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Markets, Methods & Models

an Open Text
by Douglas Curtis and Ian Irvine

SOLUTIONS TO EXERCISES

VERSION 2017 – REVISION A

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Version 2017 — Revision A

Version 2017 – Revision A: Updates include new cover and back pages, new front matter.

Version 2015 – Revision A: The content in this version has been revised in several respects. The content has been updated to include discussion about the role *Uber* has played in undermining taxi cartels in numerous cities. A new section regarding wealth inequality, and based on the best selling book of Thomas Piketty published in 2014.

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Table of Contents

SOLUTIONS TO EXERCISES FOR CHAPTER 1

1.1   1. If all 100 workers make cakes their output is $100 \times 4 = 400$.

2. If all workers make shirts their output is $100 \times 3 = 300$.

3. The diagram shows the *PPF* for this economy.

4. As illustrated in the diagram.
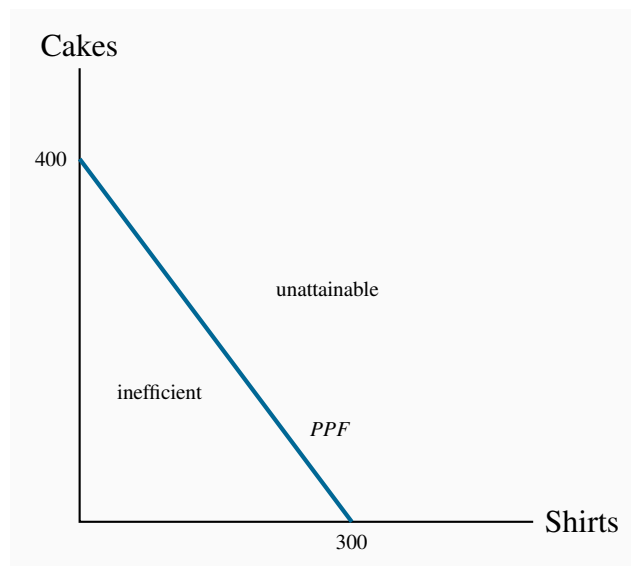
1.2   1. The *PPF* is curved outwards with intercepts of 1000 on the Thinkpod axis and 6000 on the iPad axis. Each point on the *PPF* shows one combination of outputs.

2. Different.

3. $400\,X$.

4. The new *PPF* in the diagram has the same Thinkpod intercept, 1000, but a new iPad intercept of 7200.

Thinkpods
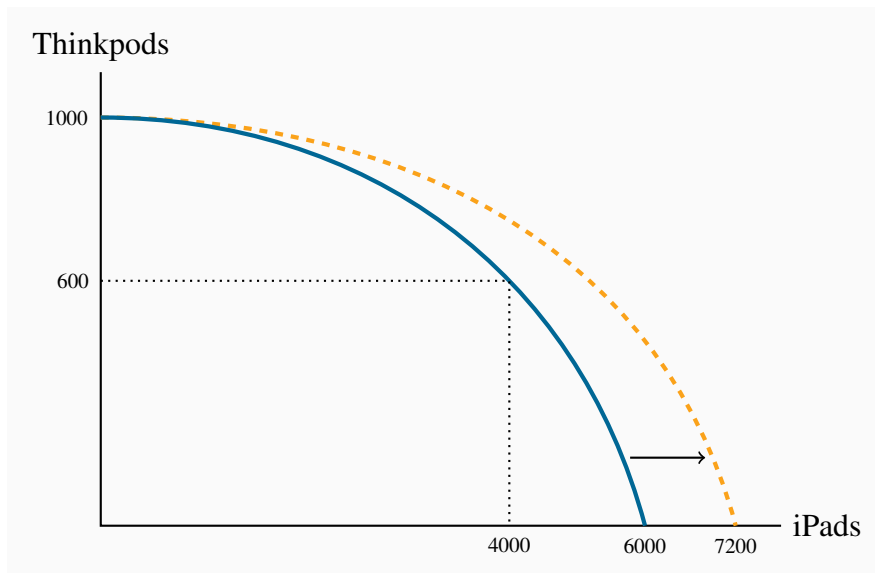
1.3 By examining the opportunity cost in the region where the combinations are defined, and by assuming a linear trade-off between each set of combinations, it can be seen that the first combination in the table is feasible, but not the second combination.
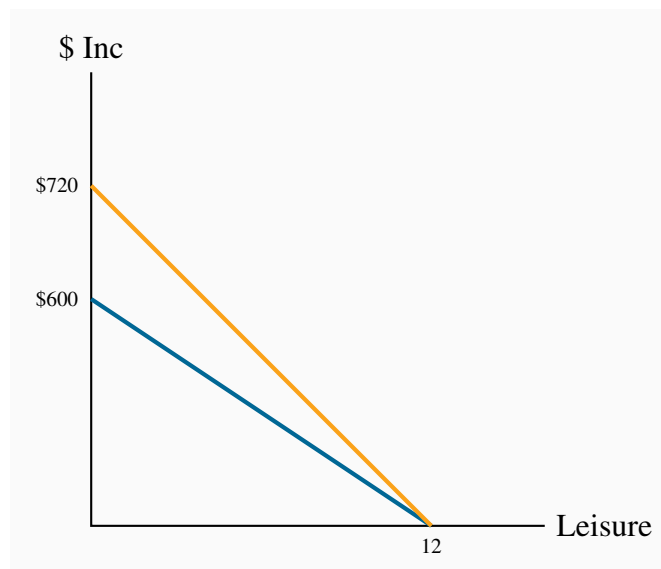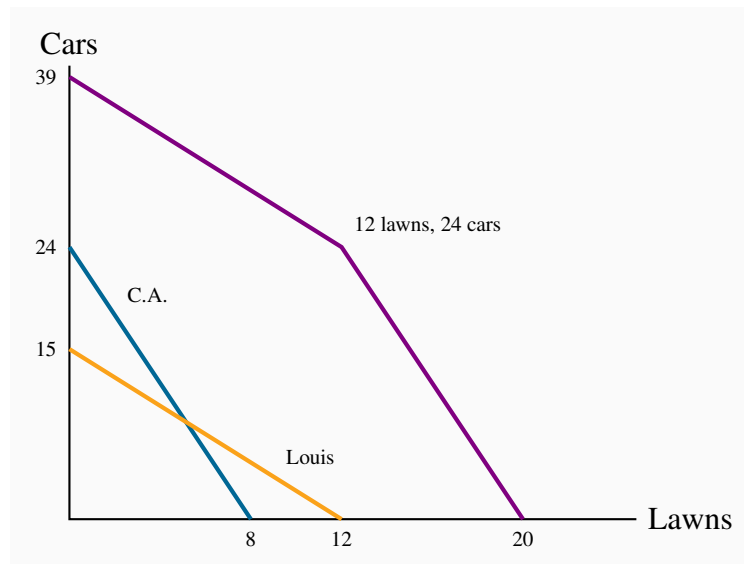
1.4 1. $50.

2. $60.

3. See diagram.

4. See diagram.

5. The person with the lower wage.

1.5   1. Louis has an advantage in cutting the grass while Carrie Anne should wash cars.

2. If they each work a twelve-hour day, between them they can cut 12 lawns and wash 24 cars.

**1.6** Following the method described in the text:

1.7   1. Carrie Anne's lawn intercept is now 12 rather than 8.

2. Yes, specialization still matters because C.A. is more efficient at cars.

3. The new coordinates will be 39 on the vertical axis, 24 on the horizontal axis and the kink point is the same.

1.8 C.A.'s intercepts are now 30 cars and 15 lawns; Louis' intercepts are 18.75 cars and 15 lawns; the economy-wide *PPF* car coordinate is thus 48.75, the lawn coordinate is 30, and the kink point is 15 lawns and 30 cars.

1.9   1. 220 cakes requires 55 workers, the remaining 45 workers can produce 135 shirts. Hence this combination lies inside the *PPF* described in Exercise 1.1.

2. 98 workers.

3. 2%.

