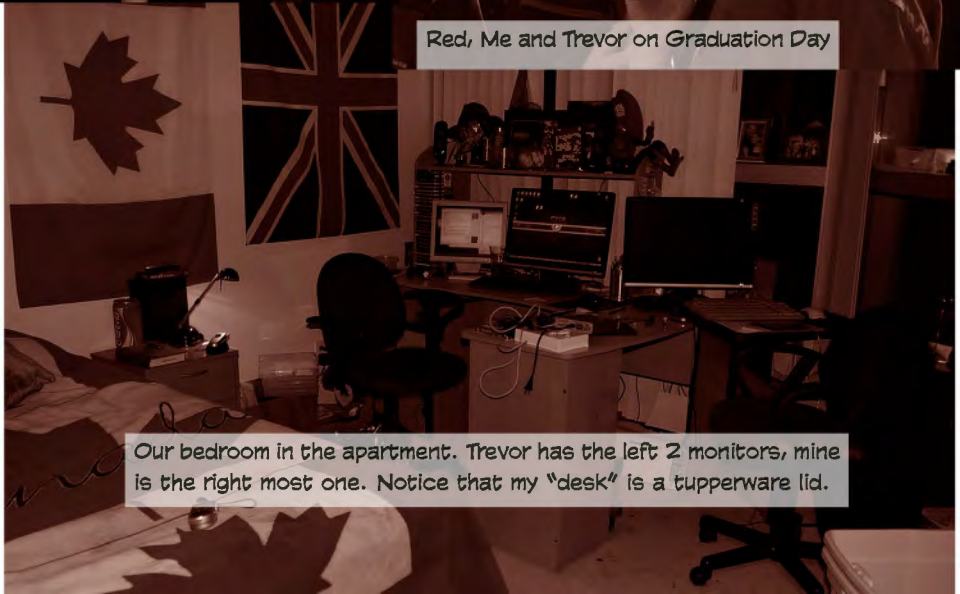
Carolling



Iron Ring Night



Red, Me and Trevor on Graduation Day

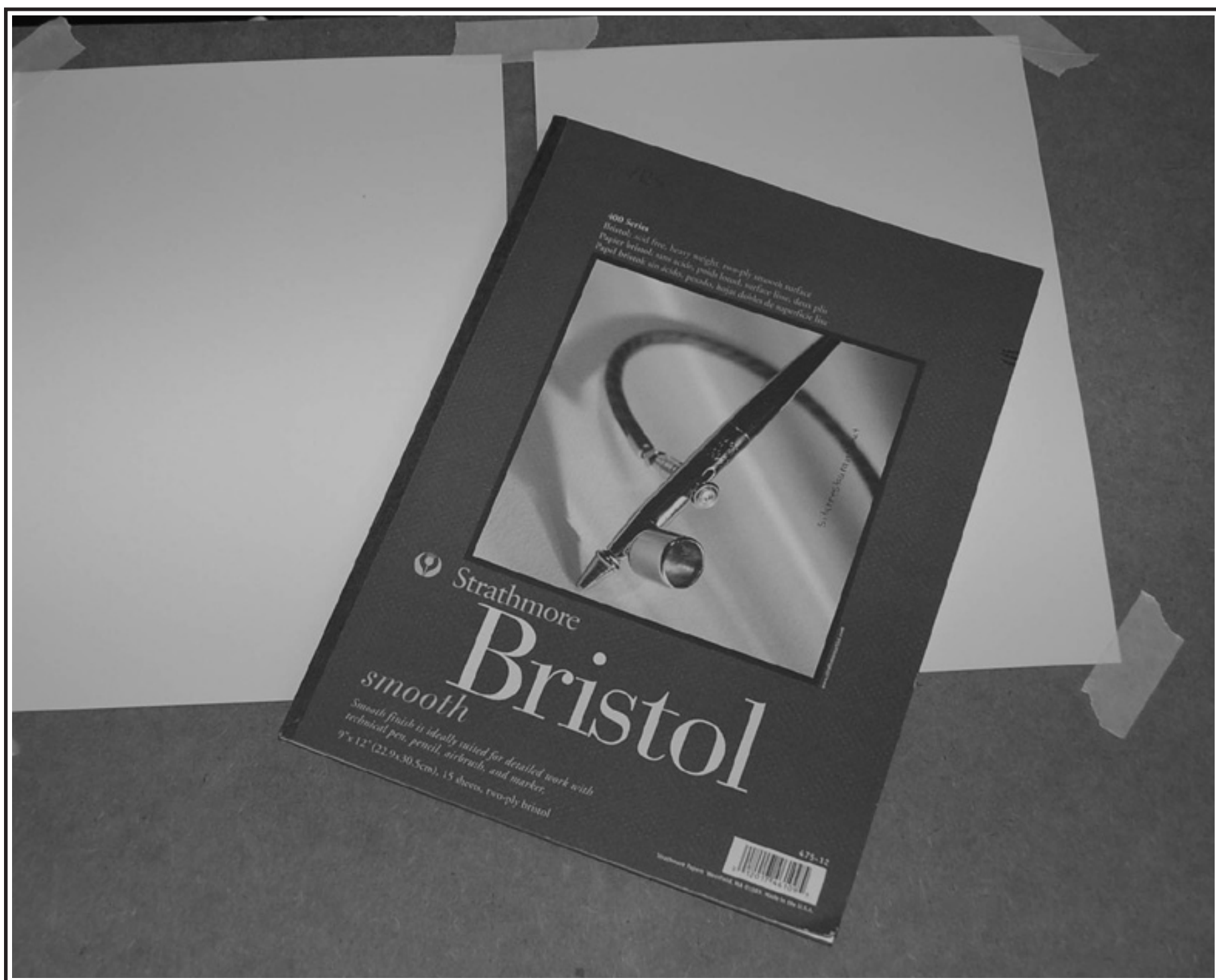


Our bedroom in the apartment. Trevor has the left 2 monitors, mine is the right most one. Notice that my "desk" is a tupperware lid.

