

Math 164, Lecture 2, Vese
Homework #8, due on Wednesday, November 23, 2005

Notes:

- Please review appendices A6, B4, and Section 2.3.1.

Problems:

[1] Consider the primal linear programming problem

$$\text{Minimize } z = c^t x$$

subject to $Ax \leq b, x \geq 0$.

Assume that this problem and its dual are both feasible.

(a) Write the dual directly (for instance without using the canonical form). Use the rules on page 148, above Example 6.2 (if you use the canonical form to obtain the dual, then further simplify the dual before the next question).

(b) Let x_* be an optimal solution vector to the primal, let z_* be its associated objective value, and let y_* be an optimal solution vector to the dual problem. Show that

$$z_* = y_*^T A x_*.$$

[2] Determine if

$$f(x_1, x_2) = 2x_1^2 - 3x_1x_2 + 5x_2^2 - 2x_1 + 6x_2$$

is convex, concave, both, or neither for $x \in R^2$.

[3] For each of the following functions, determine if it is convex, concave, both, or neither on the real line. If the function is convex or concave, indicate if it is strictly convex or strictly concave.

(a) $f(x) = 3x^2 + 4x - 5$

(b) $f(x) = e^{x^2}$

(c) $f(x) = 2x^4 + 3x^3 + 4x^2$