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07-131: Section A
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07-131 Homework 3

Problem 1 Math

LaTeX is awesome for math! Let's look evaluating the value of m if $(m+2)\times(3+4)=21$ in two ways.

Using the initial equality:

$$\begin{aligned}
& & (m+2)\times(3+4) &= 21 & &\text{(start)}\\
&\implies & (m+2)\times 7 &= 21 & &\text{(evaluating } 3+4=7\text{)}\\
&\implies & m+2 &= \frac{21}{7} & &\text{(dividing by 7 on both sides)}\\
&\implies & m+2 &= 3 & &\text{(evaluating } \tfrac{21}{7}=3\text{)}\\
&\implies & m &= 3-2 & &\text{(subtracting 2 on both sides)}\\
&\implies & m &= 1 & &\text{(evaluating } 3-2=1\text{)}
\end{aligned}$$

Therefore:

$$m = 1$$

*

Using the initial equality:

$$\begin{aligned}
& & (m+2)\times(3+4) &= 21 & &\text{(start)}\\
&\implies & (m+2)\times 7 &= 21 & &\text{(evaluating } 3+4=7\text{)}\\
&\implies & (m\times 7)+(2\times 7) &= 21 & &\text{(using distributive property)}\\
&\implies & (m\times 7)+14 &= 21 & &\text{(evaluating } 2\times 7=14\text{)}\\
&\implies & m\times 7 &= 21-14 & &\text{(subtracting 14 on both sides)}\\
&\implies & m\times 7 &= 7 & &\text{(evaluating } 21-14=7\text{)}\\
&\implies & m &= \frac{7}{7} & &\text{(dividing by 7 on both sides)}\\
&\implies & m &= 1 & &\text{(evaluating } \tfrac{7}{7}=1\text{)}
\end{aligned}$$

Therefore:

$$m = 1$$

Problem 2 Induction

Induction becomes so much easier with LaTeX! Take a look:

hello

Problem 2 Calculus

Those of you who enjoy calculus will have a blast!

Find $\lim_{x\to 2} \frac{x^2+x-6}{x^2-4}$.

$$\begin{aligned}
\lim_{x\to 2} \frac{x^2+x-6}{x^2-4} &= \lim_{x\to 2} \frac{2x+1}{2x} && \text{(by L'Hôpital's Rule)} \\
&= \frac{5}{4}
\end{aligned}$$

Another one? Ok!

Given $f(x,y) = \frac{xy}{x+y}$ if $(x,y) \neq (0,0)$ and $f(0,0) = 0$.

For $(x,y) \neq (0,0)$,

$$\begin{aligned}
\frac{\partial f}{\partial x}(x,y) &= \frac{\partial}{\partial x}\left(\frac{xy}{x+y}\right) && \text{(by substitution)} \\
&= \frac{y(x+y) - xy(1)}{(x+y)^2} && \text{(by differentiation rules)} \\
&= \frac{y^2}{(x+y)^2}
\end{aligned}$$

and

$$\begin{aligned}
\frac{\partial f}{\partial y}(x,y) &= \frac{\partial}{\partial y}\left(\frac{xy}{x+y}\right) && \text{(by substitution)} \\
&= \frac{x(x+y) - xy(1)}{(x+y)^2} && \text{(by differentiation rules)} \\
&= \frac{x^2}{(x+y)^2}
\end{aligned}$$

Alright, no more problems. Just two more equations.

$$\iiint_V (\nabla \cdot \mathbf{F})\,\mathrm{d}V = \oiint_{S(V)} \mathbf{F} \cdot \hat{\mathbf{n}}\,\mathrm{d}S$$

$$\iiint_V (\nabla \times \mathbf{F})\,\mathrm{d}V = \oiint \hat{\mathbf{n}} \times \mathbf{F}\,\mathrm{d}S$$

Problem 3 Programming

You can code in LaTeX too! Here's an intro to typesetting programs:

```
#include<stdio.h>
#include<iostream>

// My first program
int main(void)
{
  printf("Hello World\n");
  return 0;
}
```

You can also change languages really easily, like here:

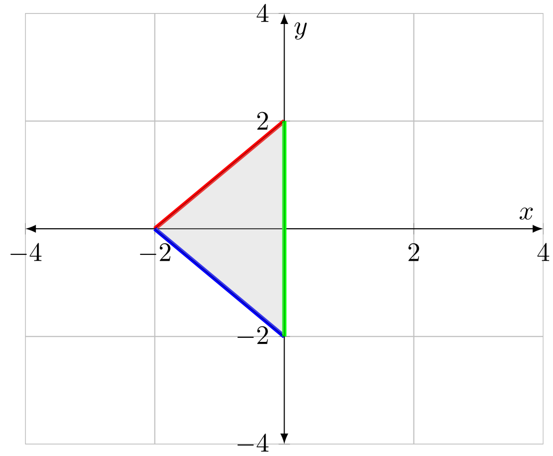
```
(* My second program *)
fun map f xs = let
  fun m ([], acc) = List.rev acc
    | m (x::xs, acc) = m (xs, f x::acc)
  in
    m (xs, [])
  end
```

or here:

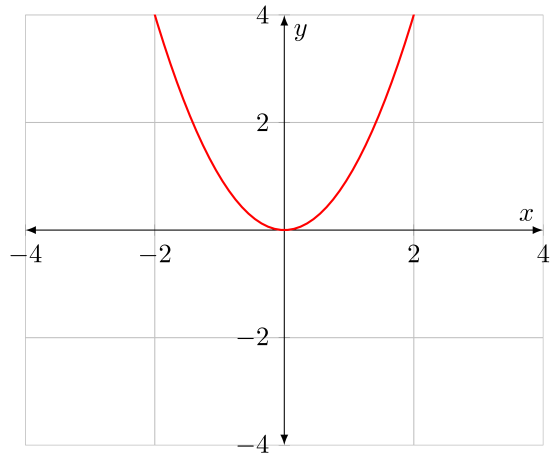
```
# My third program
def UncommonWords(A, B):
  # count will contain all the word counts
  count = {}

  # insert words of string A to hash
  for word in A.split():
    count[word] = count.get(word, 0) + 1

  # insert words of string B to hash
  for word in B.split():
    count[word] = count.get(word, 0) + 1

  # return required list of words
  return [word for word in count if count[word] == 1]
```

Problem 4 Graphing

Plotting in Latex is super fun! Here's a mini graph with some shading:



and here's a plot of $y = x^2$:



Problem 4 Images

You can make some really pretty images and figures in LaTeX too!

Carnegie Mellon University

Figure 1: CMU

(a) Amazon (b) Apple (c) Facebook

(d) Google (e) Microsoft (f) Netflix

Figure 2: FAANG logos

and can reference back to them! Take me to FAANG logos or take me to CMU.