NAME _____ TA'S NAME _____

STUDENT ID _____ SECTION _____

Math 124E and 124F
Autumn 2017

Midterm 1
October 24, 2017

Point totals are indicated in parentheses. You must show your work to receive credit. You may not use any techniques which you may have learned in a previous calculus course — e.g. the chain rule — but which have not been covered in this course. You do not need a calculator for any of the problems; consequently, you will not receive credit for any solution based on calculator computations. You must give exact answers; for example $\sqrt{3}$ is an exact answer, but 1.732 is not. Please make sure your work is neat, organized, and legible.

(15) 1. Evaluate the following limits. Your answer may be ∞ or $-\infty$.

a. $\lim_{x \to \frac{\pi}{2}^+} \tan^{-1}\left(\frac{\sin x - \cos x}{\cos^3 x}\right)$

b. $\lim_{h \to 0} \left(\frac{1}{h^2} - \frac{1}{h^2 + h + 1}\right)$

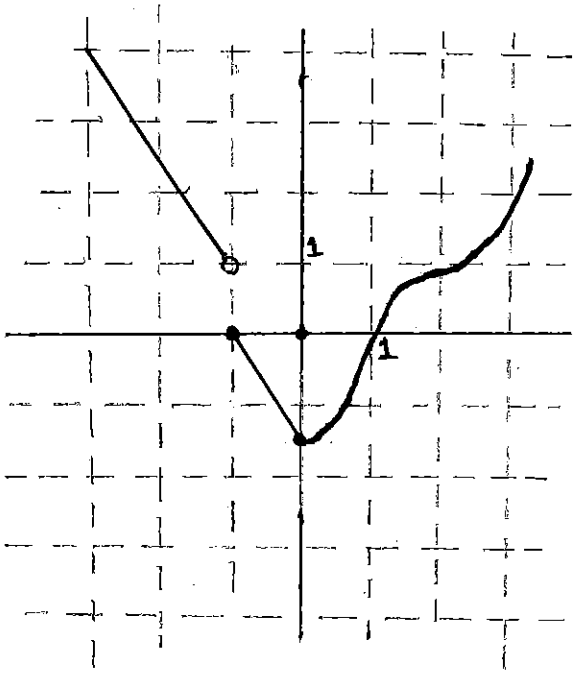
c. $\lim_{x \to -\infty} \frac{1}{\sqrt{x^2 + 3x + 1} + x}$

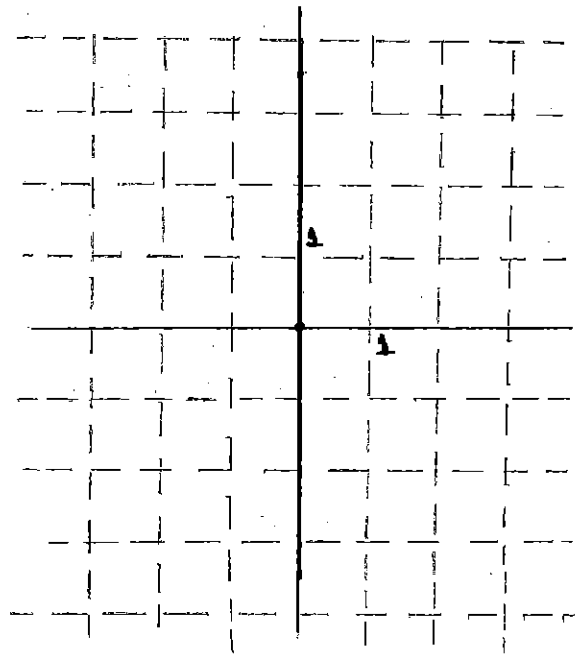
(10) 2. Consider the function $f(x) = \sqrt{x + x^2}$.

a. Write down the definition of $f'(a)$, the derivative of f at a, as a limit.

b. Evaluate this limit. (You may not use any derivative formulas.)

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





(10) 4. Consider the curve $y = \frac{1}{1+r\sqrt{x}}$, where r is a positive constant. For what value of r does the line tangent to the curve at $(4, 1/(1+2r))$ intersect the x-axis at 24?

(10) 5. A particle is traveling along the x-axis. Its position at time t is given by

$$s(t) = \sin^2 t + \cos t.$$

Find all times t with $0 < t < 2\pi$ when the particle is moving to the right.