

EXAM 4 - MTH 127-105 FALL 2009

Math 127-105

20 November, 2009

Instructor: Thomas Cuchta

Total points: 100 + 4 bonus

Name: _____

Read all of the following information before starting the exam:

- Show all work, clearly and in order, if you want to get full credit. I reserve the right to take off points if I cannot see how you arrived at your answer (even if your final answer is correct).
- Justify your answers algebraically whenever possible to ensure full credit. When you do use your calculator, sketch all relevant graphs and explain all relevant mathematics.
- Circle or otherwise indicate your final answers.
- Please keep your written answers brief; be clear and to the point.
- Good luck!

1. (5 points) Form a polynomial whose real zeros are -3, 0, 4 and whose degree is 3.

2. (24 points) Consider the polynomial function $f(x) = 2(x - 3)(x + 4)^3$.

a. (6 pts) List each real zero and its multiplicity.

b. (6 pts) Determine whether the graph of f crosses or touches the x-axis at each x-intercept.

c. (6 pts) Determine the maximum number of turning points on the graph of f .

d. (6 pts) Determine the end behavior of the polynomial (what power function does the end behavior resemble?)

- 3.** (18 points) Consider the polynomial function $H(x) = \frac{x^2+4}{x^4-1}$.
- a.** (6 pts) Find the vertical and horizontal asymptotes of $H(x)$.

b. (6 pts) Find the x-intercept(s) and y-intercept of $H(x)$.

c. (6 pts) Using the information you found above, graph $H(x)$.

4. (18 points) Consider $f(x) = \frac{x}{x-1}$ and $g(x) = x^2 + 3x + 4$. Find the composition functions $f(g(x))$, $g(f(x))$, $f(f(x))$, and $g(g(x))$.

5. (5 points) Find two functions $f(x)$ and $g(x)$ such that $f(g(x)) = \sqrt{\frac{1}{x}}$.

6. (5 points) Find the inverse function of $f(x) = \frac{2x+3}{x+2}$.

7. (5 points) Solve the following equation: $8^{-x+14} = 16^x$

8. (16 points) Suppose that a student has 500 vocabulary words to learn. If the student learns 15 words after 5 minutes, the function $L(t) = 500(1 - e^{-0.0061t})$ approximates the number of words L that the student will learn after t minutes.

a. (8 pts) How many words will the student learn after 30 minutes?

b. (8 pts) If the student has learned 90 words, how many minutes did it take him/her?

Bonus Question (2 Extra Credit Points): You learned in class that $e = 2.71828183\dots$. When introducing this number, I mentioned two OTHER ways to define it. State one.

Bonus Question (2 Extra Credit Points): Name the other.