

Math 141 Sample Problems for Exam 2

Question 1 Find the absolute maximum and minimum of $f(x) = \frac{x+1}{x^2+2x+2}$ on the interval $[-3, -1]$.

Question 2 Show that the function $f(x) = x + \frac{1}{x}$ satisfies the hypotheses of the Mean Value Theorem on the interval $[1, 2]$, and find all numbers $c \in (1, 2)$ that satisfy the conclusion of that theorem.

Question 3 Water is flowing at a rate of $50 \text{ ft}^3/\text{min}$ from a shallow concrete conical reservoir of base radius 45 feet and height 6 feet. How fast is the water level falling when the water is 5 feet deep? How fast is the radius of the water's surface changing then?

Question 4 A rocket is launched whose height at time t is $\sqrt{10t+100}$ kilometers. A spectator standing 5 kilometers away observes the rocket's launch. How fast is the angle of inclination from the spectator's eye to the rocket changing 2 minutes after launch.

Question 5 Let $f(x) = 3x^4 - 4x^3 - 12x^2 + 5$. Sketch the graph of this function on the axes below indicating the y -intercept (x -intercepts are too hard to compute), all critical points, relative or absolute extrema, and the intervals on which $f(x)$ is increasing and decreasing, concave up and down and any inflection points.

Question 6 Do the same thing as in previous problem for the function $f(x) = 5x^{2/5} - 2x$.

Question 7 Do the same thing as in previous problem for the function $f(x) = \frac{x}{x^2-9}$. Include asymptotes.

Question 8 Find the area of the largest rectangle with sides parallel to the coordinate axes which can be inscribed in the ellipse $x^2/4 + y^2/9 = 1$.