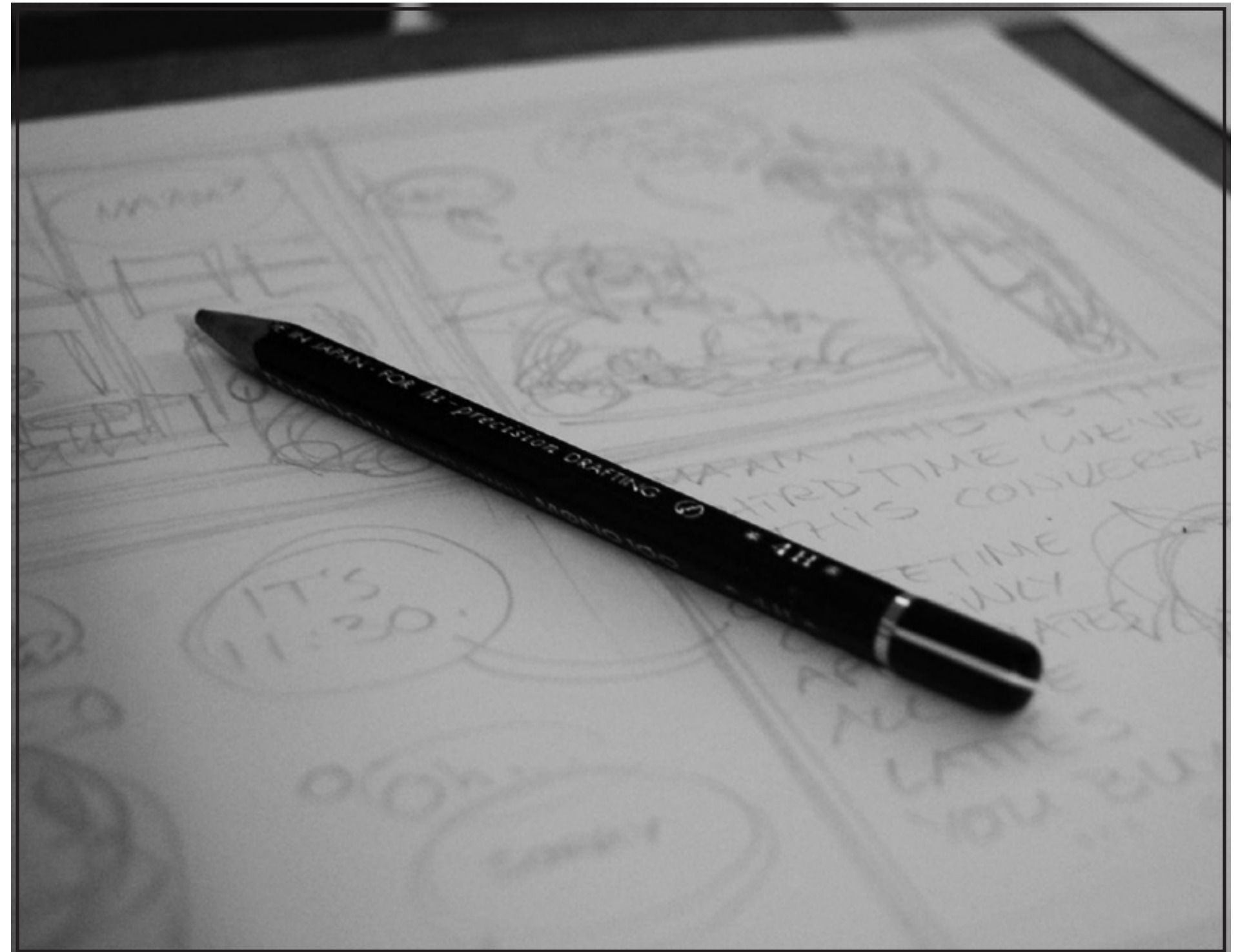
THE MAKING OF WASTED TALENT



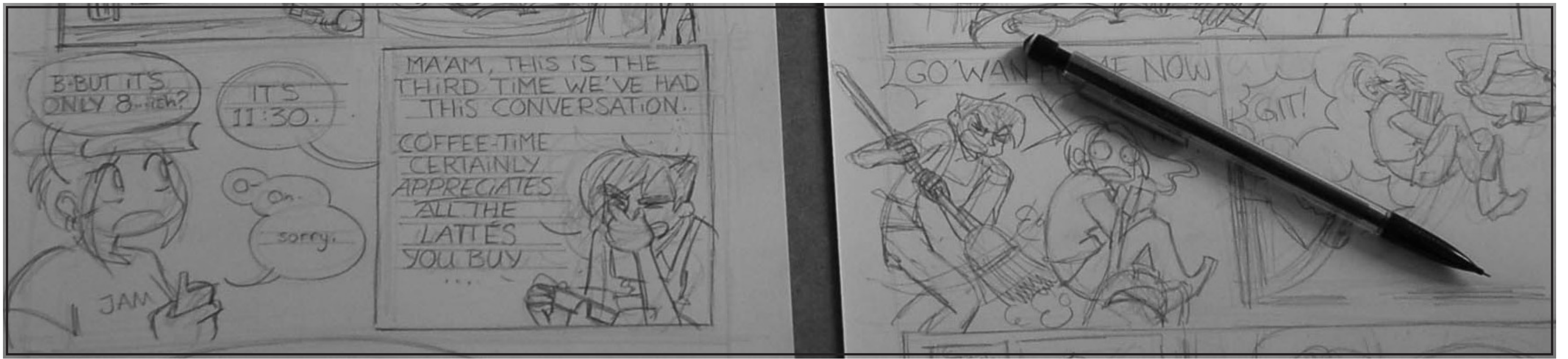
The original comics were drawn with straight ballpoint pen on loose leaf paper. You really don't need much to make comics!!



