MAT 133Y COURSE OUTLINE AND HOMEWORK PROBLEMS, 2017-2018

General remarks:

- **NB: The one and only calculator you will be permitted to use on quizzes, tests, and exams is the TI-30XIIS. NO OTHER CALCULATOR OF ANY KIND WILL BE PERMITTED.**

- The following course description for MAT 133Y is **tentative;** some material **may** be added or dropped as the course develops — depending on available time.

- References are to Chapters or Sections of books indicated by:

  HP: *Introductory Mathematical Analysis*, 13th ed., by Haeussler and Paul

  SM: *Supplementary Material* and

  HQA: *Harder Questions and Answers* by members of the Math Department and available on the MAT133Y website

- The problems included in the Course Outline represent your homework; you should work through these problems as the material is covered in lectures. *Chapter section assignments are not of equal length! Some will take much more work on your part than others.* Precisely which sections you will be responsible for (on Quizzes and Tests) will posted on the 133 website as the year progresses. *It is your responsibility to keep abreast of these announcements!*

- You should also be aware that the Quizzes, which will be written in Tutorial Hour, will be based on the homework.

- It is suggested that you try the Review Problems at the end of the chapters in HP, although these are not included in the assigned homework.

- **HQA:** You will notice that the homework includes problems from the Harder Questions and Solutions available on the website. These problems tend to be much harder than the ones from HP and you are strongly encouraged to try them yourself before using the solutions that come with them. The problems are divided by chapters, as indicated in the Table of Contents of HQA. You can also ask about these harder problems in tutorial.

- **Old Term Tests and Exams:** On the 133 website you will find old tests and exams with solutions. It is highly advisable that you try the questions found here, especially when preparing for tests and the exam. They will let you know what level of difficulty to expect.

<u>Course Outline</u>

FINANCIAL MATH:

A Note About Calculations: We expect you to use your calculator for all calculations — no tables will be supplied — and to use as many decimal places as your calculator offers for all intermediate calculations, and to round off only the final answer to the desired number of decimal places. The only occasion on which *approximation* may be required is when solving some financial equations for the interest rate i, or the number of periods n. The only approximation method we expect you to know is *trial and error*, cf Example 3, Section 2 of SM. Later on, we will also use Newton's Method (HP 12.6).

References: HP Chapter 1, Sections 1.5 (Summation of Geometric Series–used in financial calculations below) and Chapter 4 (Review of logs and exponentials)

References: HP Chapter 5; SM Sections 1 and 2.

Compound Interest HP Section 5.1, Exercises #1, 3, 5, 7, 9, 10, 11, 14, 17, 18, 19, 21, 24, 25, 26, 27, 28

Present Value HP Section 5.2, Exercises #2, 3, 5, 7, 9, 11, 13, 15, 17, 18, 19, 21, 22, 23, 24, 25; HQA #1

Continuous Compounding HP Section 5.3, Exercises #1, 3, 5, 7, 11, 13, 15, 17, 19, 21

Annuities HP Section 5.4, Exercises #8, 10, 13, 14, 17, 18, 19, 20, 21, 22, 24, 25, 26, 33, 34, 35

Amortization HP Section 5.5, Exercises #1, 2, 3, 5, 9, 11, 12, 13, 16, 21, 22; HQA #2-9 *Avoid problems in HP dealing with mortgages. They do not correspond to Canadian mortgages which we take up in SM Section 1 below.*

Perpetuities HP Section 5.6, Exercises #5, 6

Mortgages SM Section 1, Exercises #1, 2, 3, 4

Bonds SM Section 2, Exercises #1, 2, 6, 8, 9; HQA #10-11 *The Explore and Extend Section on US Treasury Securities at the end of Chapter 5 of HP has inaccurate terminology; you would be well-advised to avoid it.*

MATRIX ALGEBRA:

References: HP Chapter 6

Matrices HP Section 6.1, Exercises #1, 11, 12, 14, 15, 18, 19, 26, 28, 31, 33 ; HQA #1

Matrix Arithmetic HP Section 6.2, Exercises #3, 9, 11, 12, 18, 20, 23, 27, 28, 32, 33, 34, 37, 39, 47
HP Section 6.3, Exercises #5, 13, 14, 15, 19, 23, 25, 29, 39, 44, 46, 48, 57, 58, 61, 62, 63, 64, 65, 66, 67, 69 ; HQA #2-5

Solving Systems by Row Reduction HP Section 6.4, Exercises #21, 22, 23, 25, 27, 29, 31, 33

HP Section 6.5, Exercises #1, 2, 4, 7, 8, 10, 11, 20, 24; HQA #6-10

Inverses HP Section 6.6, Exercises #5, 6, 7, 11, 12, 17, 19, 28, 29, 30, 33, 34, 37, 39, 41, 43, 44; HQA #11-13

by reduction. That is what is expected on tests and exams.) ; HQA #14

LIMITS AND CONTINUITY:

