APPENDIX A

SOLUTIONS TO PROBLEMS

A.1 (i) The average monthly housing expenditure is $566.

(ii) The two middle numbers are 480 and 530; when these are averaged, we obtain the median monthly housing expenditure as 505, or $505.

(iii) If monthly housing expenditures are measured in hundreds of dollars, the average and median monthly housing expenditures are 5.66 and 5.05, respectively.

(iv) The average increases to $586 while the median is unchanged ($505).

A.3 If *price* = 15 and *income* = 200, *quantity* = 120 – 9.8(15) + .03(200) = –21, which is nonsense. This shows that linear demand functions generally cannot describe demand over a wide range of prices and income.

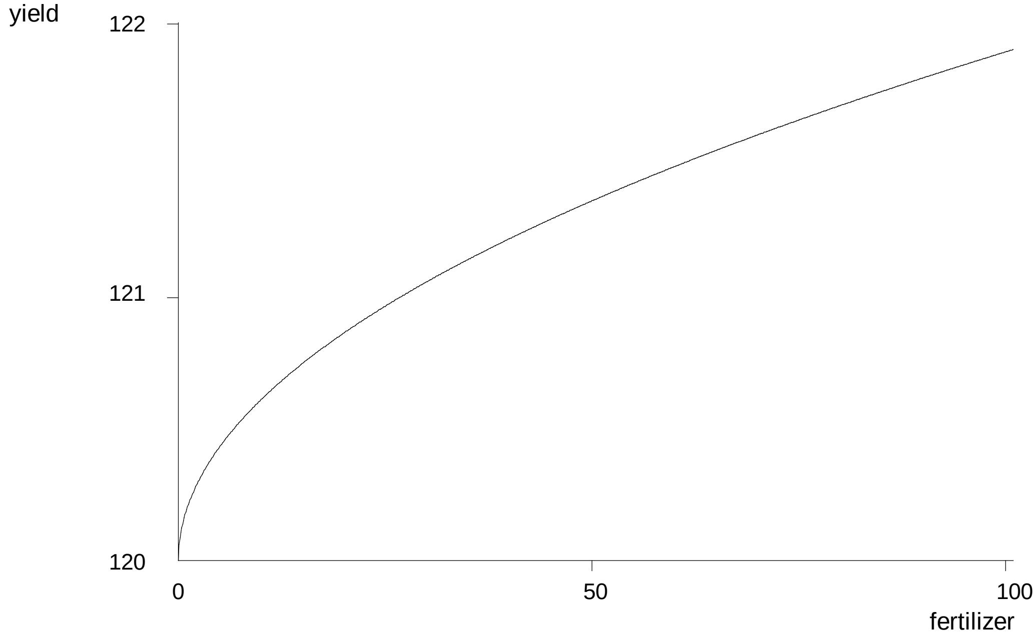
A.5 The majority shareholder is referring to the percentage point increase in the stock return, while the CEO is referring to the change relative to the initial return of 15%. To be precise, the shareholder should specifically refer to a three percentage point increase.

A.7 (i) When *exper* = 0, log(*salary*) = 10.6; therefore, *salary* = exp(10.6) ≈ $40,134.84. When *exper* = 5, *salary* = exp[10.6 + .027(5)] ≈ $45,935.80.

(ii) The approximate proportionate increase in *salary* when *exper* increases by five years is .027(5) = .135, so the approximate percentage change is 13.5%.

(iii) 100[(45,935.80 – 40,134.84)/40,134.84) ≈ 14.5%, so the exact percentage increase is about one percentage point higher.

A.9 (i) The relationship between *yield* and *fertilizer* is graphed below.



(ii) Compared with a linear function, the function

$$yield = 120 + .19\sqrt{fertilizer}$$

has a diminishing effect, and the slope approaches zero as *fertilizer* gets large. The initial pound of fertilizer has the largest effect, and each additional pound has an effect smaller than the previous pound.

A.11 (i) Let (x_1, y_1) and (x_2, y_2) be two points on the line $y = \beta_0 + \beta_1 x$.
Using summation operator,

$$\sum_{i=1}^{2} y_i = 2\beta_0 + \beta_1 \sum_{i=1}^{2} x_i$$

$$2\beta_0 = \sum_{i=1}^{2} y_i - \beta_1 \sum_{i=1}^{2} x_i$$

$$\beta_0 = (y_1 + y_2)/2 - \beta_1[(x_1 + x_2)/2]$$

$$\beta_0 = \overline{y} - \beta_1\overline{x}$$

Therefore, $(\overline{x}, \overline{y})$ is on the line $y = \beta_0 + \beta_1 x$.

(ii) Let $\{(x_i, y_i): i = 1, 2, \ldots, n\}$ denote sequence of n points on the line.
Using summation operator on the line,

$$\sum_{i=1}^{n} y_i = n\beta_0 + \beta_1 \sum_{i=1}^{n} x_i$$

$$\beta_0 = \frac{\sum_{i=1}^{n} y_i}{n} - \beta_1 \frac{\sum_{i=1}^{n} x_i}{n}$$

$$\beta_0 = \overline{y} - \beta_1 \overline{x}$$

Therefore, $(\overline{x}, \overline{y})$ is also on the line $y = \beta_0 + \beta_1 x$.