SOLUTIONS TO EXERCISES FOR CHAPTER 2

2.1 These variables are positively related.
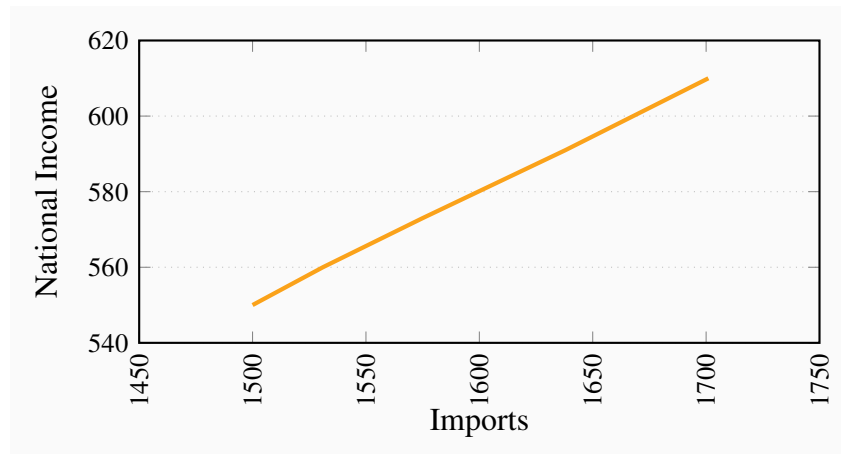
2.2 For (b) the answer is 32%, and for (c) the answer is 5.26%.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Index	0.95	1.00	1.04	1.09	1.14	1.14	1.21	1.23	1.32	1.35

2.3 To find the national unemployment rate for each year you take a weighted average of the unemployment rate in the big cities and that in other areas. The weights used are the shares of population living in each area. In 2007, for example, the national unemployment rate would be: Big city rate $\times 0.67 +$ other rate $\times 0.33 = 5 \times 0.67 + 7 \times 0.33 = 5.67$. Hence:

Year	2007	2008	2009	2010	2011
Index	5.67	7.99	8.33	10.67	9.67

2.4 For years 1 through 5 the index values for transport, rent and food are:

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Weight in total expenditure
Transport	100	100	107	107	107	10%
Rent	100	100	110	112	115	55%
Food	100	103	102	107	110	35%

The aggregate price index is the weighted average of the component price indexes with weights equal to shares in total expenditure. For Year 1 the aggregate index is $(100 \times 0.10 + 100 \times 0.55 + 100 \times 0.35) = 100$. For years 2 through 5 this methodology gives aggregate price indexes of 101, 108, 110, 114.

|	2000	2002	2004	2006	2008	2010
Nominal	100	111.54	126.92	126.92	119.23	115.38
Carrot price \$	2.6	2.9	3.3	3.3	3.1	3
CPI	110	112	115	117	120	124
CPI new base	100	101.82	104.55	106.36	109.09	112.73
Real carrot index	100	109.55	121.40	119.33	109.29	102.36

2.6 The scatter diagram plots observed combinations of income and consumption as follows. For parts (c) and (d): the variables are positively related and the causation runs from income to consumption.
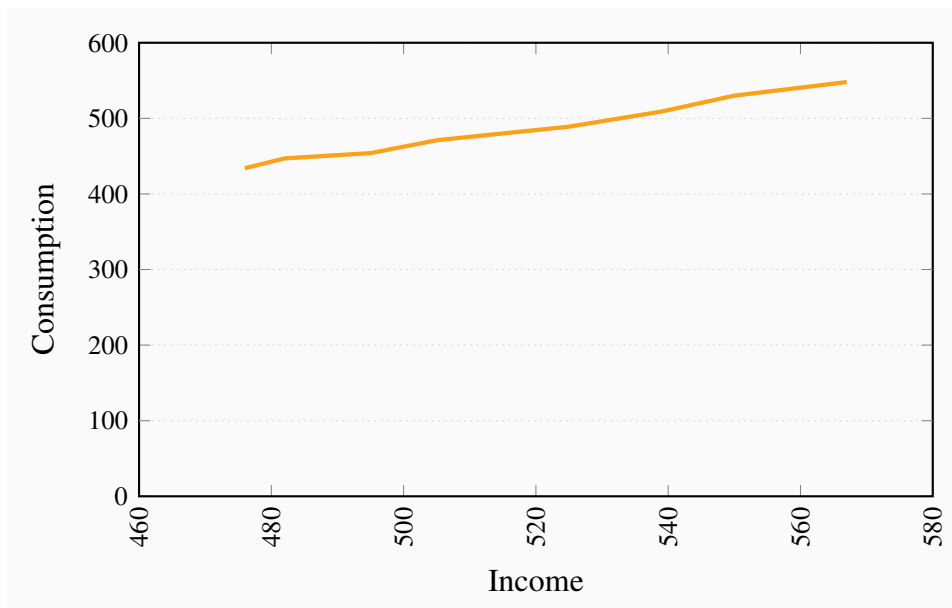
2.7 The percentage changes in income are:

Pct Inc	1.3	2.7	2.0	4.0	2.7	2.0	3.1
Pct Con	3.0	1.6	3.7	3.8	4.1	4.1	3.4

2.8 The relationship given by the equation $Y = 10 + 2X$ when plotted has an intercept on the vertical (Y) axis of 10 and the slope of the line is 2. The maximum value of Y (where X is 12) is 34.
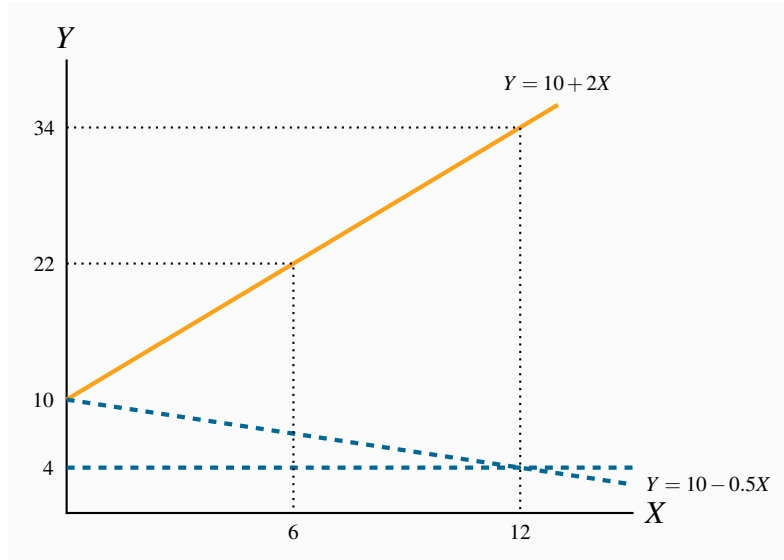
| X	0	1	2	3	4	5	6	7	8	9	10	11	12
Y	10	12	14	16	18	20	22	24	26	28	30	32	34

2.9 The relationship $Y = 10 - 0.5X$ has a Y intercept of 10 but there is now a negative slope equal to one half (-0.5). When X has a value of 12, Y has a value of 4. If you plot this in the diagram for Exercise 2.8 it is the dashed line sloping downward from 10 to 4 at $X = 12$.

2.10   1. The relationship is negative.

   2. The relationship is non-linear.

SOLUTIONS TO EXERCISES FOR CHAPTER 3

3.1   1. The diagram shows the supply and demand curves from the data in the table. These curves intersect at the equilibrium price $32 and the equilibrium quantity 7.