References: HP Chapter 10

Limits HP Section 10.1, Exercises #13, 16, 21, 22, 24, 25, 28, 31, 35, 43, 44; HQA #1-3

HP Section 10.2, Exercises #1, 2, 5, 7, 9, 11, 13, 14, 19, 23, 24, 29, 31, 32, 41, 42, 48, 49, 52, 53, 54, 57, 59, 62, 64; HQA #4-7

Continuity HP Section 10.3, Exercises #9, 10, 11, 12, 23, 25, 27, 29, 31, 32, 33, 36, 37; HQA #8-11

Continuity and Inequalities HP Section 10.4, Exercises #2, 5, 6, 9, 11, 14, 15, 17, 22, 24, 25, 27, 30

THE DERIVATIVE:

References: HP Chapters 11 and 12; SM Section 6. Chapter 11 should be mostly review of high school.

The Derivative HP Section 11.1, Exercises #13, 15, 20, 22, 25, 27, 29

HP Section 11.2, Exercises #11, 29, 34, 44, 48, 64, 69, 76, 78, 80, 85, 90 ; HQA #1-4

Rate of Change HP Section 11.3, Exercises #17, 20, 21, 26, 27, 30, 31, 38, 41, 43, 45, 46, 47; HQA #5-6

Product and Quotient Rules HP Section 11.4, Exercises #12, 16, 25, 37, 40, 53, 54, 58, 67, 69, 71, 72, 76, 77, 78 ; HQA #7-9

Chain Rule HP Section 11.5, Exercises #5, 6, 13, 15, 21, 30, 32, 41, 43, 45, 49, 53, 54, 56, 61, 63, 65, 67, 69, 70, 71, 73, 74, 79, 80, 81, 82, 84; HQA #10-13

Differentiating Logarithms Review HP Chapter 4 again if necessary; HP Section 12.1, Exercises #3, 7, 9, 11, 12, 15, 19, 21, 23, 27, 33, 36, 39, 44, 45, 48, 50, 51, 54; HQA #1-2

Differentiating Exponentials HP Section 12.2, Exercises #7, 9, 11, 14, 15, 17, 21, 23, 27, 32, 35, 37, 39, 43, 45, 46, 47, 50, 52; HQA #3-7

Implicit Differentiation HP Section 12.4, Exercises #3, 5, 7, 9, 11, 13, 15, 16, 18, 19, 20, 21, 23, 25, 26, 29, 31, 33, 39, 40; HQA #11-16

Logarithmic Differentiation HP Section 12.5, Exercises #3, 5, 7, 10, 13, 15, 19, 22, 25, 26, 27, 28, 29, 30; HQA #17-18

Higher Order Derivatives HP Section 12.7, Exercises #5, 7, 9, 11, 13, 15, 19, 21, 23, 27, 30, 32, 34, 37, 39, 40; HQA #22-24

Elasticity of Demand HP Section 12.3, Exercises #3, 5, 7, 9, 13, 15, 17, 18, 20, 21, 23, 24, 25, 26, 27, 28, 29; HQA #8-10

Newton's Method HP Section 12.6, Exercises #3, 4, 7, 8, 15, 18, 19; HQA #19-21

L'Hôpital's Rule SM Section 6, Exercises #1 through 10

MORE APPLICATIONS OF THE DERIVATIVE:

References: HP Chapter 13 and 14.1; SM Sections 3 and 4

Relative Extrema HP Section 13.1, Exercises #14, 15, 17, 41, 46, 48, 55, 60, 62, 64, 65, 68, 69, 74, 75; HQA #1-4

Absolute Extrema on a Closed Interval HP Section 13.2, Exercises #2, 4, 6, 7, 12; HQA #5-6

Concavity HP Section 13.3, Exercises #14, 23, 25, 30, 31, 50, 56, 57, 59, 61, 64, 68, 70, 73; HQA #7-10

Second Derivative Test HP Section 13.4, Exercises #2, 4, 6, 8, 13; HQA #11-12

Asymptotes HP Section 13.5, Exercises #3, 6, 8, 10, 17, 20, 23, 24, 29, 30, 31, 33, 35, 41, 44, 46, 47, 48, 49, 50, 52; 55-57 find asymptotes only; HQA #13-16

Extremum Word Problems HP Section 13.6, Exercises #3, 5, 7, 11, 13, 18, 19, 20, 21, 24, 27, 33, 34, 38, 41, 42; HQA #17-20
SM Sections 3 and 4 below are examples only; you are not expected to remember the results. The exercises are fun, and difficult at the end.

