Instructions: Show all work, and provide exact answers. For full credit will be given to the steps shown than for the final answer. Be sure to provide thorough explanations.

1. Find the absolute extrema for $f(x) = x + \frac{4}{x}$, on $[-8, -1]$.

$$f'(x) = 1 - \frac{4}{x^2} = 0 \qquad\qquad f(-8) = -8.5 \leftarrow abs.\ min$$

$$1 = \frac{4}{x^2} \qquad\qquad\qquad f(-2) = -4 \leftarrow abs.\ max$$

$$x = \pm 2 \qquad\qquad\qquad f(-1) = -5$$

Check $-8, -2, -1$

2. Maximize $Q = xy^2$ where x and y are both positive numbers such that $x + y^2 = 1$.

$$y^2 = 1 - x$$

$$Q(x) = x(1-x) = x - x^2$$

$$Q'(x) = 1 - 2x = 0$$

$$2x = 1$$
$$x = \frac{1}{2} \qquad\qquad y^2 = \frac{1}{2}$$

$$y = \frac{1}{\sqrt{2}}$$

$$\left(\frac{1}{2}, \frac{1}{\sqrt{2}}\right) \text{ is maximum}$$