

Calculus I Test 2. March 24, 2003 NAME: _____

Justify your answers. You may not use calculators, books, or notes. Do your own work. CIRCLE answers. Failure to follow these instructions will result in the loss of some or all points.

1.) A street light is mounted at the top of a 15-ft tall pole. A man 6 ft. tall walks away from the pole with a speed of 5 ft/s along a straight path. How fast is the tip of his shadow moving when he is 60 ft. from the pole?

2.) Let $g(x) = x^3 - 3x^2$. Find the absolute maximum and absolute minimum values of $g(x)$ (and where they occur) on the interval $[-1, 3]$.

3.) Let $g(x) = 1 - 9x - 6x^2 - x^3$. Carefully sketch the graph of g , including the coordinates of all local extrema and inflection points, and showing concavity.

4.) Let $g(x) = \frac{x}{1+x^2}$. Carefully sketch the graph of g , including the coordinates of all local extrema and inflection points, and showing concavity.

5.) Find the dimensions of the rectangle of largest area that has its base on the x -axis and its other two vertices above the x -axis and lying on the parabola $y = 9 - x^2$.

6.) A box with a square base is to be constructed. It is to have total volume of 100 ft^3 . The material for both the top and bottom will cost $\$5/\text{ft}^2$ while the material for the lateral sides will cost $\$2/\text{ft}^2$. What should be the dimensions of the base of the box so the cost will be minimal?

7.) Use L'Hospital's rule to find the following limits:

(A) $\lim_{x \rightarrow 1} \frac{\ln x}{x^3 - 1}$

(B) $\lim_{x \rightarrow 0^+} (1 + 3x)^{1/x}$

8.) Let $g(x) = 3x^{2/3} - x$. Find all x and y intercepts, all local maxima and minima, inflection points and any other significant points and features and carefully sketch the graph, labeling all significant points and features.

EXTRA CREDIT: Two carts, A and B , are connected by a rope 39 ft. long that passes over a pulley P (see the figure). The point Q is on the floor 12 ft. directly beneath P and between the carts. Cart A is being pulled away from Q at a speed of 2 ft/s. How fast is cart B moving toward Q at the instant when cart A is 5 ft. from Q ?