

PRACTICE PROBLEMS FOR 2200 MIDTERM EXAM 3

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1) You have 12 meters of wire and a pair of wire cutters. You will make at most one cut in the wire, bend one piece into a square, and bend the remaining wire into a circle. You wish to do this so as to maximize the sum of the areas of the square and the circle. (To be clear, you are allowed not to cut the wire at all and bend it entirely into a square or entirely into a circle.) What are the lengths of the pieces of wire that maximize the area?

2) You need to build a tin can (including the top and bottom) with a volume of 500 cubic centimeters. Suppose tin costs 1 cent per square centimeter. What are the dimensions of the can that minimize the cost?

3) You own a parking lot in Five Points and sell the spots for every home game. Last weekend, you charged \$ 15 per space and sold out all 30 spaces, so this week you have decided to increase the price. Informal research suggests that for every dollar you increase the price per space, you will leave one more space vacant. What price should you charge so as to maximize your profit?

In each of the following problems, graph the function. Your answer should take into account the following information:

- (i) The domain of the function. (If not specified, assume the domain is the largest possible on which the function makes sense.)
- (ii) Horizontal and vertical asymptotes, if any.
- (iii) Regions on which the function is increasing and on which the function is decreasing.
- (iv) Local and global maxima and minima, if any.
- (v) concavity and inflection points.

4) $f(x) = \frac{4x}{x^2+1}$.

5) $f(x) = x^4 - 4x^3$.

6) $f(x) = (2 - x)e^x$.

7) $f(x) = \frac{-3}{x^2-4}$.