2. Excess demand is 6 and excess supply is 3.

3. With excess demand the price is bid up, with excess supply the price is pushed down.

4. Equate supply P to demand: $18 + 2Q = 60 - 4Q$, implying $6Q = 42$, which is $Q = 7$. Hence $P = 32$.
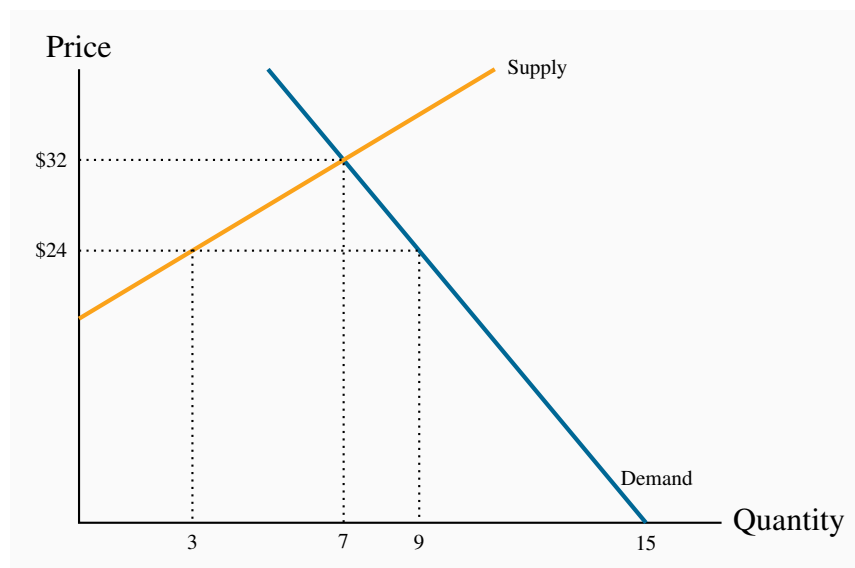
3.2   1. Demand curve facing *Air Canada* shifts left and down. The price of the substitute *Via Rail* has fallen and reduced the quantity of air transport services demanded at any price.

2. Demand curve facing *Air Canada* shifts left and down. The substitute car travel has improved in quality and perhaps declined in cost.

3. Demand curve facing *Air Canada* shifts left and down. A new budget air carrier is another substitute for *Air Canada* that will divide the market for air transport.

3.3 The market diagrams are drawn on the assumption that each product can be purchased for a given price, the supply curve in each market segment is horizontal. A downward sloping demand should characterize each market. If the cigarette market is 'quashed' the demand in the market for chewing tobacco, a substitute, should shift outward, leading to higher consumption at the same price.

Cigarettes

Chewing Tobacco
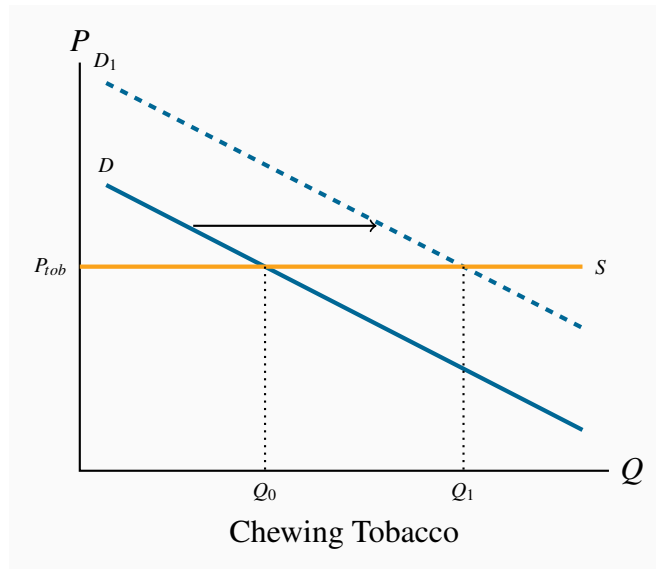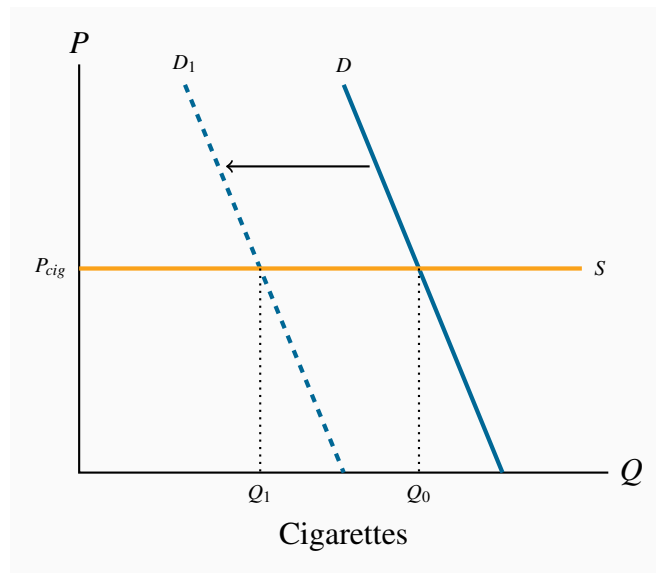
3.4 The supply curve shifts down and parallel, the demand curve shifts up and parallel.

1. Setting the new supply equal to the new demand: $10 + 2Q = 76 - 4Q$ implies $6Q = 66$ and therefore $Q = 11$, $P = 32$.

3.5 The diagram shows that equilibrium quantity is 240, equilibrium price is $130, which are the values obtained from equating supply and demand. At a price of $120 the quantity demanded is 300 and the quantity supplied 210. Excess demand is therefore 90.
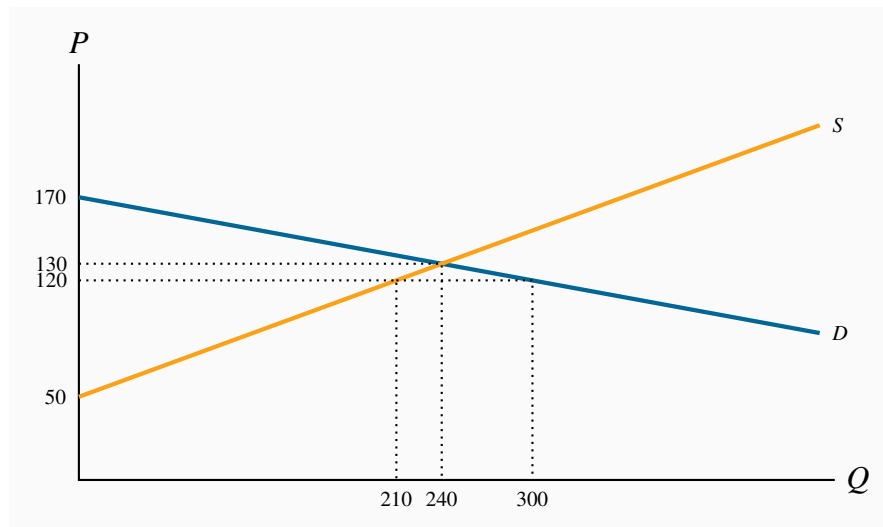
3.6 1. At a price of $140 quantity demanded is 180 and quantity supplied is 270; excess supply is therefore 90.

2. Total quotas of 180 will maintain a price of $140. This is obtained by substituting the price of $140 into the demand curve and solving for Q.

3.7 It must buy 90 units at a cost of $140 each. Hence it incurs a loss on each unit of $60, making for a total loss of $5,400.

3.8 1. The quantity axis intercepts are 84 and 126.

2. The quantities demanded are 160, 110 and 60 respectively, on the market demand curve in the diagram. These values are obtained by solving the quantity demanded in each demand equation for a given price and summing the quantities.

