IB Mathematics SL

Internal Assessment

This is a Sample Title LaTeX

- This is a Sample Subtitle -

By Student Name

Student ID

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Contents

My Practice LaTeX Document

Arthur Feng

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1 Introduction

Some text: ”Sometimes after I write a review people will e-mail me and ask[1], in so many words, ”Never mind the overview, why would I use this distribution over another one?” In Manjaro’s case this is an easy question to answer as the distribution does a lot of things well. Manjaro is a rolling release, cutting edge distribution so the project consistently provides the latest and greatest open source software. Apart from the programs in the distribution’s repositories, people running Manjaro can also make use of AUR (the large collection of software submitted by Arch Linux users). This provides Manjaro users with a huge collection of packages, most of them consistently kept up to date with upstream[1] sources.

I found Manjaro’s Xfce edition to be very fast and unusually light on memory. The distribution worked smoothly and worked well with both my physical hardware and my virtual environment. I also enjoyed Manjaro’s habit of telling me when new software (particularly new versions of the Linux kernel) was available. I fumbled a little with Manjaro’s settings panel and finding some settings, but in the end I was pleased with the range of configuration I could achieve with the distribution. I especially like that Manjaro makes it easy to block notifications and keep windows from stealing focus. The distribution can be made to stay pleasantly out of the way. In short, I think Manjaro is the ideal distribution for people who like the simple, cutting edge philosophy of Arch Linux, but who would like to set up the operating system with a couple of clicks and have settings adjustable through a friendly point-n-click interface. Manjaro has most of the same capabilities of Arch, but with a friendly wrapper which makes installing and working with software packages a quick, click-and-done process.

[1] An example footnote

The one serious issue I ran into during my trial came in the wake of an update. After several days of smooth use I ran into a problem when, after an update, Manjaro Linux would no longer boot. Attempts at booting in fallback mode or with various kernel parameters failed to get the system to a stage where I could login. Sadly, this signaled an end to my trial and acted as a reminder of the risks in maintaining a rolling release distribution.

2 Macros

Graph $Y = \frac{x}{3x^2+7}$. this is define before the beginning of the dcuments, which is called macros.
Identify the asymptotes for the graph of $Y = \frac{x}{3x^2+7}$.
This is another macros: **Remember to include a scale and label your axes.**

3 Math

This is the beginning of the article.
This is from another line.
we can also start a new paragraph by insert extra new line.
Let's show some in line math symbol, x + 1 is trade as text. but $x + 1$ is trade as math symbol, you could see the different between two symbols. Another example is

$$A = x^2 + 2x + 1$$

represent the area of the rectangle. Then, there are more math operators:

3.1 superscripts

superscripts:

$$2x^3$$

$$2x^34$$

$$2x^{3x+4}$$

$$2x^{3^m+4x+5}$$

3.2 subscripts

Same as subscripts:

$$x_1$$

$$x_{12}$$

$$x_{y_{3m+n}}$$

3.3 trig, log and square

Trig functions:

$$\sin n$$

$$y = \cos m$$

Log functions:

$$\log m$$

$$\log_5 m$$

$$\ln m$$

Square functions:

$$\sqrt{m}$$

$$\sqrt[n]{m}$$

$$\sqrt[1+\sqrt{x+1}]{m+n}$$

3.4 Fractions

About 2/3 of the glass is full. We can also write it like 2/3 and $\frac{2}{3}$ We can reformat the fractions like $\dfrac{2}{3}$, this one is much bigger. We can write more complicate equations like

$$\frac{x}{x^2+4x+1}$$

as well as :

$$\frac{\sqrt[n]{m}}{x^3+7y+m}$$

we can also add a fraction within a fraction:

$$\frac{n}{\frac{q+p}{a+b+c}+x^2}$$

4 symbol

The set of Natural numbers is denoted by $\mathbb{N}$.

There are many other symbols, such as $\mathbb{Z}$ for integer, and $\mathbb{R}$ for real number.

