Midterm 2 - 04/06 Mini Review Session - Problems

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Problem 4

Find the absolute maximum and minimum of $f(x) = x^2 + x - 2|x|$ on $[-2, 2]$

Problem 5

If f is differentiable and odd, show that for every b, there is some c in $(-b, b)$ with $f'(c) = \frac{f(b)}{b}$

Problem 6

Suppose car A starts at city A, which is 6 miles east of city O and drives west for 2 hours at a rate of 5 mph and car B starts at city B, which is 5 miles north of city O, and drives south for 3 hours at a rate of 4 mph. At what rate is the distance between cars A and B changing at the moment when they are closest to each other?

Problem 7

A cylinder is inscribed inside a sphere of radius r. Find the largest possible volume of such a cylinder.

Problem 8

Two runners start a race at the same time and finish in a tie. Prove that at some time during the race they have the same speed. (Hint: Consider $f(t) = g(t) - h(t)$, where g and h are the position functions of the two runners)

Problem 9

Find the points on the ellipse $x^2 + 2y^2 = 1$ where the tangent line has slope 1

Problem 10

What constant acceleration is required to increase the speed of a car from 30 mph to 50 mph in 5 seconds?

Problem 11

Show that $\tan(x) > x$ for $0 < x < \frac{\pi}{2}$