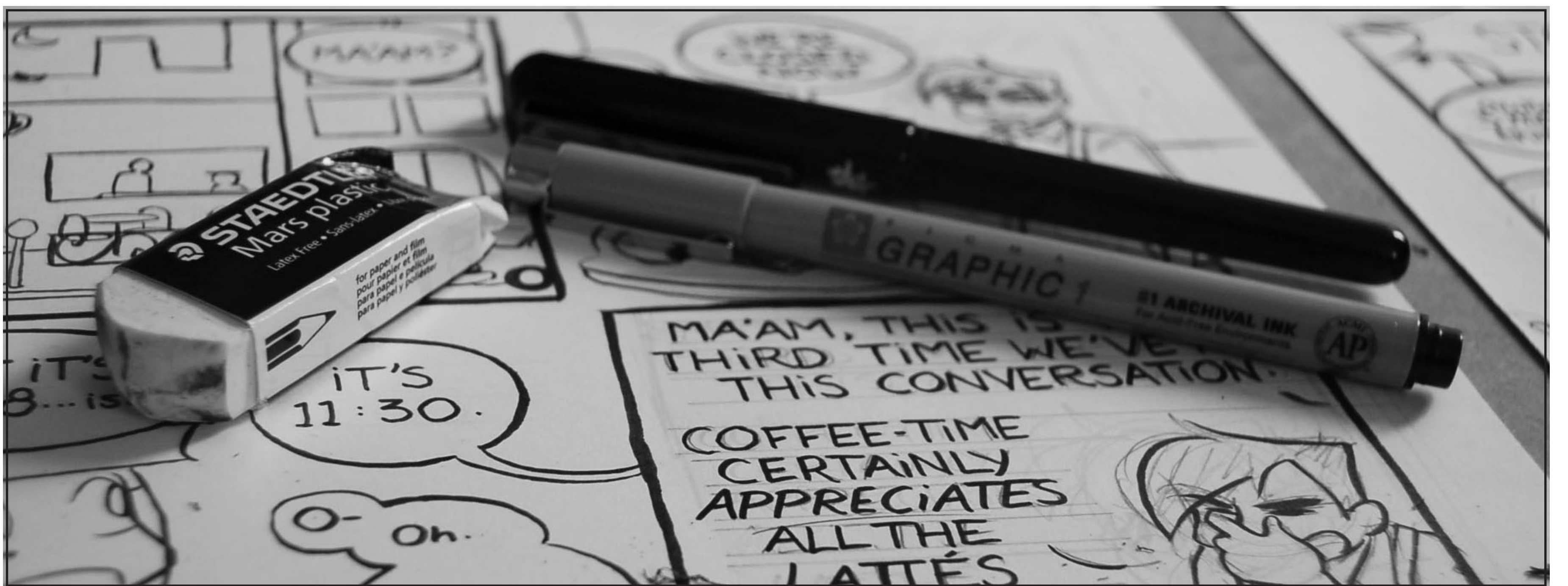
For this book, I redrew the comics on 9x12 sheets of Smooth Bristol. I like to work with two sheets at once, taped side by side on a piece of hardboard.



