

Practice Exam 2

This practice exam is similar in length, content, and format to the actual exam. This is not to say that the problems given here represent *all* of the concepts you will encounter on the actual exam, since it's difficult to "cover" all possible subjects in such a short exam! However, if you feel confident on your performance on this practice exam and you've gone over all homeworks and quizzes, you should feel confident about your upcoming performance on the actual exam.

In order to save paper, I have not included space for you to work out your solutions. (The actual exam will provide such space.) Rather, please complete solutions to the below problems on your own paper. The practice exam is worth a total of 100 points; the point value of each question is provided with that question.

- (28 points total; 4 points each) Let $f(t) = \frac{t^2-t}{t^2+t-2}$.
 - Find all critical points of the function f .
 - Find the intervals on which f is increasing, and the intervals on which f is decreasing.
 - Find all maxima and minima for the function f .
 - Find the intervals on which f is concave up, and the intervals on which f is concave down.
 - Find all inflection points for the function f .
 - Find all asymptotes for the function f .
 - Sketch a graph of the function f using the information gathered in the previous six steps.
- (12 points total; 6 points each)
 - Name all of the types of discontinuity a function can have.
 - Draw the graph of a *single* function which exhibits each of the types of discontinuity you mentioned in part (a).
- (10 points) Farmer Bob needs to build a fence to enclose his guinea pig pasture. The pasture is bordered on one side by a river, so he only needs to put fencing on three sides of the pasture, which must be rectangular. If Farmer Bob has 100 meters of fencing, what's the *largest* area he can enclose? (*Hint*: draw a diagram and set up some notation. Then figure out how to compute the area and perimeter of the enclosure...to maximize the area you must then...)
- (30 points total; 6 points each) Compute the derivative of each of the following functions (you *may* use shortcut formulas!):
 - $\frac{\sin(t)}{t}$
 - $\frac{t}{\sin(t)}$
 - $e^x \cos(x)$
 - $\frac{xe^x}{x^2+1}$
 - $\cot(x)$ (*Hint*: $\cot(x) = \frac{\cos(x)}{\sin(x)}$)

5. (10 points) As budget analyst for Crystal Curios, you find that the cost (per unit) of manufacturing u thousand glass unicorns is given by $C(u) = u^3 - 5u^2 + 7u$ dollars. Find the number of unicorns your company must manufacture if it's to minimize the cost of production, per unicorn produced. (Be sure to *prove* that you've found a minimum!)
6. (10 points) Explain in your own words what the following expression means:

$$\lim_{x \rightarrow 2} f(x) = 4.$$