

**MATH 151**  
**Midterm 1, October 5, 2005**

Last Name:	
First Name:	
SFU Student ID nr:	
Section Instructor:	N. Bruin / R. Choksi / R. Pyke

1. DO NOT LIFT UP THE COVER PAGE UNTIL INSTRUCTED.
2. Circle your instructor. If you don't, you lose a mark.
3. This test is comprised of 8 pages.
4. Once the test begins, please check that all pages are intact.
5. Do ALL questions.
6. Clearly explain your answer. No credit will be given for just writing down the answer.
7. If the answer space provided is not sufficient, write your answer on the back of the previous page. Clearly mark the question number.
8. Ordinary Scientific Calculators ONLY are allowed.  
NO GRAPHING CALCULATORS ALLOWED.
9. The test is out of 30 points.
10. The duration of the test is 50 minutes.
11. Good luck.

1) (4 marks) Evaluate the following limit if it exists. If it does not exist, explain why. You must provide your reasoning which CANNOT be simply “this is what the calculator tells me.”

$$\lim_{x \rightarrow 0^+} \frac{\sqrt{x} - x}{\sqrt{x}}.$$

---

*Answer*

**2a)** (2 marks) Let  $f(x)$  be a function. Write the definition of the derivative of  $f(x)$  at  $x = a$ .

---

*Answer*

---

**b)** (4 marks) **Using the definition in part (a)**, find  $f'(2)$  for the function

$$f(x) = x^3 + 3.$$

---

*Answer*

**3)** At time  $t = 0$ , a ball is thrown straight up in the air. The height of the ball above the ground at time  $t$  seconds is given by the function  $h(t)$  (measured in meters) where

$$h(t) = 20t - 4.9t^2.$$

**a)** (3 marks) Using any method you like, find an expression for the velocity of the ball at time  $t$ .

---

*Answer*

---

**b)** (2 marks) At what times is the velocity 0?

---

*Answer*

---

*Continued on next page*

**c)** (2 marks) What is the maximum height the ball gets above the ground? Clearly explain your answer.

---

*Answer*

**4a)** (3 marks) Evaluate

$$\lim_{x \rightarrow +\infty} \sin\left(\frac{1}{x^2}\right)$$

---

*Answer*

---

**b)**(4 marks) Find a constant  $c$  and a function  $g(x)$  such that

$$f(x) = \begin{cases} x^2 - 1 & \text{if } x \leq 1 \\ cx + 3 & \text{if } 1 < x \leq 5 \\ g(x) & \text{if } x > 5 \end{cases}$$

is continuous at  $x = 1$  AND the graph of  $f$  has a vertical asymptote at  $x = 5$ .

---

*Answer*

**5a)** (1 mark) Find a positive value for  $\delta$  such that the following statement is true:

$$\text{If } |x| < \delta \text{ then } x^2 < 0.04.$$

---

*Answer*

---

**b)** (1 mark) Write down the precise “ $\epsilon - \delta$ ” definition of

$$\lim_{x \rightarrow a} f(x) = L.$$

---

*Answer*

c) (4 marks) Using the definition in part b), prove that

$$\lim_{x \rightarrow 1} (x^2 - 1) = 0.$$

---

*Answer*

---

*Do not write below this line*

Question	Score	Max
1		4
2		6
3		7
4		7
5		6
Total		30