

# Faculty of Science Preparatory Workshop

## A Guide to Success in 1st-year Calculus

Elizabeth Maltais  
Department of Mathematics & Statistics  
University of Ottawa



### Acknowledgements:

Thanks to Dr. Monica Nevins for sharing with me her 2018 workshop presentation, upon which this presentation is based.

# Outline

- ① Studying math in University
- ② Review Questions
- ③ Conclusions

# Outline

① Studying math in University

② Review Questions

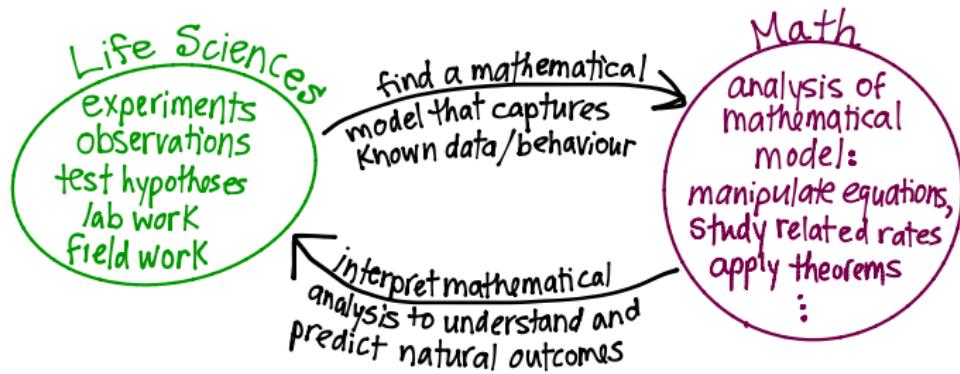
③ Conclusions

# Studying math in University

- Mathematics is a science:
  - Mathematicians research, discover, and push the frontiers of knowledge!
  - mathematical discoveries are made when someone proves new theorems.
- In other sciences, theories are hypothesized and verified using experimental data and the scientific method... and math too!

# Studying math in university

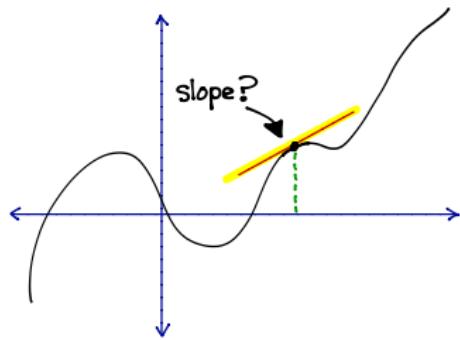
- Mathematics is foundational to all sciences:



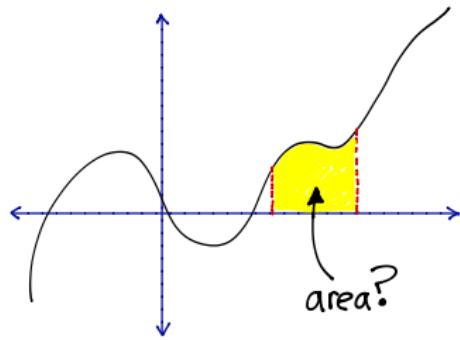
# Studying math in University

- The development of Calculus is one of the most significant scientific advances.

Calculus was developed to solve 2 problems:



Differential  
calculus



Integral  
calculus

# High School      vs.      University

## Topics (in MCV4U)

derivatives of polynomials,  
rational functions,  
exponential functions

## Teaching and Learning

daily classes, with time for  
practicing problems, handwritten  
homework, many quizzes and  
tests

## Topics (in MAT1330)

derivatives of all functions,  
DTDS  
integrals

## Teaching and Learning

2 lectures + 1 DGD per week  
weekly Möbius assignments  
2 midterms + 1 Final exam.

# High School      vs.      University

- student progress closely monitored by teachers
- class participation and "good faith effort" are factors in student grades.
- make-up tests offered for struggling students and tests missed for valid reasons.
- all exam material is covered in class
- high school is mandatory and available for free

- students are expected to be more self-directed
- grades are based solely on submitted works and what students write on their exams
- No makeup tests. If validated, weight of a missed test is moved to the final exam.
- Students may be tested on material they were told to prepare on their own
- University is voluntary and expensive.