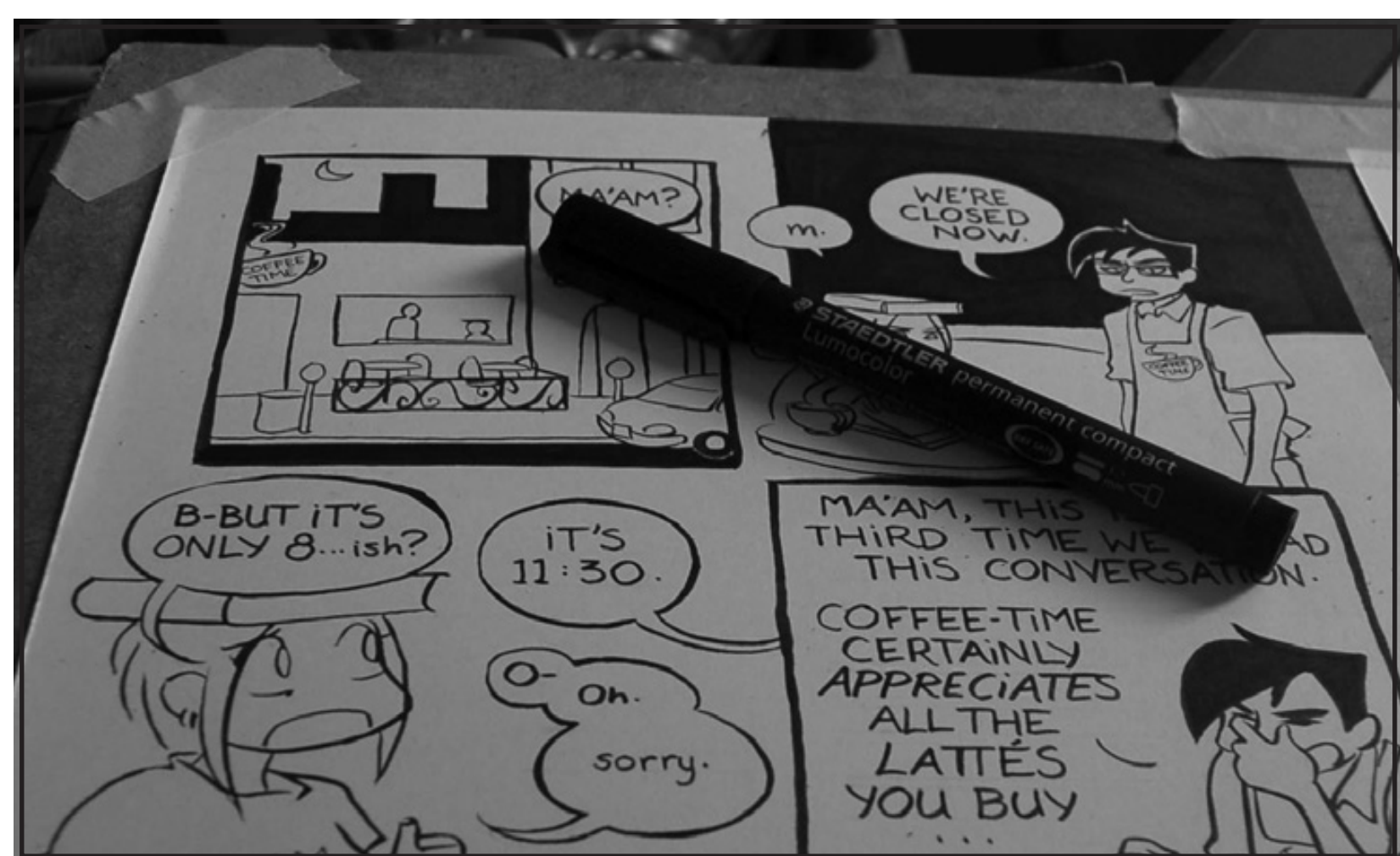
I do my rough layouts with a 4H pencil. At this stage I figure out where and what shape the boxes will be, rough out the characters and place the dialogue bubbles.



I tighten everything up with a regular ol' mechanical pencil. Nothing fancy! 0.07 HB lead. I finish drawing all the letters and characters.



I trace over the primary lines with my Graphic 1 (lettering), and my Pentel Brush Pen. I call this step "Pre-inking". I then erase the pencil lines with a Staedtler white eraser.



I fill in the Solid Black areas with a Staedtler Lumocolor permanent marker.