π ζ η $\equiv$

4.1 Function

The function $f(x) = (x-3)^x + \dfrac{1}{2}$ has domain $\mathrm{D}_f : (-\infty, \infty)$ and range $\mathrm{R}_f : \left[\frac{1}{2}, \infty\right)$

$$\lim_{x \to a^-} f(x)$$

$$\lim_{x \to a} \frac{f(x) - f(a)}{x - a} = f'(a)$$

$$\int \sin x \, dx$$

$$\int_a^b$$

$$\int\limits_a^b$$

$$\int\limits_{2a}^{a+b} x^2 \, dx = \left[\frac{x^3}{3}\right]_a^b$$

$$\sum_{n=1}^{\infty} ar^n = a + ar + ar^2 + \cdots + ar^n$$

$$\int_a^b f(x)\,dx = \lim_{x\to\infty} \sum_{k=1}^{n} f(x_k)\cdot \Delta x$$

$$\vec{v} = v_1\vec{i} + v_2\vec{j} = \langle v_1, v_2\rangle$$

4.2 Parentheses

Parentheses:

$$(x+1)$$

$$[x+1]$$

$$\{x+1\}$$

$$\$12.55$$

$$3\left(\frac{3}{5}\right)$$

$$3\left[\frac{3}{5}\right]$$

$$3\left\{\frac{3}{5}\right\}$$

$$\left|\frac{x}{x+1}\right|$$

5 Table and Array

The one serious issue I ran into during my trial came in the wake of an update. After several days of smooth use I ran into a problem when, after an update, Manjaro Linux would no longer boot. Attempts at booting in fallback mode or with various kernel parameters failed to get the system to a stage where I could login. Sadly, this signaled an end to my trial and acted as a reminder of the risks in maintaining a rolling release distribution(see talbe 1).

1	1	2	3	4	5
$f(x)$	10	11	12	13	14

Table 1: Caption goes here

The one serious issue I ran into during my trial came in the wake of an update. After several days of smooth use I ran into a problem when, after an update, Manjaro Linux would no longer boot. Attempts at booting in fallback mode or with various kernel parameters failed to get the system to a stage where I could login. Sadly, this signaled an end to my

$$\begin{eqnarray}
5x^2 - 9 &=& x + 3 \tag{1}\\
4x^2 &=& 12 \tag{2}\\
x^3 &=& 3 \tag{3}\\
x = &\approx& \pm 1.732 \tag{4}
\end{eqnarray}$$

Another array:

$$\begin{eqnarray*}
5x^2 - 9 &=& x + 3\\
4x^2 &=& 12\\
x^3 &=& 3\\
x = &\approx& \pm 1.732
\end{eqnarray*}$$

6 List

6.1 enumerated list

enumerated lists with three level: bulleted lists, and nested lists

1. pencil
2. calculator
3. ruler
4. notebook
   (a) assessments
      i. test
      ii. quizzes
   (b) homework
   (c) notes
5. paper

6.2 lists

billeted lists:

- pencil
- calculator
- ruler
- notebook
  - assessments
    * test
    * quizzes
  - homework
  - notes
- paper

6.3 with new index

change the label of the list:

Commutative: $a + b = b + a$

Associative: $a + (b + c) = (a + b) + c$

Distributive: $a(b + c) = ab + ac$

7 Font

This will produce *italicized* text.

This will produce **bold-faced** text.

This will produce SMALL CAPS text.

This will produce `typewriter` text.

Please visit Mrs. Krummel's website at `http://wwwmrskrummel.com`

Size of the font:

Please excuse my dear aunt Sally .

Please excuse my dear aunt Sally .

Please excuse my dear aunt Sally.

Please excuse my dear aunt Sally .

Please excuse my Dear aunt Sally .

Please excuse my Dear aunt Sally .

Please excuse my Dear aunt Sally .

Please excuse my Dear aunt Sally .

8 Text position

Position of the words:

This is centered

This is on left. This is on left.This is on left.This is on left.

This is on right. his is on right. his is on right. his is on right.