3.9

3.10
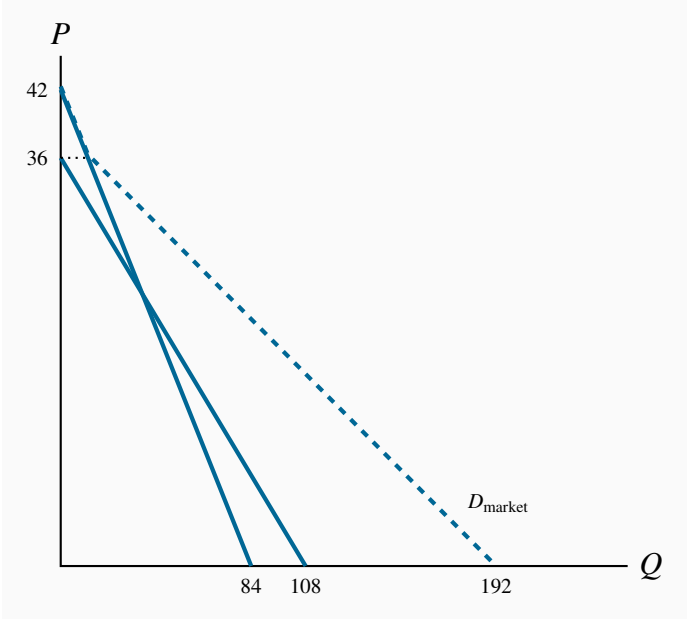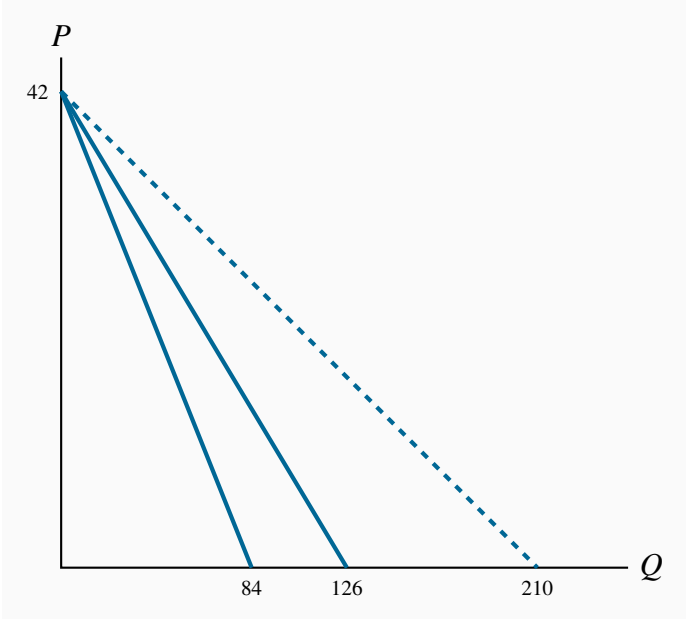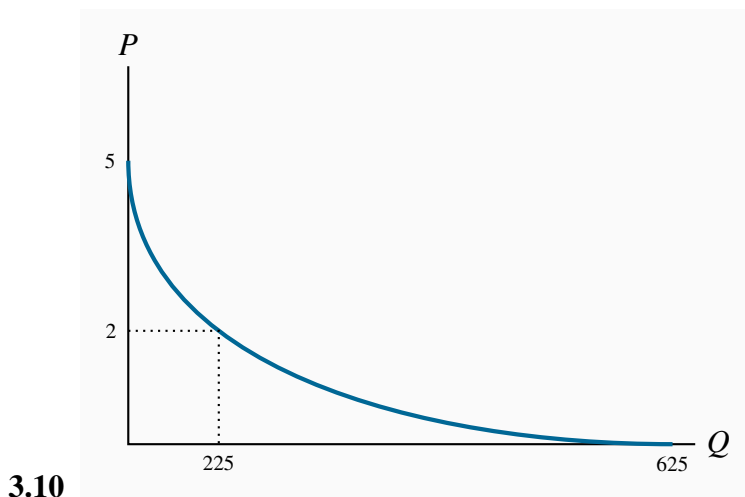
3.11   1. The equilibrium admission price is $P = \$21$, $TR = \$630$.

2. The equilibrium price would now become $18 and $TR = \$648$. Yes.

3. The answer is no, because total revenue falls.

3.12 Wages are a cost of bringing lettuce to market. In the market diagram the supply curve for lettuce shifts upwards to reflect the increased costs. If demand is unchanged the price of lettuce rises from P_0 to P_1 and the quantity demanded falls from Q_0 to Q_1.
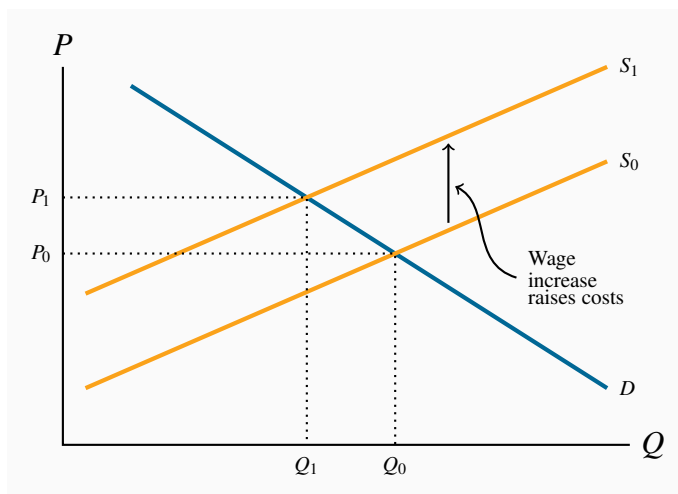
SOLUTIONS TO EXERCISES FOR CHAPTER 4

4.1   1. The intercepts for this straight line demand curve are $P = \$14$, $Q = 1400$.

2. Total revenue is this product of price times quantity. Compute it!

3. At $P = \$7$, total revenue is $4,900.

4. Elasticities, in descending order, are 0.22, 0.33, 0.47, 0.65, 0.87, 1.15.

5. Elasticity becomes greater than one in magnitude at one point where total revenue is maximized.
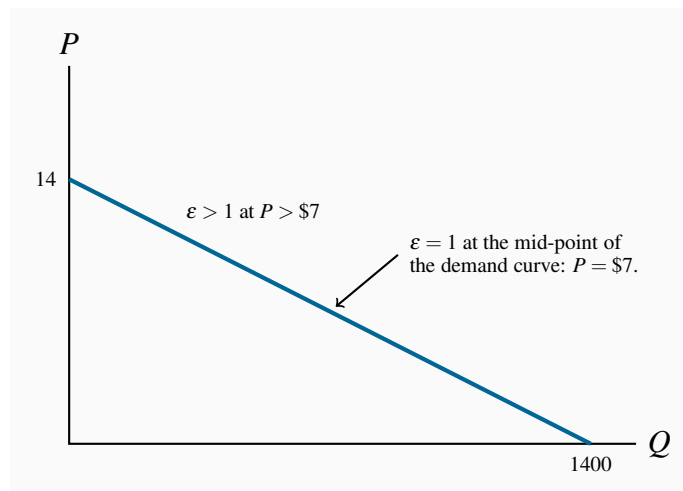
4.2   1. The supply curve is vertical at a quantity of 100.

2. We are told $-0.5 = \%\Delta Q/\%\Delta P$. The percentage change of quantity is $-10/95$; therefore the percentage change in price must be: $\%\Delta P = -(10/95)/-0.5 = 20/95 = 21\%$. The new price is therefore $0.4 \times 1.21 = 0.48$.
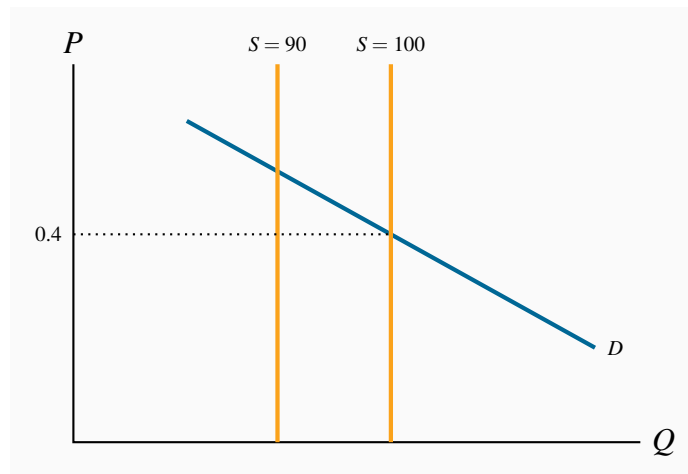
4.3   1. Since the price is fixed the supply curve is horizontal. See figure below.