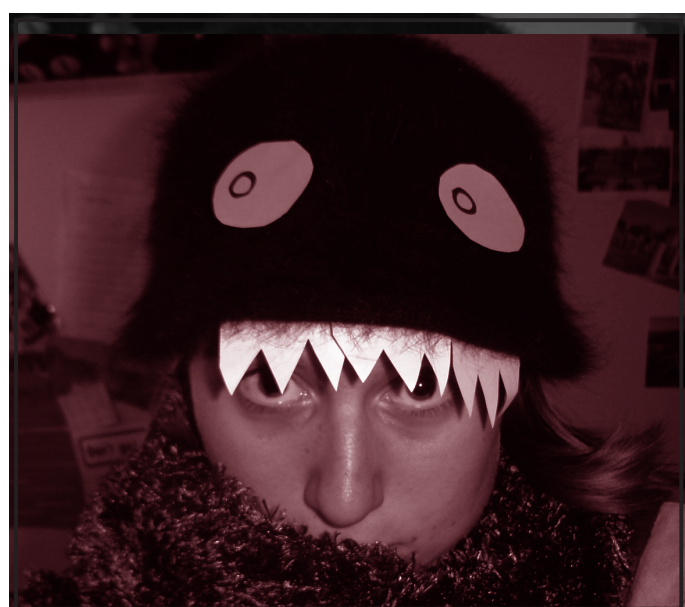


I put in little details and refine my lines and letters with a Pigma Micron 0.01 marker. At this point I'm pretty much done! The little extras - the red areas and dots, are done in photoshop.

ANSWERS TO SELECTED PROBLEMS

1. Don't you just hate it when you flip to the back of the textbook and you got the **FIRST DANG PROBLEM** wrong!?
6. You might be wondering why it's a "second year" Mech. At UBC we all have a common first year of engineering. We split into majors in second year and that's when they **REALLY** start drilling you into the ground.
8. (It's a heart, okay?).
11. It's Trevor! We started dating at the end of second year's December finals. He was attending a different school. Thinking back I'm really not sure how he put up with my general unavailability, but he did!
What a guy
13. Lucky is the "dealer" here, in case you can't tell. For most of first and second year, Anime was one of the few ways I was able to unwind. After that I learned how to drink.
14. Pumpkin Date Chocolate-Chip Muffins!
Large Bowl:
1 2/3 C Flour
1 c Sugar
1 tsp Baking Soda
1 tsp Salt
1/2 tsp each of Cloves,
Cinnamon and Nutmeg
1/4 tsp baking powder
Small Bowl:
1/2 c oil
1/2 c water
1 c chocolate chips
Add to mix in small bowl:
1 c canned pumpkin
2 eggs
1 c chopped walnuts
Mix wet to dry, bake @325°F 30m
17. Was a tough call for me whether or not to keep the swear in. It's just not the same without it. Rather, it's just not Red without it.
18. ...at which point everyone else copied his data.
19. I have nothing against keeners/the naturally gifted. Really, I don't. They just make life difficult, is all.
22. I should mention that after every splash image is a start of a new academic year in the comic ... more or less. In third year I moved into the upper-year dorms with my best friend Kyle.
24. For posterity's sake, W.O.W = World of Warcraft, an online rpg that came out right after finals in second year. I was a Night Elf Druid, in case you were wondering. Weren't you?

26.



I'll admit, it's probably funnier if you've seen the hat.

27. I **think** this is the first comic that ever got printed in the Mecha (our department newsletter)

29. Look up "Bananaphone"... you're welcome! (or, sorry?) Trevor is eating Twizzlers and Coke, which comprise about 70% of his diet.

30. My parents live on the other side of the country, so when my dad would drop into town on business trips, it was always a nice change of pace. Meals that didn't consist of rehydrated noodles!! Quite novel.

31.



I'm holding my betta fish in the pizza box. My first betta was named "Caffeine", and I kept a caffeine molecule on top of his tank.

34. Panel 4 is a direct quote... I don't think the policy was working quite as they intended...

35. Don't get me wrong, these days I really look forward to jeans day... but my true fashion sense would never fly.

36. To avoid any confusion: Canada IS metric, but most of our exports/imports are to the USA, so most of industry still works in imperial. This particular pump was for a European country... you know, where they take metric more seriously.

37. Tanking is a sacred rite whereby some chump is thrown into a pond of water. The engineers built a cairn-shaped tank of water in front of the cheeze specifically for this purpose. You can see it in action by looking up "UBC Cheeze" on the Youtubes.

38. After 20 consecutive hours of studying, everything degrades into a dirty joke.

40. This really happened!! Nobody believes me.

41. We call this "raping the bell curve". "Fizzers" (Engineering Physics students) are notorious for it.

43. "AUGH, I have to write TWO ESSAYS this term!!" It was in the comment section of this comic that the term "extreme underwater basket weaving" popped up, leading to the subsequent google results.

