



LAKE FOREST  
COLLEGE

## MATH 110 Final Exam

Professor Suha Dajani

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- Please read the instructions carefully.
- Show all your work for full credit.
- Write neatly.

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Good Luck

1. (5 points) Find the limit (NO SHORT CUT)

$$\lim_{x \rightarrow -\infty} \frac{x^4 - 4x^3 + 1}{2 - 2x^2 - 7x^4}$$

2. (15 points) If  $f(x) = \frac{(3x+12)(x-2)}{(x-1)(x+5)}$ . Show your detailed work to find.

- (a) x and y intercepts
- (b) Horizontal and vertical asymptotes
- (c) Increasing, decreasing, critical points, and max/min
- (d) Concavity and Inflection points
- (e) Sketch the graph and clearly label all of the above.

3. (6 points) Find the anti-derivative  $F(x)$  of each function  $f(x)$

- (a)  $f(x) = x + 12x^2$
- (b)  $f(x) = \sec x \tan x + 4x$
- (c)  $f(x) = e^x + e^{-x}$

4. (10 points) We have  $45\text{m}^2$  of material to build a box with a square base and no top. Determine the dimensions of the box that will maximize the enclosed volume. Hint: The surface area of a closed box is  $A = 2lw + 2lh + 2wh$ , where  $w, l, h$  are the width, length, and height, respectively.

5. (5 points) Use L'Hospital's Rule to evaluate

$$\lim_{x \rightarrow 0^+} x \ln x$$

6. (10 points) Evaluate the sum

$$\sum_{i=1}^{20} 100(i^2 - 5i + 1)$$

7. (14 points) Use Riemann sum

$$A = \lim_{n \rightarrow \infty} \sum_{i=1}^n f(x^*) \Delta x$$

to approximate the area under the curve

$$f(x) = x^2 + 2 \quad \text{on } [-2, 1]$$