9 Graph

The one serious issue I ran into during my trial came in the wake of an update. After several days of smooth use I ran into a problem when, after an update, Manjaro Linux would no longer boot. Attempts at booting in fallback mode or with various kernel parameters failed to get the system to a stage where I could login. Sadly, this signaled an end to my. Image must be saved as **.png .jpg .gif or .pdf** files(see the figure 1 and figure 2).

Figure 1: manjaro icon

Let's put another image into the document:

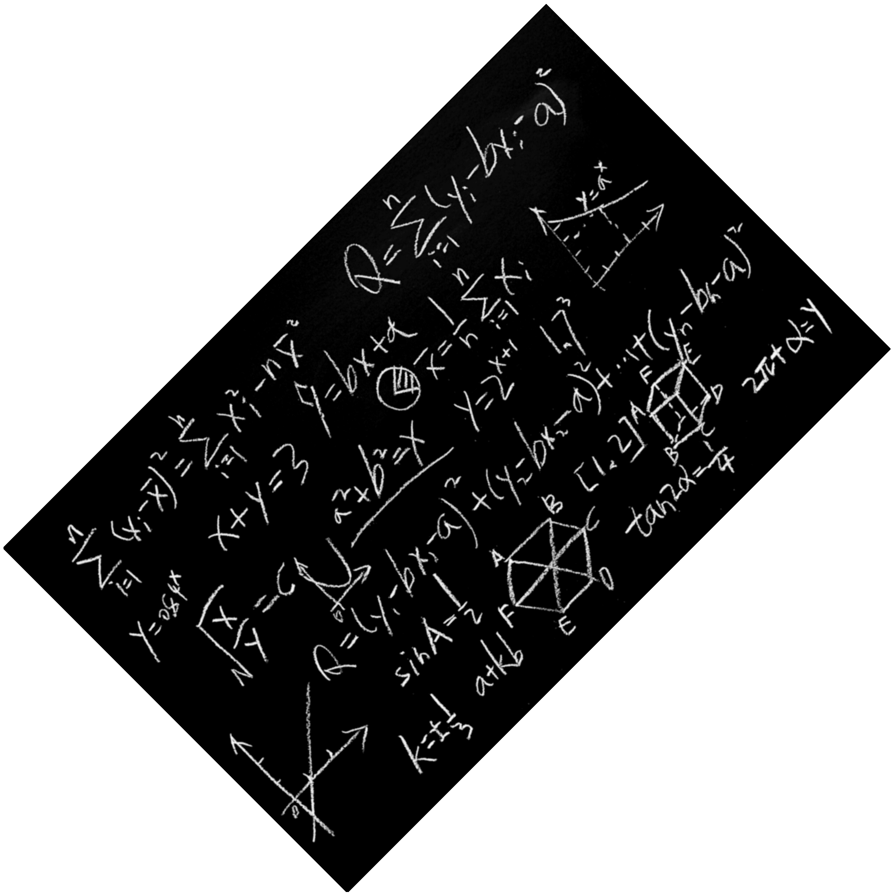

Figure 2: matho equations

10 Bibliography

References

[1] Alcosser, Howard. "Diamond Bar High School." *Internal Accessment: Mathmatical Exploration.* Web, 27 May 2018.

11 MIP

11.1 Mixed Integer Programming

Definition 11.1. (Mixed Integer Programming)
Let $m, n \in \mathbb{N}$, The given matrix $A \in \mathbb{R}^{m\times n}$, vectors $b \in \mathbb{R}^m$, and the vector $c \in \mathbb{R}^n$, and a set $\mathcal{I} \subseteq N = \{1, \ldots, n\}$. the problem

$$\begin{aligned} \text{(MIP)} \quad & c^* = \min c^T x \\ & s.t. \quad Ax \geq b \\ & \qquad\quad x_i \in \mathbb{Z}_{\geq 0} \quad \forall_i \in \mathcal{I} \\ & \qquad\quad x_j \in \mathbb{R}_{\geq 0} \quad \forall_i \in \mathcal{N} \setminus \mathcal{I} \end{aligned}$$

is called *mixedintegerprogram* with the objective function $c^T x$ and constraints $A_i x \geq b_i$ for all $i = 1, \ldots, m$.