44. At this point I decided that I wanted to be YOUR SOURCE for "Extreme Underwater Basket Weaving". As of printing, Wasted Talent is the #1 google result for it.
48. This is during "Skulk Night" (see glossary).
50. I didn't SET OUT to find a pink shirt, it was just slim pickings at the mall that day. *sigh*. To the shirt's credit, it also had a whale embroidered on it. A WHALE!
51. This is the first time I saw my boss since being hired. I was in the same situation that Red describes on page 74. Once I had been through all the Solidworks tutorials, I decided the clutter was driving me TOO CRAZY.
53. Another patch you can earn is the "40 beer" patch. You have to consume 40 Beer in 12 hours. Red and I didn't really feel up to the beer challenge, but one day we decided to try a "40 Coffee" challenge. The patches that sometimes show up on our reds are to honour that day. (As it turns out, you get reeeeeally sleeeepy after about 20 coffees.)
54. The next four comics were among the first I drew with marker! I drew them just after University, when I didn't have many current stories to tell. They don't belong in the next book, and I decided they were nice enough to include here! So, please forgive the minor style shift for the next four pages.
55. Our emails all had the structure you@interchange.ubc.ca . Weird, I know.
58. The Red is notorious for its "wet dog" smell.
60. I took Orthopedic Biomechanics in fifth year (calculating stresses on bones and ligaments, etc. and also designing knee implants.) I had the opportunity to witness a knee replacement surgery. I really didn't want to go, but my friend Kate told me it was a once-in-a-lifetime opportunity, and she was probably right. I'm amazed I didn't puke or pass out, but now if I ever go under the knife I'm going to believe that the surgeon is singing "Come On Eileen" and I'm really not sure how I feel about that.
62. I got kicked out of this cafe (and others) sooooooooooooo many tiiiiiiiiimes.
65. The "fishes" are alpha phase!
67. I never took this course, so I wrote Red for help. "I don't remember the course well enough to give an accurate question, but I remember enough terms to put together a bullshit question that sounds right, but may or may not be solvable with the given information. Any ways, here goes nothing:

10.a. Calculate the stall speed off the aircraft given an aspect ratio of 4.2, a weight of 1000kg, drag coefficient of 0.15 and a NACA 1112 wing at an angle of attack of 5 degrees. State and justify all assumptions.

10.b. If, at 5,000 feet in the air and a groundspeed of 120km/h, the engines fail, calculate whether the plane could glide to the airport at 2km away, or prepare for an emergency landing on the highway 500m away. The aircraft's steepest landing approach is 10 degrees.

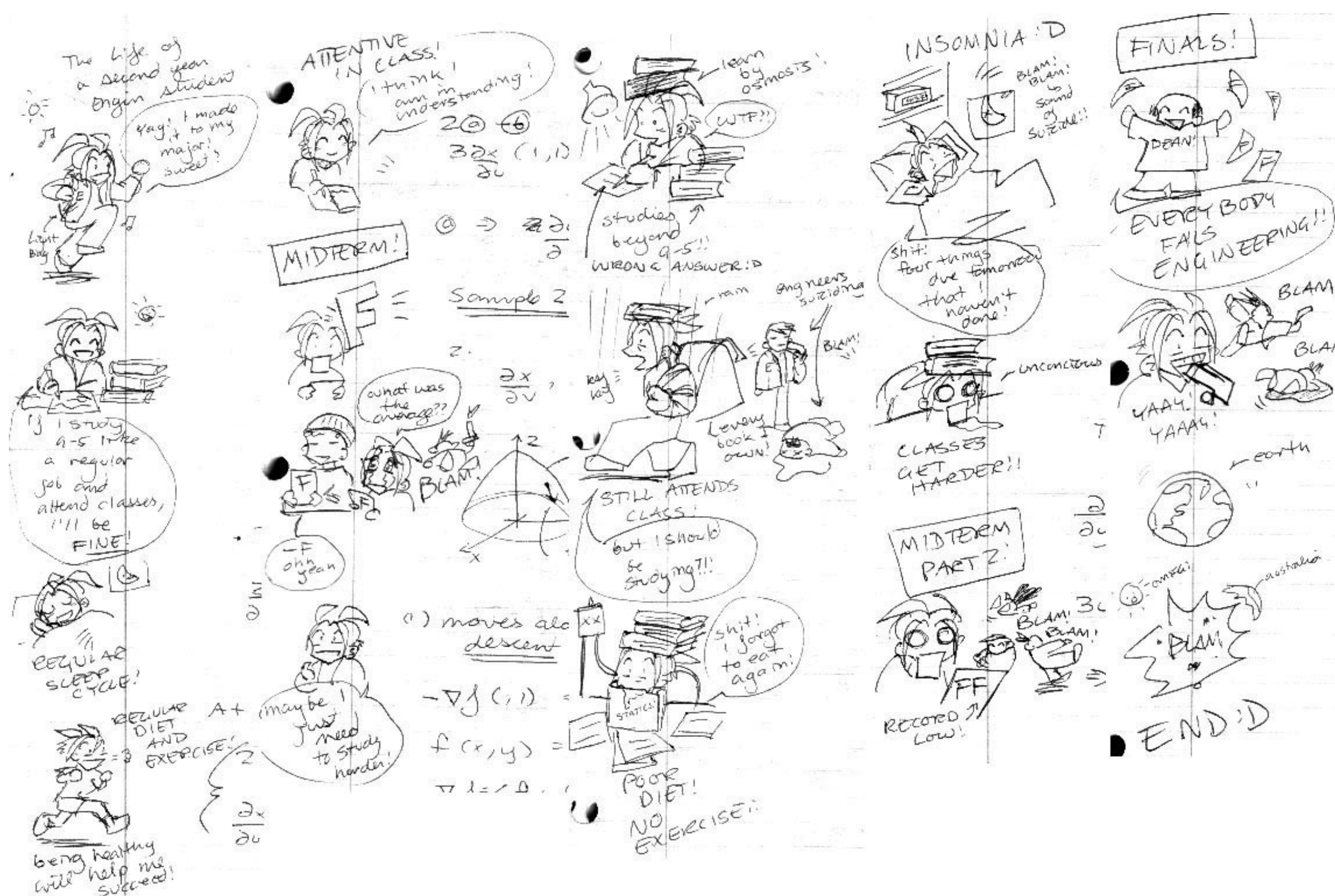
10.c. "Draw the three-dimensional free body diagram showing all relevant forces acting on the aircraft on approach."