2. You cannot estimate a demand elasticity value since there has been no price change.

3. Here the (adjoining) horizontal supply curve shifts upwards by 60%. If enrolment has increased the demand curve must also have shifted upwards. Draw an additional supply curve representing a 60% upward shift, and find an intersection between the new demand and new supply such that the percentage increase in quantity is 15% (this diagram is not included here).
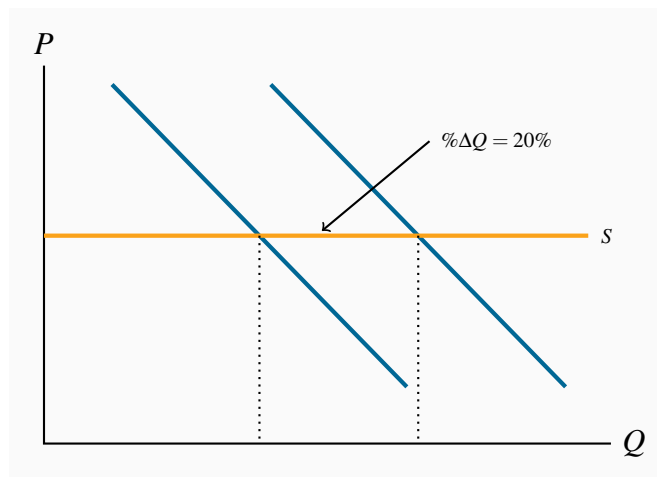

4.4   1. The demand curve is nonlinear.

2. Total revenue is price times quantity.

3. Elasticity values are 0.71, 0.78, and 0.82 respectively.
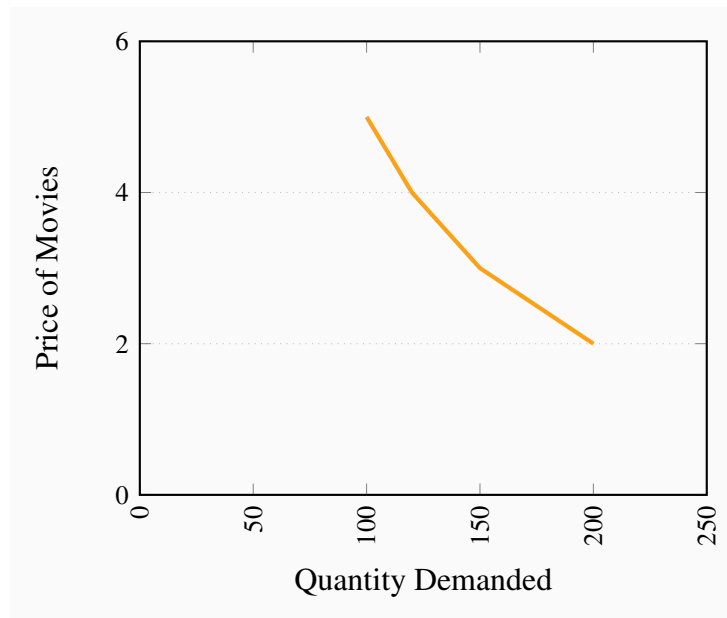
4.5 The supply curve is vertical at $Q = 40$. Substituting this quantity into the demand equation yields an equilibrium price of $40.

1. The supply curve is vertical at $Q = 40$. Substituting this quantity into the demand equation yields an equilibrium price of $40.

2. The supply elasticity is zero and the demand elasticity is -5.0. The latter is obtained by noting that $\Delta P / \Delta Q = -0.2$, and $P = \$40$ at $Q = 40$. Using the elasticity formula yields -5.0.

3. Since the elasticity value exceeds unity he should reduce the price and install more seats if his objective is to generate more revenue.

4. Above the price $24, which is the mid-point on the demand curve, demand is elastic.
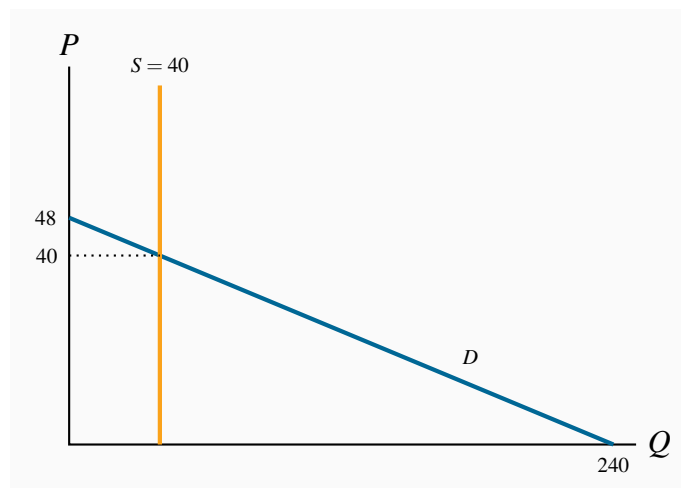
4.6   1. There has been a 20% increase in price. Feeding this into the elasticity formula yields $-0.6 = \%\Delta Q/20\%$. Hence the percentage change (reduction) in quantity is 12%.

2. Following the same reasoning as in part (a) the result is 24%.

3. In the short run revenue rises since demand is inelastic (less than one in absolute value); in the long run it falls since demand is elastic (greater than one in absolute value).

4.7   1. It is elastic for magazines and inelastic for CDs and Cappuccinos.

2. A reduction in magazines purchased and an increase in cappuccinos purchased. Magazines are complements and cappuccinos are substitutes for CDs.

3. The demand curve for magazines shifts down in response to an increase in the price of CDs and it increases in response to an increase in the price of cappuccinos.

4.8   1. Reduce the price, because the elasticity is greater than one.

2. Yes, it would reduce train ridership because the positive cross-price elasticity indicates that these goods are substitutes.

4.9   1. Plot the scatter.

2. The scatter is a positively sloping group of points indicating a positive relationship.

3. The elasticities estimated at mid values are 1.0, 0.64, 0.47, 0.52, 0.29 and 0.32. For example: the first pair of points yields a $\%\Delta P = 5/12.5$ and $\%\Delta Q = 8,000/20,000$. Hence, $\%\Delta Q/\%\Delta P = (8,000/20,000)/(5/12.5) = 1.0$.

4. They are normal goods because the income elasticity is positive.

4.10   1. All three supply curves intersect at $P = \$18$ and $Q = 8$.

2. The supply elasticities are 1.0, 1.125 and 1.5 respectively. These are obtained from substituting the equilibrium P and Q values into Equation 4.1 Part (c) in the text, and noting that the slopes, $\Delta Q/\Delta P$, from each equation are 2.25, 2, and 1.5.

3. The elasticities are computed in the same way, once you have calculated the equilibrium quantity for each equation at this new price: 1.0, 1.2 and 2.0.

4. The supply curve through the origin always has a value of unity.
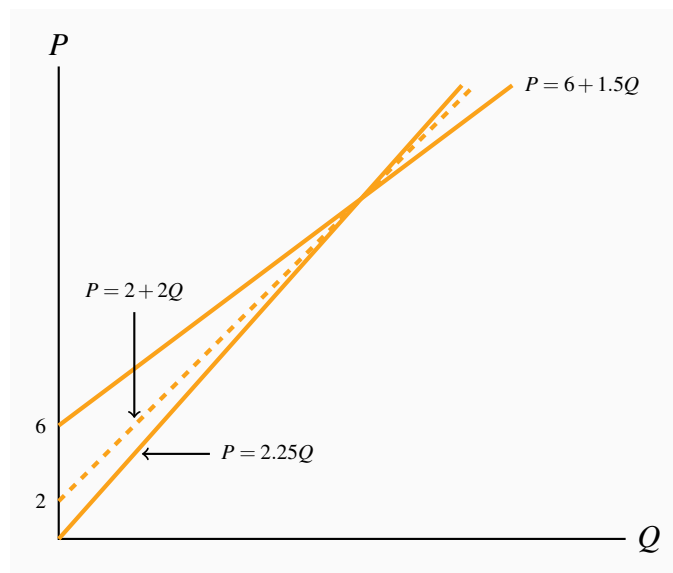
4.11   1. The price intercept for the demand curve is 48 and the quantity intercept is 240. The supply curve goes through the origin with a slope of 1. The equilibrium price is $40 and the equilibrium quantity is 40.

