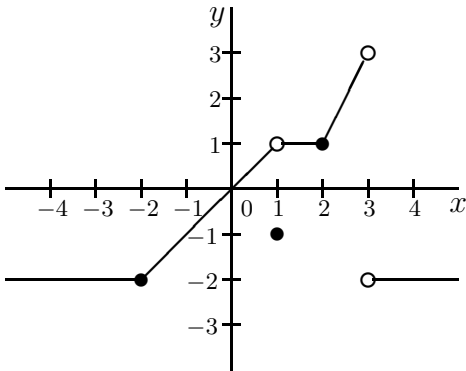


PART A - Multiple Choice (20 marks)

Circle your answer in each question below **and** mark it on the (scantron) answer sheet. Code as you go. Extra time will NOT be given for coding answers at the end of the exam. Be advised that ONLY THE SCANTRON CARD WILL BE MARKED IN THIS SECTION, but only this question paper will be returned to you.

In the questions in Part A, if the quantity you are asked to find is not defined or does not exist, select DNE.

Use the graph of  $y = f(x)$ , provided below, to answer questions A1 to A5.



1  
mark

A1. Find  $f(1)$ , if it exists.

A: $-1$	B: $0$	C: $1$	D: $2$	E: DNE
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1  
mark

A2. Find  $\lim_{x \rightarrow 3^-} f(x)$ , if it exists.

A: $-2$	B: $-1$	C: $1$	D: $3$	E: DNE
---------	---------	--------	--------	--------

1  
mark

A3. Find  $\lim_{x \rightarrow 2} f(x)$ , if it exists.

A: $-2$	B: $0$	C: $1$	D: $2$	E: DNE
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1  
mark

A4. Find all  $x$ -values at which  $f$  is discontinuous.

A: $x = 3$ only	B: $x = 1$ and $x = 3$ only
C: $x = 1, x = 2$ and $x = 3$ only	D: $x = -2, x = 1, x = 2$ and $x = 3$
E: $f$ is continuous everywhere	

1  
mark

A5. What is the range of  $f$ ?

A: $(-\infty, \infty)$	B: $(-\infty, 3) \cup (3, \infty)$	C: $(-\infty, -2] \cup [3, \infty)$	D: $[-2, 3]$	E: $[-2, 3)$
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Use the following function  $f$  to answer questions A6 to A8.

$$f(x) = \begin{cases} x - 3 & \text{if } x < 2 \\ 2 - x^2 & \text{if } x \geq 2 \end{cases}$$

1  
mark

A6. Find  $\lim_{x \rightarrow 2^-} f(x)$ , if it exists.

A: $-2$	B: $-1$	C: $0$	D: $1$	E: DNE
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1  
mark

A7. Find  $\lim_{x \rightarrow 2^+} f(x)$ , if it exists.

A: $-2$	B: $-1$	C: $0$	D: $1$	E: DNE
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1  
mark

A8. Is  $f$  continuous at  $x = 2$ ?

A: Yes	B: No	C: Cannot be determined
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Use the following functions to answer questions A9 to A11.

Let  $f(x) = \sqrt{x + 2}$  and  $g(x) = x^2 - 1$ .

1  
mark

A9. If  $h = \frac{f}{g}$ , what is the domain of  $h$ ?

A: $(-\infty, \infty)$	B: $[-2, \infty)$	C: all $x \neq \pm 1$
D: $(-2, 1) \cup (1, \infty)$	E: $[-2, -1) \cup (-1, 1) \cup (1, \infty)$	

1  
mark

A10. If  $h = f \circ g$ , find  $h(x)$ .

A: $h(x) = x + 1$	B: $h(x) = x - 3$	C: $h(x) = \sqrt{x^2 - 1}$	D: $h(x) = \sqrt{x^2 + 1}$	E: DNE
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1  
mark

A11. If  $h = g \circ f$ , find  $h(3)$ .

A: $\sqrt{5} - 1$	B: $\sqrt{6}$	C: $4$	D: $8$	E: DNE
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1  
mark

A12. Find  $\lim_{x \rightarrow 1} \frac{x^2 + x - 2}{x - 1}$ , if it exists.

A: $0$	B: $3$	C: $-1$	D: $1$	E: DNE
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1A13. Find  $\lim_{x \rightarrow 2} \frac{4 - 2x}{x + 1}$ , if it exists.

mark

A: 0	B: 3	C: $\frac{1}{3}$	D: 1	E: DNE
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1A14. Find  $\lim_{x \rightarrow -\infty} \frac{2}{x}$ , if it exists.

mark

A: 0	B: 2	C: $\frac{1}{2}$	D: $-1$	E: DNE
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1A15. Find  $\lim_{x \rightarrow \infty} \frac{3x^2 - 1}{5x^2 + x + 6}$ , if it exists.

mark

A: 0	B: $\frac{3}{5}$	C: $-\frac{1}{6}$	D: 1	E: DNE
------	------------------	-------------------	------	--------

1A16. If  $f(x) = x^2 - \sqrt{x^3} + x - 7$ , what is the slope of the tangent line to  $y = f(x)$  at the point with  $x = 1$ ?

mark

A: $-6$	B: $\frac{3}{2}$	C: 1	D: $3 - \sqrt{3}$	E: DNE
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Use the following information for questions A17 to A19.