Other than the question, it's a completely true story. Red is also known for having written poetry on exams to kill time, and writing exams with crayon.

70. These squirrels are Carolling - an engineer's tradition. On the last day of December classes, we parade around campus bringing "good cheer" to all the 8am classes.

85. Whoa, wait, commentary for the commentary page!?! *HEADSPLODE* Sorry if this is a bit inconvenient to read, I'm addicted to bleeding art off the side of the page, I thought this would be the best way to provide some additional information without breaking up the reading experience.

BONUS! THE ORIGINAL WASTED TALENT



This is the original, first version of "Life of a Second Year Mech", taken directly from the margins of my notes. If it wasn't for the laughter it brought my classmates, I might not have made any more than this.

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GLOSSARY

Iron Ring - A ring that all Canadian Engineers receive when they graduate from an accredited University. The rings are worn on the little finger of the working hand. When you are writing, you are always conscious of it being there because it will drag along the page. It serves as a reminder of our responsibilities to the public.

Keener - Those students who go the extra mile in their studies to ensure a perfect score in every course. They are either the ones who spend all of their time in the library, cataloguing and memorizing every scrap of information, or the ones for whom even this advanced material comes naturally.

P.P. - A First Year Engineering Student. (A first-year in other faculties at UBC is called a "Frosh".) They were originally nicknamed "Z.Z."s because the Engineering Undergraduate Society always called clubs in alphabetical order. One day, the first-years united and passed a motion to rename themselves "A.A.'s. After which, the EUS passed a motion to call clubs in REVERSE alphabetical order. The First Years asked for a compromise - a nickname somewhere in the middle of the alphabet. Henceforth, they were known as the "P.P"s.

Skulk Night - An event held every E-week (first week of February), which is a massive, epic scavenger hunt. The letter "E" is liberated from many signs, and mysterious cairns appear all over the city.

THANK YOU

To the friends who got me through Mechanical Engineering and kept me laughing- Red, Ainaz, Lucky, Kyle, Elise, Wyatt, Trian, New Guy, Kate, British Mike and many, many others.

To Trevor, for putting up with all my Jamminess

To the webcomickers who have shown tremendous faith in my silly scribbles: Dave Stanworth, JJ McCullough, Jeph Jacques, Meredith Gran, Rich Stevens, Joel Watson, Kris Straub, Malki!, and Aaron Diaz.

To Jonathon Dalton, Jeff Ellis and the other members of Cloudscape Comics for being my local support group.

And especially to you, my wonderful readers!
Without you, none of this would be possible.



ABOUT THE AUTHOR



Portrait by J.J. McCullough www.filibustercartoons.com

Angela Melick earned a degree in Mechanical Engineering from the University of British Columbia in 2007. She is a practicing engineer in Vancouver, Canada, where she lives with her husband, Trevor. We Are The Engineers is the first collection of her webcomic, Wasted Talent. The webcomic updates weekly at:

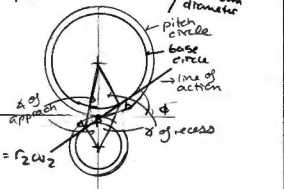
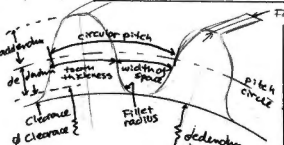
WWW.WASTEDTALENT.CA

GEARS: ω transmits thru // ω generates radial loads ONLY!

MECH325 FORMULA SHEET
MIDTERM #1

GEARS: ω to be used to transmit motion thru intersecting shafts
used when torque velocity ratios

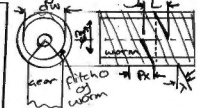
pitch = $\pi d = \pi m$
 $= N m$
 thickness of space
 depth = $(a+b) \cdot c$
 $d_{\text{um}} = 1/2 p$
 $d_{\text{al}} = 1.25/p$
 circular pitch = N/d
 $a = 6 - a$
 $p = d/N$
 depth = $(a+b)$



pitch radius
 thickness = $P/2$
 tangential velocity = $r\omega_1 = r_2\omega_2$
 $\omega_1 \rightarrow$ usually 20, 25, was 48
 angle of action
 \rightarrow angle of approach + angle of recess
 ratio = $q_e = \frac{L_{ab}}{P} \approx 1.2$
 action $\approx 1.2 P$