2. The supply curve shifts upwards everywhere by $12.

3. The price will increase to $42 and the quantity declines to 30.

4. The curve still goes through the origin but with a slope of 1.3 rather than 1.0 (not illustrated in the figure).

5. The equilibrium quantity is $Q = 32$; corresponding price is $P = 32 \times 1.3 = 41.6$.
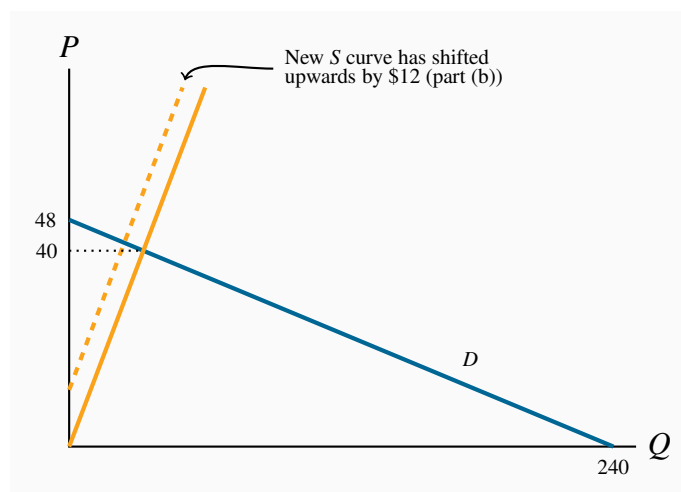
4.12   1. The demand curve has a price intercept of 100 and a quantity intercept of 50. The supply curve is horizontal at a price of $30. The equilibrium quantity is 35 units at this price.

2. The new, tax-inclusive, supply curve is horizontal at $P = \$40$ (not illustrated in the figure). The equilibrium price is \$40 and the equilibrium quantity becomes 30. With 30 units sold, each generating a tax of \$10, total tax revenue is \$300.

3. Since the equilibrium is on the lower half of a linear demand curve the demand is inelastic.
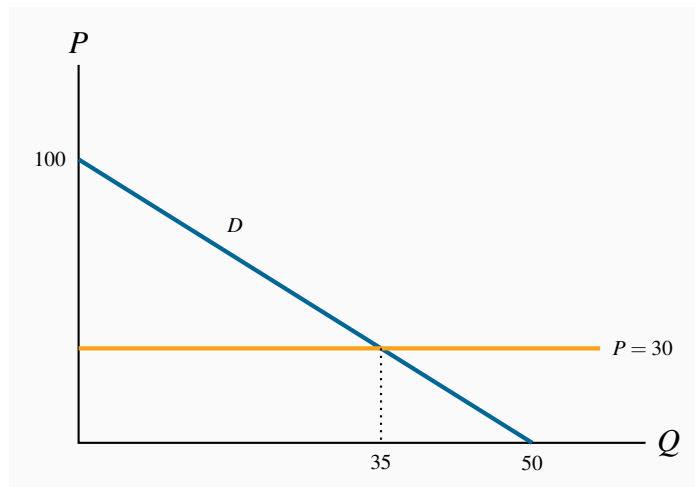
4.13 As illustrated in the text, we could equally shift the demand curve down by \$10 to yield $P = 90 - 2Q$. Equating this to $P = 30$ yields $Q = 30$ once again. The price of \$30 here is what goes to the supplier; the buyer must pay this plus the tax – that is \$40.

4.14   1. The supply and demand curves are illustrated below.

2. Solving the demand equations for $Q = 20$ yields prices of \$12 and \$15 respectively.

3. The consumer bears the entire tax burden.
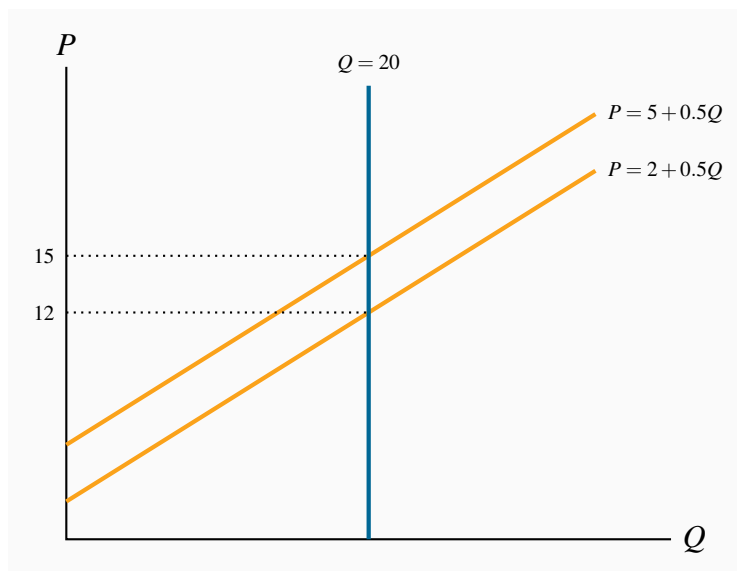
SOLUTIONS TO EXERCISES FOR CHAPTER 5

5.1 1. The step functions are similar to those in Figure 5.1. In ascending order, Margaret is the first supplier, Liam the second, etc. You must also order the demanders in descending order.

2. Two: Margaret and Liam will supply, while Jones and Lafleur will purchase. The third highest demander (Murray) is willing to pay $6, while the third supplier is willing to supply only if the price is $9. Hence there is no third unit supplied.

3. The equilibrium price will lie in the range $7.0-$7.5. So let us say it is $7. The consumer surplus of each buyer is therefore $1 and $0.5. The supplier surpluses are zero and $2.

4. Two driveways will still be cleared. The highest value buyers are now willing to pay $12 and $8. The third highest value buyer is willing to pay $7.0. But on the supply side the third supplier still supplies only if he gets $9. Therefore two units will be supplied. If the price remains at $7 (it could fall in the range between $7 and $8) the consumer surpluses are now $5 and $1, and the supplier surpluses remain the same.

5.2 1. The supply curve is horizontal at a price of $10. The demand curve price intercept is $34 and the quantity intercept is 34. The equilibrium quantity is 24.

2. The new supply curve is $P = 12$. Substituting this price into the demand curve yields $Q = 22$.

3. Tax revenue is $44: each of the 22 units sold yields $2. The deadweight loss is the standard triangular area in Figure 5.4. It is $2.

5.3 1. With a supply curve given by $P = 10$, the new demand curve yields an equilibrium quantity of 24 once again. The new demand curve is 'flatter' at the equilibrium than the original, indicating that it is more elastic.

2. With a tax of $2 imposed the new equilibrium quantity is 21. Hence tax revenue is $42. The DWL is $3.

5.4 1. The supply curve goes through the origin and the demand curve is horizontal at $W = $16 – see diagram below.

2. The equilibrium amount of labour supplied is 20 units. The supplier surplus is the area above the supply curve below the equilibrium price= $160.

3. At a net wage of $12, labour supplied falls to 15. The downward shift in the wage reduces the quantity supplied. The new supplier surplus is the triangular area bounded by $W = 12$ and $L = 15$. Its value is therefore $90.
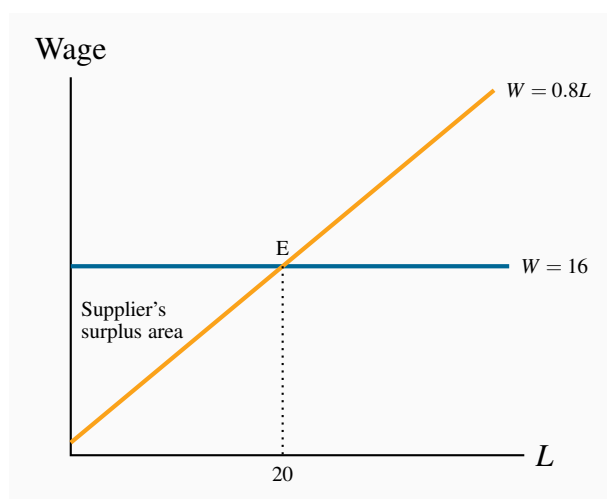
5.5   1. The demand curve shifts inwards.