\* excerpt from Prof. Joseph Khouri's Math Study Guide.

# How to Succeed

Learning math is like learning music or like training for a sport.

- You need to practice!
- Stay mathematically fit: Do lots of exercises!
- Simply reading the textbook or reviewing lecture notes will not suffice.

# How to Succeed

- challenge yourself:

# How to Succeed

- challenge yourself:  
→ don't just read solutions



# How to Succeed

- challenge yourself:
  - don't just read solutions or try to memorize solutions



# How to Succeed

- challenge yourself:

→ don't just read solutions or try to memorize solutions



→ solve lots of easy problems ✓



# How to Succeed

- challenge yourself:

→ don't just read solutions or try to memorize solutions



→ solve lots of easy problems ✓



then solve some that are more challenging ✓



# How to Succeed

- challenge yourself:

→ don't just read solutions or try to memorize solutions



→ solve lots of easy problems ✓



then solve some that are more challenging ✓



and don't forget to sprinkle in some ✓  
super-crazy-difficult problems too!



They will help you reach the "next level"

# How to Succeed

- Attend all lectures – physically and mentally
- Work regularly (beyond attending lectures)
  - Möbius homework
  - textbook exercises
  - DGD problems
- Seriously study for your midterms!
- ASK for help when you need it

# Where to get help with math

- weekly DGD
- professor's office hours
- visiting the Math Help Centre
- reading the textbook
- using resources available on Brightspace .
- reviewing with the Calculus Readiness Module

# What is "Mobius Assessment" ?

möbius

## Preview

In MapleTA, we write mathematical expressions with calculator syntax. You can check your typesetting with the preview button (looks like a magnifying glass). It is possible to use the symbolic mode to enter formulas (the button with the  $\Sigma$ ), but this is slower, and not as reliable.

Some common rules:

- $a \times b = a * b$  (the shorthand  $ab$  is sometimes accepted);
- $e^x = e \wedge x$ ;
- $\sqrt{a} = \text{sqrt}(a)$  or  $a \wedge (1/2)$  (since  $\sqrt{a} = a^{1/2}$ ) and similarly  $\sqrt[3]{x} = x \wedge (1/3)$ ;
- $|x| = \text{abs}(x)$ .

Don't forget to use parentheses when needed!

Type formulas for the following expressions. Then use the preview button, and "How did I do?" on the right, to verify that your answers are what you wanted. Experiment!

$$\frac{e^x \sin(x)}{2} = \boxed{(e^x) * \sin(x) / 2}$$

$$e^{t/2} = \boxed{e^{(t/2)}}$$

$$\frac{1}{x^2/2} = \boxed{1/(x^2/2)}$$

$$\sqrt[5]{b} = \boxed{b^{(1/5)}}$$

$$|x^2 - x + 2| = \boxed{\text{abs}(x^2 - x + 2)}$$

Grade

How Did I Do?

Close

# What is "Mobius Assessment" ?

möbius

## Preview

In MapleTA, we write mathematical expressions with calculator syntax. You can check your typesetting with the preview button (looks like a magnifying glass). It is possible to use the symbolic mode to enter formulas (the button with the  $\Sigma$ ), but this is slower, and not as reliable.

Some common rules:

- $a \times b = a * b$  (the shorthand  $ab$  is sometimes accepted);
- $e^x = e \wedge x$ ;
- $\sqrt{a} = \text{sqrt}(a)$  or  $a \wedge (1/2)$  (since  $\sqrt{a} = a^{1/2}$ ) and similarly  $\sqrt[3]{x} = x \wedge (1/3)$ ;
- $|x| = \text{abs}(x)$ .

Don't forget to use parentheses when needed!

Type formulas for the following expressions. Then use the preview button, and "How did I do?" on the right, to verify that your answers are what you wanted. Experiment!

$\frac{e^x \sin(x)}{2} = (e^x) * \sin(x) / 2$     NOT  $e^{1+t}/2$  ( $= \frac{e^t}{2}$ )

$e^{t/2} = e^{(t/2)}$    

$\frac{1}{x^2/2} = 1/(x^2/2)$     OR  $2/(x^2)$

$\sqrt[5]{b} = b^{(1/5)}$    

$|x^2 - x + 2| = \text{abs}(x^2 - x + 2)$    

Grade

How Did I Do?

