Problem 1. Rewriting the problem in standard form:

$$\min \quad -e^{-w^T x}$$
$$\text{s.t} \quad w^T Aw - w^T Ay - w^T x \leq -a$$
$$y^T w - w^T x = b$$

Problem 5. Let m be the number of milk bottles and k be the number of knobs. Then

$$\min \quad -(0.07m + 0.05k)$$
$$\text{s.t} \quad 4m + 3k \leq 240,000$$
$$2m + 1k \leq 6000$$

Problem 6. Solving for the critical points:

$$f(x,y) = 2x^2 y + 4xy^2 + xy$$
$$f_x = 4xy + 4y^2 + y$$
$$f_y = 2x^2 + 8xy + x$$
$$f_{xx} = 4y$$
$$f_{yy} = 8x$$
$$f_{xy} = f_{yx} = 4x + 8y + 1$$

Set $f_y = 0$, then

$$2x^2 + 8xy + x = 0 \Rightarrow x(2x^2 + 8y + 1) = 0 \Rightarrow x = 0, y = \frac{-2x^2 - 1}{8}$$

Set $f_x = 0$, then

$$4xy + 4y^2 + y = 0$$
$$x = 0 \Rightarrow y(4y + 1) = 0 \Rightarrow y = 0, -\frac{1}{4}$$

Problem 11. Let $f(x) = ax^2 + bx + c$ where $a > 0$ and $b, c \in \mathbb{R}$.

Problem 14.