   2. Yes, because consumers previously did not have full information about the product.

5.6   1. Yes.

   2. Yes, because the congestion effect is not incorporated into the price of driving.

5.7   1. The free market equilibrium is obtained by equating demand and private-cost supply curves: $Q = 10$, $P = \$7$.

   2. Using the social supply curve yields and equilibrium of $Q = 6$. These answers are illustrated graphically in Figure 5.5.

5.8   1. Equating demand to price yields $Q = 100$km. See figure below.

   2. Using a price of $2.5 rather than $2.0 yields a quantity of 75km.
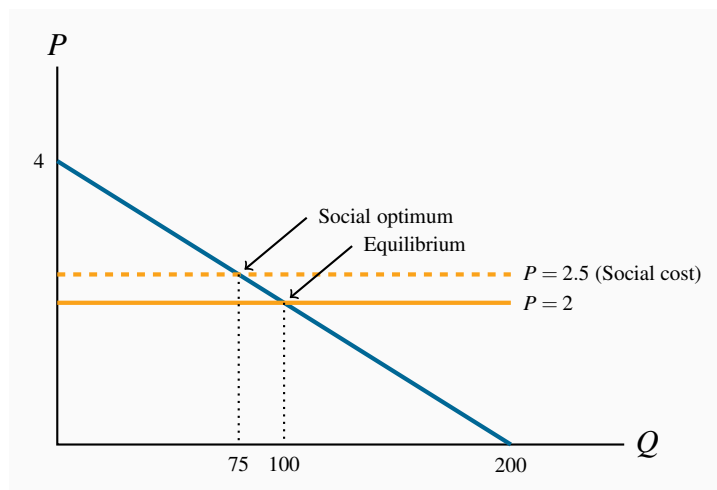
5.9   1. The supply curve is horizontal at $P = \$1$. The demand curve has a price intercept of 5 and a quantity intercept of 1000. The equilibrium quantity is 800.

   2. The socially optimal quantity is obtained by recognizing that the social cost is $1.25 rather than $1.0. Here $Q^* = 750$.

5.10   1. The demand curve is horizontal at $P = \$12$. The supply curve slopes upwards with a price intercept of $6. Equilibrium is $L = 60$.

   2. Surplus is the area beneath the demand curve above the supply curve= $180.

**5.11**   1. The equilibrium here is $Q = 20$, $P = \$4$.

   2. Consumer surplus is $200.

   3. The new quantity is $Q = 18$ and $CS = \$162$.

5.12 The marginal abatement curves are essentially the demand for pollution rights on the part of the producers. If we sum these curves horizontally it is easy to see that the price intercept remains at $24 and the horizontal intercept becomes 72 ($= 24 + 48$). Hence the total demand for abatement becomes $MA = 24 - (1/3)pol$. The MD function is $MD = \$12$. This is the 'supply' function because firms are able to buy the pollution rights at this price. The efficient level of pollution is 36 units.

5.13   1. See diagram below. The answers are $15 and $6.

   2. As long as the abatement costs are different it is profitable to trade. With a total number of permits available of 36 units, the amount they trade will depend upon the price they agree upon. Provided the price lies between $6 and $15 they have an incentive to trade.
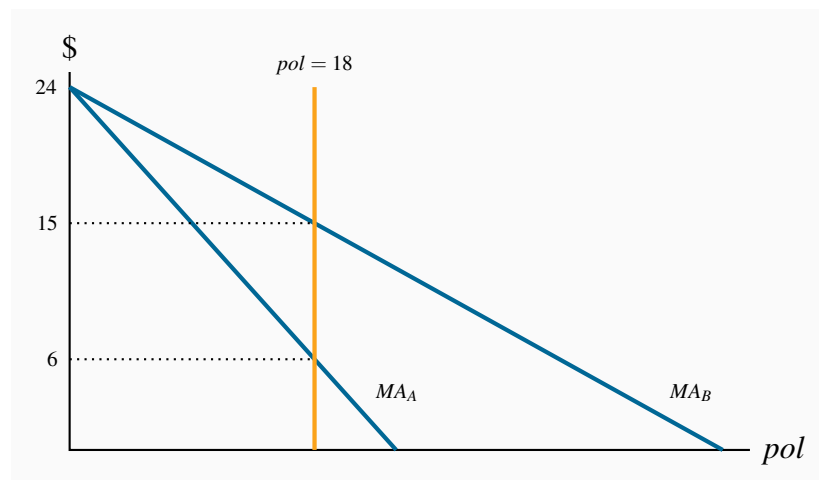
5.14 Firm A would purchase 14 units and Firm B would purchase 28. Clearly the lower price price means that the total amount of pollution emitted is greater.

5.15   1. The market solution is obtained by equating the market demand and supply. This yields $Q = 16$ and $P = \$20$.

2. The socially optimal amount takes account of the fact that there are positive externalities. The demand curve that reflects these externalities is above the private demand curve. Hence the socially optimal equilibrium is at a greater output $Q = 32$.

3. To induce a demand of 32 units in the private marketplace the price would have to be $4. Hence the subsidy per unit would be $16.

5.16 The demand curve would have to be shifted upwards to the point where it intersects the supply curve at 32 units. The new price intercept would have to be $52. Hence the subsidy would again be $16.

5.17   1. Equating the functions yields $Q = 35$, $P = \$7$.

2. The solutions becomes $Q = 30$, $P = \$12$.

3. The consumer pays $12, the supplier gets half of this.

4. Using the customary triangle formulas yields $CS = \$450$; $PS = \$90$; $DWL = \$15$.

SOLUTIONS TO EXERCISES FOR CHAPTER 6

6.1 Since the additional utility per dollar spent on another unit of either activity is the same (1.2 units), he should be indifferent as to where he spends it. However, if he gets an income increase that is sufficient to cover the purchase of one unit of the goods then snowboarding yields the highest *MU* per dollar spent.

6.2 The utility and marginal utility curves are given below.
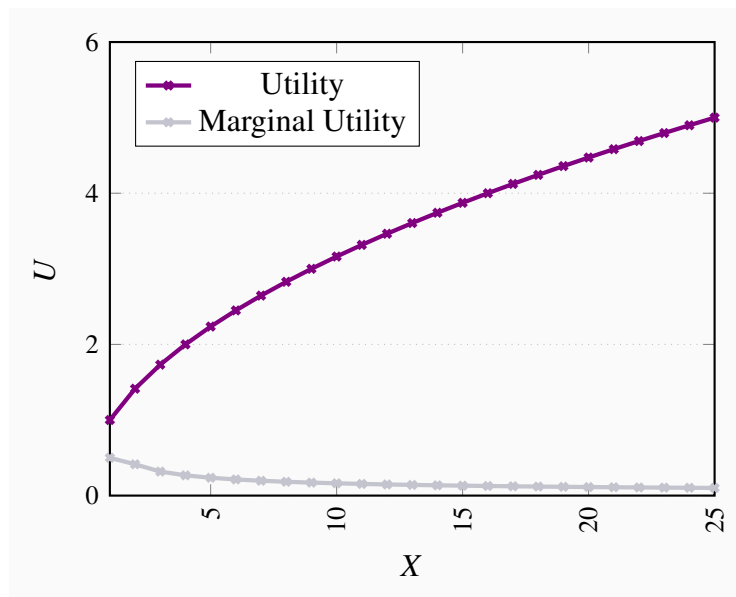
6.3   1. The cappuccino intercept is 8 and the M intercept is 24. The slope is $-1/3$.
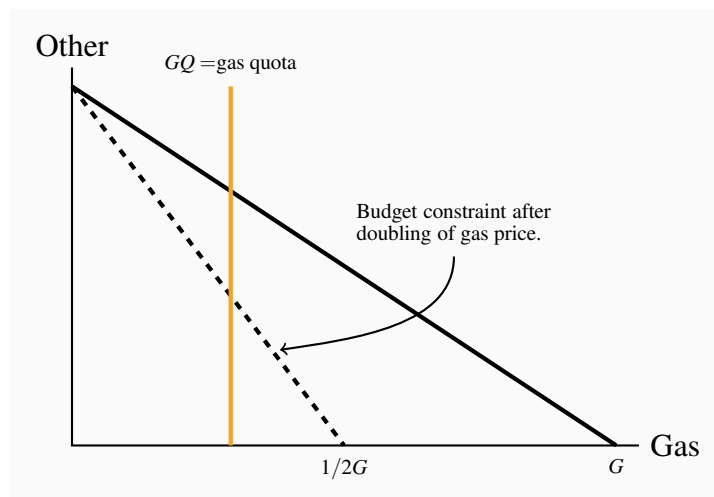
2. New slope is $-1/4$.

