#8.9

#25 (4) (a) $\max \sum_1^n \lambda_i u^i(x_i, y_i, H) = \sum \lambda_i y_i - \sum \lambda_i v_i(x_i) - H \sum a_i$

$= \sum \lambda_i y_i - \sum \lambda_i v_i(x_i) - bA \sum x_i$

s.t. $\sum y_i + c \sum x_i \leq \sum \mathring{y}_i$

FOC: $\left.\begin{array}{ll} y_i: & \lambda_i = \sigma \\ x_i: & \lambda_i v_i'(x_i) - bA \lambda_i \leq c\sigma \end{array}\right\} \; v_i'(x_i) - bA = c$

THE MARGINAL CONDITIONS FOR PARETO OPTIMALITY ARE $v_i'(x_i) = c + bA$, $i = 1, \ldots, n$; IN WORDS: THE MARGINAL VALUE TO A FAMILY OF DRIVING AN EXTRA MILE IS EQUAL TO THE MARGINAL FUEL COST c, PLUS THE MARGINAL SOCIAL COST bA OF THE RESULTING POLLUTION.

(b) $\max_{x_i} \; \mathring{y}_i - cx_i + v_i(x_i) - a_i b(x_1 + \cdots + x_n)$,

TREATING x_j $(j \neq i)$ AS PARAMETRIC.

FOC: $-c + v_i'(x_i) - ba_i = 0$,

i.e., $v_i'(x_i) = c + ba_i$, $\quad i = 1, \ldots, n$.

EACH FAMILY'S CHOICE OF MILES DRIVEN, x_i, WILL BE WHERE THE VALUE OF THE MARGINAL MILE IS EQUAL TO THE MARGINAL FUEL COST c, PLUS THE MARGINAL EFFECT UPON ONLY THE FAMILY OF THE RESULTING POLLUTION.

(c) v_i' IS POSITIVE AND DECREASING, SO x_i WILL BE LARGER IN (b) THAN IN (a): $ba_i < bA$.