A vector $x \in X_{MIP} = \{x \in \mathbb{R}_{\geq}0^n \mid A_x \geq b,\, x_i \in \mathbb{Z}_{\geq 0}\, \forall i \in \mathcal{I}\}$ is called $feasiablesolution$ and X_{MIP} the set of feasible solutions. A feasible x^* is called optimal, if x^* satisfies $c^* = c^T x^*$.
Common special cases of MIPs are *linearprograms* (LPs) for $\mathcal{I} = \emptyset$ and *integerprogram* (IPs) for $\mathcal{I} = N$. Additional, an integer variable bounded by 0 and 1 is called *binaryvariable*. let $\mathcal{B} \subset \mathcal{I}$ denote the set of binary variables. An integer program with $\mathcal{B} = N$ is called *binaryprogram* (BP) or *mixedbinaryprogram* (MBP), if $\mathcal{B} = \mathcal{I} \subsetneq N$.
A lower or dual bound on a MIP can be computed by neglecting the intergrality constraints. the so-obtained problem is called the *LP-relaxation* of the MIP.

Definition 11.2. (LP-relaxation)

Given a MIP as introduced in Definition **??**. The LP-*relaxation* is defined as

$$\begin{aligned} \text{(MIP)} \quad & c^* = \min c^T x \\ s.t. \quad & Ax \geq b \\ & x \in \mathbb{R}^n_{\geq 0} \end{aligned}$$

Analogous to X_{MIP} we can define X_{LP} as the set of feasible solutions of the LP-relaxation. A feasible solution $x^*_{LP} \in X_{LP}$ is called LP-*optimal* if $c^*_{LP} = c^T x^*_{LP}$. In general solving MIPs is NP-hard. One common method for solving MIPs is LP-$basedbranch-and-bound$. This method splits the problem into smaller subproblems, and procedure is repeated on these subproblems. At any point a global upper or primal bound is given by the best known solution, if existent, and a local lower bound or dual bound is given by the respective LP-relaxation.

11.2 Pseudo-Boolean optimization

In the section 2.4 we will present a special kind of a binary problem, a so-called $pseudo{-}Booleanproblem$. For this purpose we introduce the basic definition of a $pseudo-Booleanproblem$ in this section.For more detail we refer to Hammer and Rubin and Boros and Hammer and the references therein. Let us denote by $\mathbb{B} = \{0, 1\}$ the set of binary values and let $N = \{1, \ldots, n\}$ be an index set, Reflecting to Boros and Hammer we consider functions in n binary variables $x_1, x_2 \ldots, x_n$ and denote the binary vector by $(x_1, x_2, \ldots, x_n in \mathbb{B}^n)$. A function $f : \mathbb{B}^n \to \mathbb{R}$ of the form

$$f(x_1, x_2, \ldots, x_n) = \sum_{S \subseteq N} C_S \prod_{i \in S} x_i$$

where $C_s \in \mathbb{R}$ for each $S \subseteq N$, is called $pseudo-Booleanfunction$. see e.g., Hannmer et al. The degree of the function $deg(f)$ is given by the seize of the largest set $S \subseteq N$ which$C_S \neq 0$.A pseudo-Boolean function f is called linear, quadratic, cubic etc. if $deg(f) \leq 1, 2, 3$ etc. repectively. Liu and Truszczynski defined a $pseudo-Booleanconstraint$ as an integer inequality of the form

$$\sum_{i=1}^{n} a_i x_i \geq b$$

with $a_i, bin\mathbb{Z}$ and $xi \in \mathbb{B}$ for all $iin[n]$. A binary problem defined by a pseudo-Boolean objective function and a set of pseudo-Boolean constraints is called $pseudo-Boolean\,optimization\,problem$.