

MATH 132, SEC. 21, SAMPLE MIDTERM 3

1. Find the absolute maximum and minimum values of $f(x) = x\sqrt{4-x^2}$ on the interval $[0, 2]$.
2. Show that at some instant during a 2-hour automobile trip the cars speedometer reading will equal the average speed for the trip.
3. Consider $f(x) = \frac{x^2 - x}{x^2 - 4x + 4}$.
 - a. Find the domain of f and any vertical or horizontal asymptotes.
 - b. Find all roots of f .
 - c. Find where f is increasing/decreasing and any local extrema.
 - d. Find where f is concave up/down and any inflection points.
 - e. Use parts a-e to draw a graph of f .
4. You are planning to close off a corner of the first quadrant by a line segment 20 units long running from $(a, 0)$ to $(0, b)$. Show that the area of the triangle is largest when $a = b$.
5. You are allowed to ship a box only if the sum of its length and girth (distance around) does not exceed 108 in. What dimensions will give a box with a square end the largest possible volume?
6. Compute the following limits:
 - a. $\lim_{x \rightarrow 0} \frac{2x}{x + 7\sqrt{x}}$
 - b. $\lim_{x \rightarrow 0} \frac{\sin(x^2)}{2x}$
7.
 - a. We wish to use Newton's method to find the real root of $f(x) = x^3 + x - 1$. Starting with $x_0 = 0$, find x_2 .
 - b. On the picture of $f(x)$ below, draw x_0, x_1 , and x_2 .
8. Compute the following indefinite integrals:
 - a. $\int (x^4 - 2x^3 + 7)dx$
 - b. $\int (\sqrt{x} + \sqrt[3]{x})dx$
 - c. $\int \sin(3x)dx$