

Math 007
Fall 2020
Midterm Exam 1

The following exam is 2 pages long and consists of 3 problems. It is worth 10% of your final grade. You must turn in your solutions by **11:59 PM Eastern on Monday, September 21**. Late submissions are subject to the same penalty scale as homework assignments (consult the syllabus for details). Submit your work by uploading a PDF to our shared Microsoft OneDrive folder.

Partial credit will be awarded for work that is done towards a correct solution. Solutions lacking proper justification are subject to penalty.

You **may** consult the book, or any other texts. You **may** also use any computational resources, including a grapher program. However, this should only be used to give you an idea of what a graph looks like, or to confirm solutions that you have worked out. The output of graphing software does not, by itself, constitute justification or work towards a solution.

You **may not** consult any of your classmates for this test, but you **may** ask me for assistance.

Problem:	1	2	3	Total
Points:	10	10	10	30
Score:				

1. (10 points) An open box is to be made from a 16×20 inch rectangular sheet of cardboard by cutting $h \times h$ inch squares into the four corners and folding the edges upward. The box doesn't have a top. To see a problem with a similar setup, consult the opening example of Section 3.2 of the textbook. Include units in your solutions.
 - a.) (4 points) Define a polynomial $f(h)$ that expresses the surface area of the outside of the box in square inches in terms of the h -inch cut length.
 - b.) (2 points) At what positive value of h does the box cease being a box and have no surface area?
 - c.) (4 points) The manufacturer specifies that the surface area of the box must be at least 124 in^2 and at most 256 in^2 . Give the interval of all acceptable values for h . **Hint:** You should get nice whole number endpoints for your interval. If you don't, your polynomial from part (a) may be wrong.
2. (10 points) Define a rational function, $f(x)$, that meets the following requirements:
 - $f(x)$ has at least one vertical asymptote;
 - at the (or at least one of the) vertical asymptote(s) $x = c$, $f(x) \rightarrow \infty$ as $x \rightarrow c^-$, and $f(x) \rightarrow \infty$ as $x \rightarrow c^+$;
 - the line $y = 2x + 1$ is a slant asymptote for $f(x)$.

You must present your rational function in the form $f(x) = \frac{p(x)}{q(x)}$, where $p(x)$ and $q(x)$ are polynomials. Your solution must also include a sketch of the graph of $f(x)$, with work explaining how you know the above conditions are met.

3. (10 points) When graphing the polynomial $p(x) = 2(x - 1)^2(x + 1)^2(1 - 2x)$, Andre drew the picture that appears below. Assuming Andre used the book's 7-step process for graphing polynomials, describe all of the steps he got wrong, and how you would have correctly completed these various steps. Your solution should include a correct graph of $p(x)$.

