

NAME _____ TA'S NAME _____

STUDENT ID _____ SECTION _____

Math 124C
Winter 2012

Midterm 1
January 31, 2012

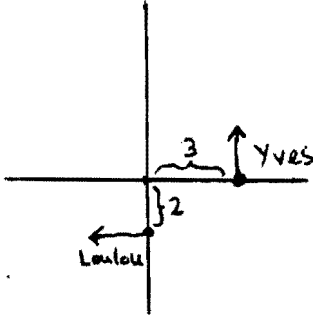
Point totals are indicated in parentheses. You must show your work to receive credit. You do not need a calculator for any of the problems; consequently, you will not receive credit for any solution based on calculator computations.

(12) 1. Evaluate the following limits:

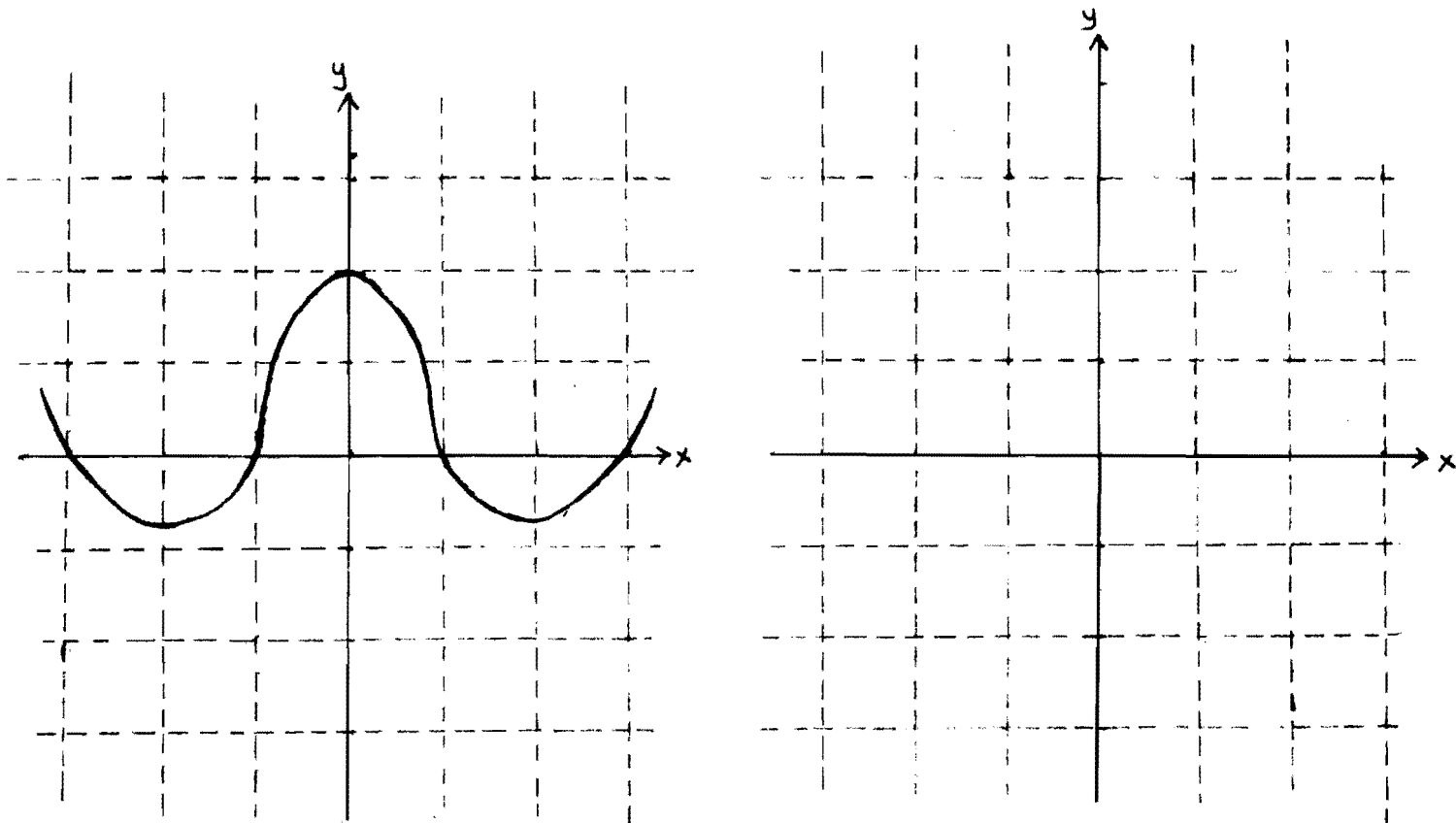
a. $\lim_{h \rightarrow 0} \left[\frac{\frac{1}{h^2+3h-1} + 1}{h} \right]$

b. $\lim_{x \rightarrow \infty} \tan^{-1} \left(\frac{x - 2x^3}{x^2 + 1} \right)$

- (12) 2. Yves is located 3 miles east of an intersection between two main roads. (See picture below.) He is walking north along a side street at the rate of 4 miles per hour. Loulou is located 2 miles south of this intersection and is walking west along another side street at the rate of 3 miles per hour.
- Write a formula for the distance (in miles) between Yves and Loulou at time t (in hours).
 - What is the instantaneous rate of change of the distance between them at time $t = 0$? (You may not use any formulas for the derivative that you may have learned in a previous calculus course.)



- (10) 3. The graph of an even function f is shown below. Use this graph to estimate $f'(-3)$, $f'(-2)$, $f'(-1)$, $f'(0)$, $f'(1)$, $f'(2)$, and $f'(3)$. (If any of these derivatives don't exist, explain why.) Then sketch the graph of the derivative function f' .



- (8) 4. Let $g(x)$ be the function defined by

$$g(x) = \begin{cases} 2(x-1) & x \leq 0 \\ x^2 - 1 & x > 0. \end{cases}$$

(2) a. Find $(g \circ g)(1)$.

(6) b. Find $\lim_{h \rightarrow 0^-} \frac{(g \circ g)(1+h) - (g \circ g)(1)}{h}$. (You must clearly show how you obtain this limit—don't just write an answer.)

- (12) 5. Suppose that a and b are constants and that the curve $ax^3 + x^2 + bx + 3$ passes through the point $(-1, 1)$. In addition, the line tangent to the curve at this point has equation $y = 5x + 6$. Find a and b .