Differentials HP Section 14.1, Exercises #5, 10, 14, 22, 25, 35, 38, 45, 46; HQA Problems for HP Chapter 13 #21-24

INTEGRATION:

References: HP Chapters 14 and 15

The Indefinite Integral, Antidifferentiation, and Substitution HP Section 14.2, Exercises #9, 15, 19, 23, 27, 31, 35, 43, 45, 48, 49, 52, 53, 54, 55 ; HQA #1-2
HP Section 14.3, Exercises #2, 3, 6, 11, 15, 19, 20, 21, 22; HQA #3-4
HP Section 14.4, Exercises #8, 10, 13, 15, 21, 24, 28, 32, 39, 41, 44, 47, 50, 52, 56, 60, 62, 63, 65, 69, 70, 72, 75, 77, 79, 82, 84, 86, 88; HQA #5-7
HP Section 14.5, Exercises #4, 5, 6, 8, 16, 17, 19, 20, 23, 24, 27, 29, 30, 31, 35, 36, 40, 41, 43, 45, 47, 48, 50, 52, 56, 59, 61, 63, 65, 66, 68, 69, 70; HQA #8-10

Summation Notation HP Section 1.5 **really 1.5**, Exercises # 6, 9, 13, 14, 15, 19, 21, 23, 25; HQA #11-12

The Definite Integral HP Section 14.6, Exercises #3, 7, 8, 11, 19, 21, 22, 23; HQA #13-15

The Fundamental Theorem of Calculus HP Section 14.7, Exercises #7, 12, 15, 16, 18, 21, 28, 30, 33, 35, 36, 39, 42, 43, 44, 47, 48, 49, 52, 53, 55, 57, 59, 61, 66, 67; HQA #16-19

Area HP Section 14.9, Exercises #6, 11, 12, 18, 23, 32, 35, 36, 37, 41, 44, 47, 48, 54, 55, 59, 61, 63; HQA #24-27

Consumers' and Producers' Surplus HP Section 14.10, Exercises #1, 3, 6, 7, 8, 9, 10; HQA #31

Integration by Parts HP Section 15.1, Exercises #3, 6, 7, 17, 18, 20, 21, 22, 23, 24, 25, 26, 27, 28, 30, 31, 32, 33, 34, 35, 36, 37 ; HQA #1-5

Partial Fractions HP Section 15.2, Exercises #3, 4, 9, 11, 13, 15, 19, 28, 30, 31, 32; HQA #6-8
(In this section, the subsections "Distinct Irreducible Quadratic Factors" and "Repeated Irreducible Quadratic Factors" will be omitted, but see Example 5,pg. 699.)

Integration *without* **Tables and Continuous Cash Flows** HP Section 15.3, Exercises #5, 6, 9, 10, 13, 16, 19, 21, 22, 25, 27, 29, 31, 34, 37, #39–56, #59, 60, 61, 62
(Don't use tables. Do the integrals by the techniques you have learned. Much harder, but good exercise, are problems #20, 24 and other unassigned problems with square roots.)

Average Values HP Section 15.4, Exercises # 3, 5, 7, 9, 10, 11, 13; HQA #9-10

Improper Integrals HP Section 15.7, Exercises #1, 2, 3, 5, 7, 9, 11, 13, 14, 15, 17, 18, 19; HQA #17-21

Differential Equations: Separation of Variables HP Section 15.5, Exercises #2, 3, 5, 7, 8, 11, 13, 17, 19, 20, 21, 22, 25, 26, 27, 35, 36, 37; HQA #11-13
HP Section 15.6, Exercises #1, 2, 3, 5, 9, 11, 12, 13; HQA #14-16

CALCULUS OF SEVERAL VARIABLES:

References: HP Chapter 2.8 and HP Chapter 17

Functions of Several Variables HP Section 2.8, Exercises #4, 5, 7, 11, 12, 15, 17, 21, 25, 27, 28; HQA #1-2

Partial Derivatives HP Section 17.1, Exercises #2, 5, 7, 8, 22, 24, 27, 28, 29, 30, 31, 34, 35, 36, 37, 38, 39; HQA #3-5
HP Section 17.2, Exercises #1, 3, 4, 6, 7, 9, 10, 12, 13, 16, 18, 19, 20, 22, 23, 25; HQA #6-9

Implicit Partial Differentiation HP Section 17.3, Exercises #2, 3, 7, 8, 10, 16, 19, 20, 21; HQA #10-13

Higher Order Partials HP Section 17.4, Exercises #1, 3, 5, 7, 9, 12, 14, 18, 20, 21, 22, 23, 24; HQA #14-17

Chain Rule HP Section 17.5, Exercises #1, 3, 4, 5, 6, 9, 11, 15, 16, 17, 18, 19, 20; HQA #18-21

Finding and Classifying Critical Points for Two Variables HP Section 17.6, Exercises #2, 4, 6, 9, 11, 14, 16, 17, 20, 23, 25, 28, 29, 30, 33, 35, 36, 37; HQA #22-25

Lagrange Multipliers HP Section 17.7, Exercises #1, 3, 5, 7, 9, 12, #13-24 ; HQA #26-29