MATH 121 **Sample Exam 2**

Give complete explanations, not just answers, for full credit. Give exact answers whenever possible, otherwise give answers accurate to two decimal places. Sketch any calculator graph you use including the axes with a scale.

Turn in this sheet with your test booklet. Write your TA's name and your discussion time on the booklet.

1. (10 pts) Which of the following statements are true for all positive values of a and b? Briefly explain your reason for each TRUE or FALSE answer.

   a)$(a+bi)(a-bi) = a^2 - b^2$

   b)$\dfrac{\ln(a \cdot b)}{\ln(b)} = \ln(a)$

   c)$\sqrt{a-b} = \sqrt{a} - \sqrt{b}$

   d)$\log(\frac{1}{a}) + \log(a) = 0$

   e)$e^{a+b} = e^a + e^b$

2. (15 pts) For the rational function $f(x) = \dfrac{3x-2}{2x+5}$

   a) Find all x-intercept(s).

   b) Find the y-intercept.

   c) Find the vertical asymptote.

   d) Find the horizontal asymptote.

   e) Using the above information, sketch a graph of the rational function $f(x)$, labeling all of the above on the graph.

3. (15 pts.)(a) Find a polynomial $P(x)$ of degree 5 with real coefficients that has -1 as a zeros of multiplicity 3 , 3 as a zeros of multiplicity 2, and satisfies $f(2) = 3$.

   (b) Describe the end behavior of $P(x)$ as $x \to -\infty$.

4. (15 pts.) The number of students infected with flu after t days at a local high school is modeled by the function

$$P(t) = \frac{1600}{1 + 99e^{-0.4t}}$$

   (a) What was the initial number of infected students?

   (b) When will 200 students be infected? Give your answer in days accurate to 2 decimal places.

   (c) The school will close when 400 of the student body are infected. When would the school close? Give your answer in days accurate to 2 decimal places.

5. (15 pts.) How long will it take for an investment to double in value when interest is earned at an annual rate of 5.5% compounded continuously? Give your answer in years accurate to 3 decimal places.

6. (15 pts) Find all roots, real and complex, of $x^3 + x^2 + 3x - 5 = 0$.

7. (15 pts) Find all solutions to the equation $\ln(x - 4) + \ln x = \ln 5$.