Textbook Examples

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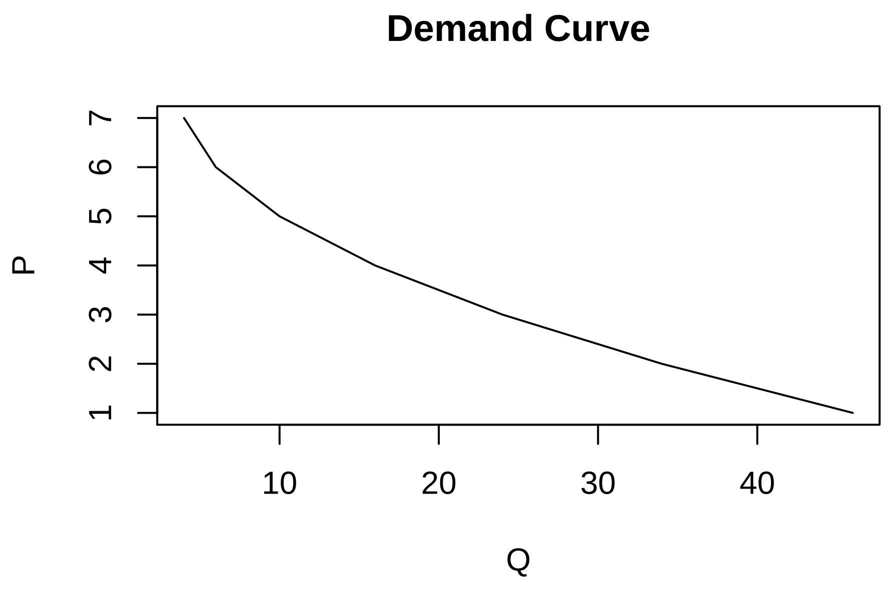
1 Box 3.3, p. 66

The following equation for a demand curve

$$Q = 60 - 15P + P^2$$



$$p_{ed} = \frac{\text{proportionate change in } Q}{\text{proportionate change in } P}$$

Remember

$$\text{proportionate change } x = \frac{\Delta x}{x} \times 100$$

so, for a very small change in price

$$p_{ed} = \frac{dQ}{dP} \times \frac{P}{Q}$$

$$\frac{dQ}{dP} = -15 + 2P$$

Therefore, what is the elasticity at the price of 3?

$$P_{ed} = \frac{dQ}{dP} \times \frac{P}{Q}$$

$$-15 + 2P \times \frac{3}{24}$$

$$-15 + 6 = -9$$

$$-9 \times \frac{3}{4} = -\frac{9}{8}$$

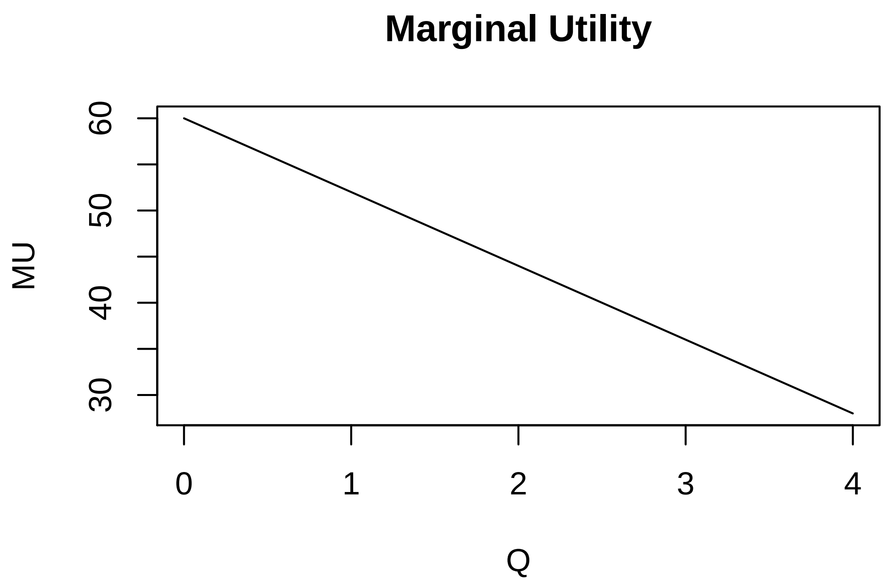
This is elastic.

2 Box 4.1 p. 102

Consumer Utility is

$$TU = 60Q - 4Q^2$$

$$MU = \frac{dTU}{dQ} = 60 - 8Q$$



3 Box 5.4, P. 138

This is discussed in the lecture on calculus and is in the lecture slides.

4 Box 5.9 p. 166

Total Revenue

$$TR = 48Q - Q^2$$

Total Cost

$$TC = 12 + 16Q + 3Q^2$$

There is a table in the textbook that will calculate the costs and revenues for each of the quantities. As Profit is the difference between total cost and total revenue, finding the maximum profit that way is relatively easy.

However, it is also possible to use the fact that profits will be maximised at the point where marginal revenue equal marginal cost. Remember that marginal revenue is the derivative of total revenue and marginal cost is the derivative of total cost. Marginal Revenue

$$MR = \frac{d(TR)}{d(Q)} = 48 - 2Q$$

Marginal Cost

$$MC = \frac{d(TC)}{d(Q)} = 16 + 6Q$$

Set $MR = MC$

$$48 - 2Q = 16 + 6Q$$

Solving for Q

$$32 = 4Q$$

or

$$Q = 4$$

Now substitute 4Q into the equation for Total Profit

$$TP = TR - TC$$

or

$$TP = 48Q - Q^2 - (12 + 16Q + 3Q^2)$$
$$TP = -12 + 32Q - 4Q^2$$

substitute $Q = 4$

$$TP = -12 + (32 \times 4) - 4(4^2)$$
$$TP = 52$$