

Practice midterm 2

1. Find the absolute minima and maxima, if any, of the following functions:

- (a) $(x+2)/(x^2+5)$ on $[-4, 4]$.
(b) $1/(\sin(x) + \cos(x))$ on $(-\pi/4, 3\pi/4)$.

2. (a) Find the linearization of the function $f(x) = \sqrt{x+16}$ at $x = 0$. (b) Use the linearization above to estimate the value of $\sqrt{16.8}$.

3. Consider the function

$$f(x) = \frac{x^3}{x^2 - 1}$$

- (a) Find all x- and y- intercepts.
(b) Find any and all asymptote. Justify your answers using limits.
(c) Find the intervals where the function is increasing or decreasing.
(d) Find and classify all local extrema.
(e) Find the intervals where the function is concave up or concave down.
(f) Find all points of inflection (if any).
(g) Sketch a graph of the function, labeling all points.

4. Use implicit differentiation to find the equation of the tangent line to the following curve at the point $(1, 1)$:

$$x \sin(xy - y^2) = x^2 - 1.$$

5. At 12:00 noon, ship A is 150 km west of ship B. Ship A is sailing east at 35 km/h and ship B is sailing north at 25 km/h. How fast is the distance between the ships changing at 4:00 pm?
6. An open box is to be made by cutting a square from each corner of a 12-in. by 12-in. piece of metal and then folding up the sides. What size square should be cut from each corner to produce a box of maximum volume?
7. A ladder 15 feet long leans against a vertical wall. If the bottom of the ladder slides away from the wall at a rate of 1 ft/sec, how fast is the top of the ladder sliding down the wall when the bottom of the ladder is 9 ft from the wall?
8. Jack and Jill have an on-again off-again love affair. The sum of their love for one another is given by the function $y(t) = \sin(2t) + \cos(2t)$. (a) Find the times when their total love is at a maximum. (b) Find the times when they dislike each other the most.