Math 121 Exam 1 Lowman Fall 2013

- **No Calculators, No Cell Phones**.
- Put your NAME, UIN, TA's NAME and DISCUSSION TIME on the exam booklet. Do not write in the upper right corner of the booklet, this is used for grading. Also include Math 121, Exam 1, Fall 2013
- Show all work in exam booklet. Clearly label and box answers. If no work then no credit.
- Keep the exam sheet, turn in your exam booklet. You must finish by 10:50PM.

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1. Given that $x1 = i$ is a root of $f(x) = 2x^4 + 6x^3 - 6x^2 + 6x - 8$, find all remaining roots (real and complex) and then **write the function as a product of four linear factors**. **You must use** long or synthetic division and the fact that complex roots will occur in conjugate pairs. Once you reduce the function to a quadratic factor, using division, you can use any method to find the remaining roots and factors. You will not get credit if you use other methods or do not show all all steps.

2. Write the rule of a function $g(x)$ obtained by performing the following transformations (one after the other) on $f(x) = \frac{1}{x}$. Your final answer should be in the form $y = g(x)$. Show your work for each step.

   (a) T_1 **:** shift **left** by **1**.

   (b) T_2 **:** stretch vertically by **3**.

   (c) T_3 **:** stretch horozontally by **2**.

   (d) T_4 **:** shift down by **4**.

   (e) T_5 **:** reflect about the y axis.

3. Find the inverse of the function $f(x) = \frac{2-x}{2x+1}$

4. Given $f(x) = \frac{2(x+3)}{x-2}$, find the intervals where $f(x) > 0$ and $f(x) < 0$ You must show your work.

5. Consider the rational function $f(x) = \frac{2x(x+3)}{x^2-2x}$:

   (a) Find the domain and range of the function: $f(x)$

   (b) Find any removable singularities and reduce the function.

   (c) Find all x-intercepts and y-intercepts.

   (d) Find the vertical asymptote. Determine what is happening to the left of the VA by plugging in a number to the left of the VA. Repeat to the right.

   (e) Determine the Right end behavior of $f(x)$ i.e. as $x \to \infty$, $f(x) \to$**?** You should find a Horizontal asymptote to the right. Give the equation of the asymptote and determine if $f(x)$ is aproaching from above or below by plugging a number into $f(x)$ and comparing to the HA line.

   (f) Determine the Left end behavior of $f(x)$ i.e. as $x \to -\infty$, $f(x) \to$**?** You should find a Horizontal asymptote to the left. Give the equation of the asymptote and determine if $f(x)$ is aproaching from above or below by plugging a number into $f(x)$ and comparing to the HA line.

   (g) Using the above information, sketch a graph of $f(x)$ labeling all of the above on the graph. Use at least **1/2** page for your graph.

   (h) Is your answer for problem 4 consistent with your graph? Why or why not. Give the correct answer based on your graph and your answer for problem 4.