$f$  and  $g$  are differentiable functions and it is known that  $f(1) = 2, f'(1) = 3, g(1) = 1$  and  $g'(1) = 2$  and also that  $f(2) = 4, f'(2) = -2, g(2) = 5$  and  $g'(2) = -1$ .

1A17. If  $h = fg$ , find  $h'(1)$ .

mark

A: 1	B: 2	C: 6	D: 7	E: DNE
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1A18. If  $h = \frac{f}{g}$ , find  $h'(1)$ .

mark

A: $-1$	B: 1	C: $\frac{3}{2}$	D: 2	E: DNE
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1A19. If  $h = f \circ g$ , find  $h'(1)$ .

mark

A: $-2$	B: $-1$	C: 3	D: 6	E: DNE
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1A20. If  $f(x) = x^4 - x^{5/2} + 2x$ , find  $f''(x)$ .

mark

A: $x^4 - x^{5/2} + 2x$	B: $4x^3 - \frac{5}{2}x^{3/2} + 2$	C: $12x^2 - \frac{15}{4}x^{1/2}$	D: $4x^2 - \frac{5}{2}x^{1/2} + \frac{2}{x}$	E: DNE
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**PART B (30 marks)**

**NOTE: SHOW ALL YOUR WORK FOR ALL QUESTIONS.**

*8 marks* B1. On a small planet in a galaxy far, far away, a ball is dropped from a height of 50 metres. The height of the ball, in metres,  $t$  seconds after it is dropped is given by  $s(t) = 50 - 2t^2$ .

(a) How long does it take for the ball to hit the surface of the planet?

(b) What is the average velocity of the ball from time  $t = 1$  to time  $t = 4$ ?

(c) What is the velocity of the ball at time  $t = 2$ ?

(d) Find  $a(t)$ , the function giving the acceleration of the ball  $t$  seconds after it is dropped.

- 7 marks* B2. Consider the function  $f(x) = x^2 - 3x + 2$ .
- (a) Find all  $x$ -values at which the graph of  $y = f(x)$  crosses the  $x$ -axis.

- (b) At what value of  $x$  does the graph of  $y = f(x)$  have a horizontal tangent line?

- (c) Find an equation of the tangent line to the curve  $y = f(x)$  at the point  $(-1, 6)$ .

*9 marks* B3. Find the derivative of each of the following functions. **DO NOT SIMPLIFY your answer.**

(a)  $f(x) = x^4 - \frac{3}{x^2} + 5$

(b)  $f(x) = (x^3 - 3x + 4)(x^2 + 2x + 1)$

(c)  $f(x) = \frac{x^2 - 1}{3x + 5}$

(d)  $f(x) = (x + \sqrt{x})^5$

*3* marks B4. Consider the function  $f(x) = x^2$ .

(a) Find  $f(x + h)$ .

(b) Use the **definition** of the derivative to show that  $f'(x) = 2x$ . (Hint: You've already done the first step of the 4-step process.)

*3* marks B5. If  $f(x) = (x^2 + 3x + 4)^2$ , find  $f''(x)$ . **DO NOT SIMPLIFY your answer.**

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Instructor's Name (**Print**)

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Student's Name (**Print**)

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Student's Signature

THE UNIVERSITY OF WESTERN ONTARIO  
LONDON CANADA  
DEPARTMENT OF MATHEMATICS

**Mathematics 012a Test 1**

Friday, October 12, 2007

**Code 111**

7:00 p.m. - 8:30 p.m.

INSTRUCTIONS

1. There are **two parts** to this exam:  
**PART A** (20 marks) in multiple choice format and  
**PART B** (30 marks) in show your work format.
2. Do not unstaple the booklet. Questions are printed on both sides of the paper, they begin on Page 1 and continue to Page 7. There are 20 questions in Part A and 5 questions in Part B.
3. Use the (scantron) answer sheet for Part A. Fill in the top of the answer sheet completely. You must both *print* and *code* your student number and exam code (111 or 222) on the answer sheet. Mark your answers to all questions (1-20) in the left columns of the (scantron) answer sheet and circle the answer on the exam (question) paper.
4. Exam paper, (scantron) answer sheet and all scrap paper must be handed in at the end of the exam!
5. In Part B, answer all questions in the space provided, and show all your work unless otherwise instructed.
6. CALCULATORS ARE NOT PERMITTED.
7. TOTAL MARKS = 50.
8. Clearly fill in the top of this page. Circle your section in the list below.

001 V. Olds  
002 S. Chebolu  
570KC S. Camiletti



Student Number (**Print**)

Student's Name (**Print**)

FOR GRADING ONLY

PAGE	MARK
1–3	
4	
5	
6	
7	
TOTAL	