University of Ottawa
MAT 2384 Midterm Exam Version A

June 17, 2020. Duration: 80 Minutes.
Instructor: Robert Smith?

Family Name:_____ First Name:_____

Take your time to read the entire paper before you begin to write, and read each question carefully. Remember that certain questions are worth more points than others. Make a note of the questions that you feel confident you can do, and then do those first: you do not have to proceed through the paper in the order given.

- You have 80 minutes to complete this exam. Complete this version if your student number is EVEN.
- This is an open-book exam, so you may consult any source.
- You may print out this exam and write on it or just write on your own blank paper. If you do the latter, please make sure you copy the question correctly.
- When you are finished, scan the pages into a single document and upload it in the "Assignments" tab on Brightspace (the same place you found this). You may use a scanner or your phone or any other device.
- Save the exam in the format "FirstnameLastnameXXX.pdf" where XXX is the last three digits of your student number. Midterms not in this format will not be considered valid.
- You have an extra 15 minutes to upload the exam. Please do not wait until the last minute to do this.
- The correct answer requires justification written legibly and logically: you must convince me that you know why your solution is correct.
- Where it is possible to check your work, do so.
- Good luck!

Student number:_____, Total marks: _____ out of 32

Problem	1	2	3	4	5	6	7
Marks							

You may complete any five of the first six questions, but you must answer Question 7. Indicate clearly which question you are not answering.

Question 1. [5 points] Explain some of the similarities and some of the differences between using a Laplace transform and using any other method to solve a differential equation. Give a first-order example of each. (Note: You must use full sentences. Only write on this page.)

Question 2. [5 points] Use a Laplace transform to solve $y'' - y = \cos t + \delta\left(t - \frac{\pi}{2}\right)$, $y(0) = 0$, $y'(0) = 5$.

Question 3. [5 points] Use a Laplace transform to solve $y'' - 6y' + 13y = 0$, $y(0) = 3$, $y'(0) = 2$.

Question 4. [5 points] Solve the initial-value problem

$$y^3 - \frac{y^2}{x} + \left(\frac{3}{2}xy^2 - 2y\right)y' = 0 \qquad y(1) = -1.$$

Question 5. [5 points] Solve the initial-value problem

$$t^8 \frac{dQ}{dt} + (3 - 4t^7)Q = 0, \qquad Q(1) = 1$$

Question 6. [5 points] Use convolution to solve $6y' + y = \cosh 7t$, $y(0) = 0$.

Question 7. [7 points] Consider the following set of data:

x	0.5	1	2
y	0.462117	0.761594	0.96402

a) Write down the Lagrange polynomial of degree 2. Do not simplify.
b) Use your Lagrange polynomial to estimate the y value when $x = 1.4$.
c) To how many decimal places is this accurate? (Hint: $-0.4 \leq f''' \leq 1.2$.)