

Name: \_\_\_\_\_

Each problem is worth 10 points; you must show all your work (excluding arithmetic) for full credit.

1. Find the derivatives:

(a)  $\frac{d}{dx} [3^x]$

(b)  $\frac{d}{dx} [\log x]$

(c)  $\frac{d}{dx} [e^{(x^2-5x)}]$

(d)  $\frac{d}{dx} [\ln (\frac{1}{x} + \sqrt{x})]$

2. Find the derivative:

$$\frac{d}{dx} \left[ e^{\sqrt{\frac{5-x}{3+x}}} \right]$$

3. Find all local extrema and inflection points of

$$f(x) = \frac{(x - 5)^2}{(x - 4)^2}$$

- Graph the function  $f(x)$  from problem 3 by hand. Show all intercepts, asymptotes, local extrema, inflection points, intervals of increase/decrease, and intervals of concavity.

5. Suppose a seller at an indoor flea market wants to construct a triangle-shaped booth using two  $3' \times 9'$  sheets of plywood propped up with cinder blocks, with the long end parallel to the floor. The third side of the triangle will be one of the walls of the room, and each sheet of plywood will touch the wall at one point on the floor. Determine how far apart these points should be in order to maximize the floorspace inside the booth.

6. Find the equation of the tangent line to the ellipse

$$\left(\frac{x+2}{5}\right)^2 + \left(\frac{y-7}{10}\right)^2 = 1$$

at  $(x, y) = (-6, 13)$ .