UNIVERSITY OF REGINA
Department of Mathematics and Statistics

Calculus II
Mathematics 111

Final Exam, Winter 2017 (April 22nd)

Time: 3 hours **Full Name:**_____

Pages: 10 **Student Number:**_____

Instructor: (check one)

- ☐ Chun-Hua Guo (111-001)
- ☐ Martin Argerami (111-002)
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- ☐ Robert Petry (111-C01/C02)
- ☐ Iqbal Husain (111-L01)

INSTRUCTIONS

1. **Do not** open the exam until you are instructed to do so.
2. **All work and answers** are to be placed **on the right side pages of this exam** below the question. If you require more space for an answer, work on the left side (facing) page and **indicate** on the question there is work to be found there.
3. The left side pages are to be used as **scrap paper**. They are provided for **rough work and checking only** and will not be graded unless you expressly indicate there is work to be found there.
4. Place final answers in **blanks at right** when provided.
5. To receive full credit for correct answers it is necessary to **show all work**.
6. The exam has a total of **100 marks**. The marks allocated for each question are found **to the left** of the question.
7. **Do not** remove staples or any pages from the exam.
8. **No electronic devices (including calculators)** are allowed during this exam.

For instructor use only:

Page:	2	3	4	5	6	7	8	10	Total
Marks:	16	10	14	14	12	8	16	10	100
Score:									

Marks

(5) 1. If $f(x) = 3e^{x\ln(4)}$ determine the inverse $f^{-1}(x)$ and calculate $f^{-1}(12)$.

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2. Find the derivatives of the following functions.

(5) (a) $y = \log_5(e^x) + e^{(\cos^{-1} x)}$

(6) (b) $y = (\tan x)^{\tan^{-1} x}$ (Use logarithmic differentiation.)

(10) 3. Find the limits.

(a) $\lim_{x \to 0^+} \frac{x^2}{x - \ln(1+x)}$ Answer:_____

(b) $\lim_{x \to 0} \left(\frac{1}{e^x - 1} - \frac{1}{x} \right)$ Answer:_____

4. Evaluate the given integrals. (For definite integrals give exact values for your answers.)

(7) (a) $\int_0^{2\pi} (4x+1)\sin(3x)\,dx$

(7) (b) $\int \frac{6x^2+3x+2}{x^3+x}dx$

(7) (c) $\int \tan(3x)\,\sec^6(3x)\,dx$

(7) (d) $\int \frac{x^2}{(4-x^2)^{3/2}}\,dx$

(6) 5. Determine if the following integral converges. convergent / divergent
(Circle your answer. Hint: Consider a comparison integral.)

$$\int_2^\infty \frac{1}{\sqrt{x^2 - x}} dx$$

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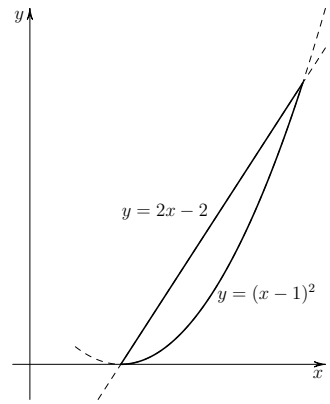
(6) 6. Determine the Maclaurin series of $f(x) = 3^x$ and find its radius of convergence R.

$R =$ _____

(8) 7. The region $\mathcal{R}$ bounded by the curves $y = 2x - 2$ and $y = (x-1)^2$ is shown.
Setup (but **do not evaluate**) a definite integral for each of the following volumes.
(You do not need to simplify your integrands.)



(a) The volume generated by revolving region $\mathcal{R}$ about the y-axis.

(b) The volume generated by revolving region $\mathcal{R}$ about the x-axis.

(16) 8. Determine if the following series converge or diverge, circling your answer at right. Clearly state the test used and show the application of the test. Each is worth 4 marks.

(a) $\displaystyle\sum_{n=1}^{\infty} \frac{\sqrt{3+n}}{n+1}$ convergent / divergent

(b) $\displaystyle\sum_{n=2}^{\infty} \frac{1}{n(\ln n)^2}$ convergent / divergent

(c) $\displaystyle\sum_{n=1}^{\infty} \frac{1}{2^n n^2}$ convergent / divergent

(d) $\displaystyle\sum_{n=1}^{\infty} \ln\left(\frac{3n^2}{8n^2+2}\right)$ convergent / divergent

(10) 9. Find the radius of convergence R and the interval of convergence of the power series

$$\sum_{n=2}^{\infty} \frac{n}{n^2-1}(x-2)^n$$

(Remember to check for convergence/divergence at the endpoints of your interval if it is of finite length.)

$R =$ _____

Interval = _____