Close

# \*Some advice from your peers

- \* taken from course evaluations for MAT1341  
(thanks to prof. Barry Jessup and Prof. Monica Nevins!)
- "ask questions..."
- "don't try to cram..."
- "allow lots, I mean lots of time for studying..."
- "don't study this course while watching a hockey game..."
- "the course moves along quickly. Taking 20 minutes the night before a class to read over the material makes the course substantially easier..."
- "no matter how bored you are, attend all classes..."

# \*Some advice from your peers

- "missing one lecture makes the next seem like it's in a foreign language..."
- "read one section and then do the exercises before going on to the next one..."
- "wear a sweater and a jacket to class, they make a good pillow and blanket..."
- "don't wait until the last moment to start studying or to start the suggested exercises..."
- "nine beers before the midterm is just too much..."

# Review Questions

- Let's refresh our math skills with a quiz !

10 multiple choice questions

→ Math is a language.

→ our quiz will highlight some of the most common misunderstandings.

# Review Questions

- Let's refresh our math skills with a quiz !

10 multiple choice questions

INSTRUCTIONS:

- for each question, take a few minutes to think about your answer.
- Then vote using your colour cards.

# Question 0

What is the meaning of the expression  
 $p(ax)$  ?

Yellow Card

$p$  times  $a$  times  $x$

Blue Card

function  $p$  evaluated  
at  $a$  times  $x$

# Question 0.5

What is the meaning of the expression  
 $(1,2)$  ?

Yellow Card

the point in the  
Cartesian plane  
with coordinates  
 $(1,2)$

Blue Card

the open interval  
of real numbers  $x$   
such that  $1 < x < 2$

# Question 1 True or false ?

$$\cos(x) = \cos x$$

Yellow Card

True

Blue Card

False

## Question 2 True or false ?

$$\cos(x + 1) = \cos x + 1$$

Yellow Card

True

Blue Card

False

# Question 3

Which of the following are ALWAYS TRUE ?

Yellow Card

$$\sqrt{x^2+4} = x+2$$

Blue Card

$$\ln(x+y) = \ln(x) + \ln(y)$$

# Question 4

Which of the following simplifications are **CORRECT** ?

Yellow Card

$$\frac{x(x+2) + 1}{x(x+1)} = \cancel{\frac{x(x+2) + 1}{x(x+1)}} \\ = \frac{(x+2) + 1}{x+1}$$

Blue Card

$$\frac{\cos(2\pi x)}{x} = \cancel{\frac{\cos(2\pi x)}{x}} \\ = \cos(2\pi)$$

# Question 5

For which of the following values of  $x$  is

$$|x| = -x \quad ?$$

Yellow Card

$$x = -3$$

Blue Card

$$x = \pi$$

# Question 6

When is the following equation true ?

$$\sqrt{x^2 + 4x + 4} = x + 2$$

Yellow Card

for all  $x$

Blue Card

for  $x \geq -2$

# Question 7

Given  $p = -\log_2(k)$ ,

what is  $k$  in terms of  $p$  ?

Yellow Card

$$k = 2^{-p}$$

Blue Card

$$k = -2^p$$

# Question 8

which of the following are equal to  
 $(\cos x)^2$  ?

Yellow Card

$$\cos x^2$$

Blue Card

$$\cos^2 x$$

# Question 9

which of the following are equal to  
 $\sin^{-1} x$  ?

Yellow Card

$$\csc x$$

Blue Card

$$\frac{1}{\sin x}$$

# Question 10

What is the value of  $\sin(x)$  if  $x = \frac{\pi}{6}$  ?

Yellow Card

0.009138

Blue Card

$\frac{1}{2}$

# Outline

- ① Studying math in University
- ② Review Questions
- ③ Conclusions

# Conclusions

- Proper use and interpretation of notation is crucial!
- Simplifying is not always as simple as we wish!
- Absolute value is a function!
- Love logs!
- Don't get confused by trig functions, inverse trig functions, and all their wild notational conventions!
- For angle measure, degrees are obsolete; use radians!

# Conclusions

- Math is a science and it's foundational to all sciences!
- Practice is Key!  
To be mathematically fit, you need to do lots of exercise on a regular basis!  
Excellence is not an act, but a habit.

Good luck and have a great year!