$H_p = T x n$
 $5252 (\text{imp})$
 $T = d/2 W t$
 $W t = 126048 H_p$
 $n d \text{ (cimp)}$

GEAR TRAINS
 $R = \text{Gear Ratio} = \frac{\omega_2}{\omega_1}$
 $= \frac{N_1}{N_2} = \frac{d_1}{d_2} = \frac{z_2}{z_1}$
 \pm Gear Train Value
 $= \pm \frac{\text{driven } N}{\text{driver } N}$
 $L_0 + \text{same direction}$
 $- \text{opp. direction}$
IDLER: a gear that is both driving and driven. ($n=0$)
 $\omega_{\text{last}} = e \omega_{\text{first}}$
 $N_{\text{last}} = e N_{\text{first}}$
 GEARS w/ ARM...
 $\frac{N_1}{N_2} = e = \frac{N_1 - N_A}{N_2 - N_A}$

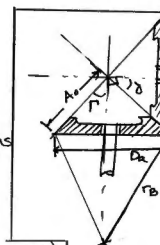


$P_x = \text{axial pitch of } \omega_x$
 $= P_t @ \text{shaft } x = q$
 $P_t = \text{transverse pitch of } \omega$
 $\lambda = \text{worm lead } \lambda$
 $\tan \lambda = L/\pi d_w$
 $\psi_g = \text{Gear helix } \lambda$
 $= \lambda @ \text{shaft } = 90$
 $d_g = \text{gear pitch } \phi$
 $= N_g P_t / \pi$
 $d_w = \text{worm pitch } \phi$
 \rightarrow chosen s.t. C
 $C < 0.375 \leq C < C < 0.87$ damped

CRYSTAL SYSTEMS

Cubic $a=b=c$ $\alpha=\beta=\gamma=90$
 Tetra. $a=b \neq c$ $\alpha=\beta=\gamma=90$
 Rhomb. $a \neq b \neq c$ $\alpha=\beta=\gamma \neq 90$
 Orthom. $a \neq b \neq c$ $\alpha=\beta=\gamma=90$
 Mono-clinic $a \neq b \neq c$ $\alpha=\gamma=90 \neq \beta$
 Tri-clinic $a \neq b \neq c$ $\alpha \neq \beta \neq \gamma \neq 90$

GEARS: BEVEL GEARS

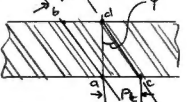


transmits between shafts @ 90 or any λ
 $A_0 = \text{cone distance}$
 $\gamma, \gamma' = \text{pitch } \lambda$
 $D_a = \text{pitch } \phi$
 $\tan \gamma = \frac{N_{\text{pinion}}}{N_{\text{gear}}}$
 $N = \# \text{ of teeth}$
 $r_{av} = \text{pitch } r @ \text{midpoint}$
 $r_b = \text{back-one dist.}$
 $N' = \# \text{ teeth of imaginary gear} = \frac{2r_{av}}{P}$

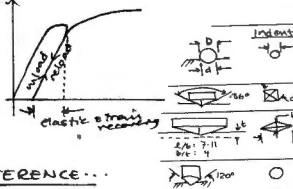
RACK & PINION GEARS: d = pitch dia, N = 0

GEARS: HELICAL GEARS

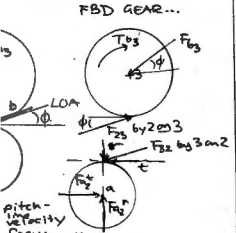
also transmits thru // shafts
 quieter: more gradual mesh.



ELASTIC RECOVERY



SPUR GEARS



$P_n P_n = \pi$

$P_t = \text{(transverse) circular pitch}$
 $P_n = \text{normal circular pitch} = P_t \cos \psi$
 $\psi = \text{helix } \lambda$
 $P_x = \text{axial pitch} = P_t / \tan \psi$
 $P_n = \text{normal diametral pitch} = P_t / \cos \psi$
 $P_t = \text{transverse diametral pitch}$
 $\phi_n = \text{normal pressure } \lambda$
 $\phi_t = \text{transverse pressure } \lambda = \tan^{-1} \left(\frac{\tan \phi_n}{\cos \psi} \right)$
 $N' = \text{virtual } \# \text{ of teeth} = N / \cos^3 \psi$
 \rightarrow strength calc

INTERFERENCE...

$N_p = N_g$
 $N_p = \text{smallest pinion tooth } \#$
 $= \frac{4k \cos \psi}{6 \sin^3 \phi} (1 + \sqrt{1 + 3 \sin^2 \phi})$
 $N_g = N_p = \text{smallest pinion}$
 $N_p = \frac{2k \cos \psi}{(1+2m) \sin^3 \phi} (m + \sqrt{m^2 + (1+2m) 5 m^2 \phi^2})$
 $N_p = 4k \cos \psi / 2 \sin^3 \phi$
 largest gear w/ specified PINION
 $N_g = \frac{N_p^2 \sin^2 \phi E - 4k \cos \psi}{4k \cos \psi - 2 \sin^3 \phi}$
 $M = W^2 R$

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Comedy

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