3. Yes, yes, yes.

4. All lie inside.

6.4   1. Let G be the initial intercept on the gasoline axis, then $1/2G$ is the new intercept.

2. A vertical line at a point less than $1/2G$ reduces the feasible set to the area bounded by the new budget constraint (dashed line) and the vertical line GQ.

6.5 The new intercept on the gasoline axis will be less than $1/2G$.

6.6   1. The theatre ticket intercept is 6 and the cappuccino intercept is 24. See below.

2. See below.

3. No. The cost exceeds the budget.

4. We cannot say without knowing the shape of the indifference curves. In this case the individual has more of one good and less of the other.

5. No. The cost of such a combination would be $84.
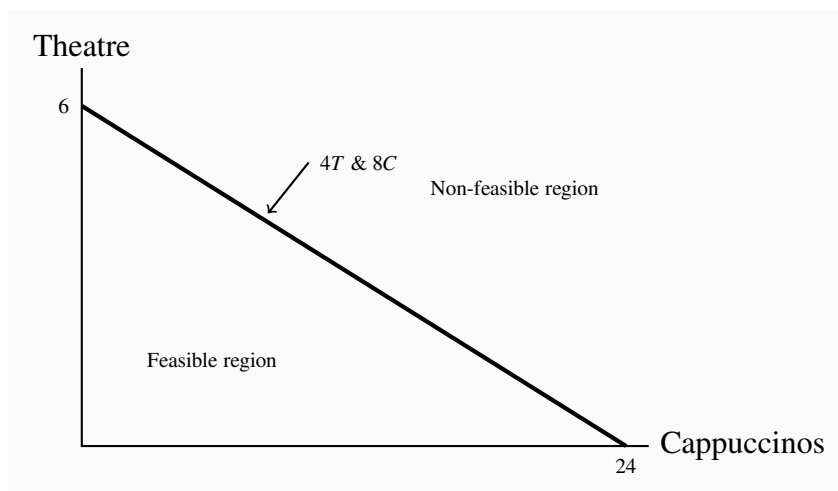
6.7 They are not strictly convex to the origin, and so they do not display a diminishing marginal rate of substitution.

6.8   1. The meals intercept is 10, and the movies intercept is 25.

2. The meals intercept is now 20. More meals will be purchased, but we cannot say about movies – it depends upon whether they are substitutes or complements for meals. However, the individual will reach a higher level of utility.

3. The new movie intercept is 50. This budget line is parallel to the original line. Since both goods are normal then more of each will be consumed.

4. In part (b) we cannot be sure that more of each good is consumed; in part (c) more of each must be consumed. Utility levels increase with each price reduction however.

6.9 If Lionel can buy 10 bottles of wine for $120, then each bottle must cost $12. Similarly cheese must cost $30 per kilo.

1. The wine intercept must be 180/20=9. Similarly the cheese intercept must be 180/30=6.

2. Yes, he can afford the original combination with the new budget constraint and still have $20 remaining – which he can spend on the goods.

6.10 Indifference curve is given below. When x goes from 3 to 4, y declines by 1 unit; when x goes from 15 to 16, y declines by 0.05.

6.11 See figure below.

Income consumption curve
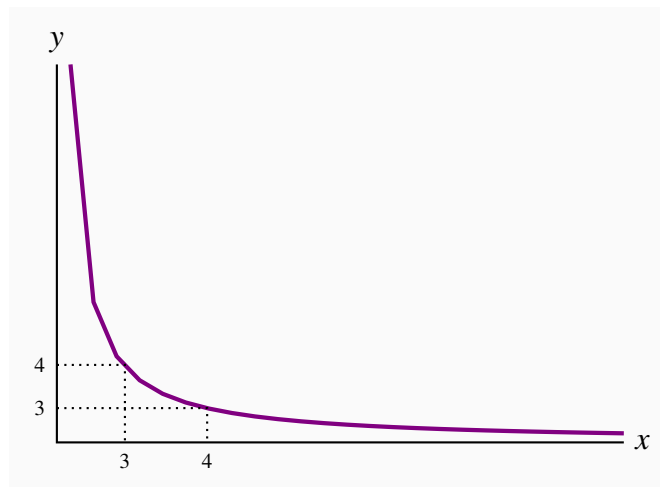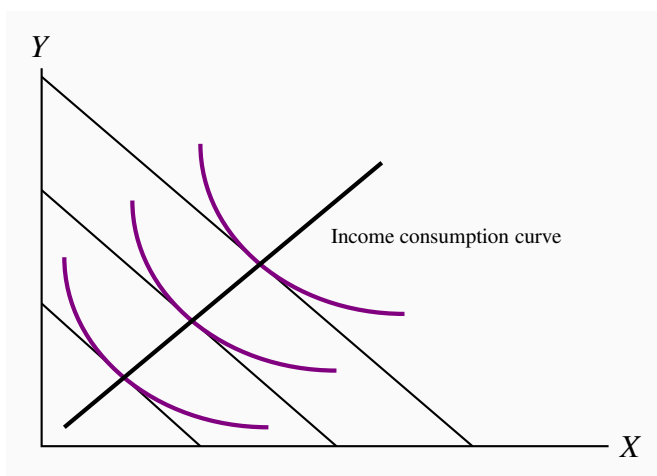
6.12 See the figure below. Part (b) will see the rotation point stay at the X intercept.

Price consumption curve for X

6.13   1. His new marginal utility per dollar schedule is 3.25, 2.625, 2.125, 1.75, 1.5, 1.32, 1.19. Therefore his new equilibrium will be 4 snowboard outings and 5 jazz.
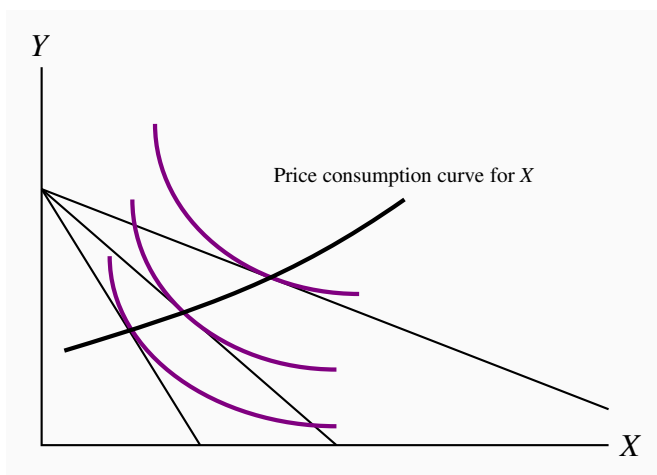
2. When the price of jazz was $20 he purchased 4 units of each. Using the mid-point elasticity formula, his jazz consumption has increased by $1/4.5 = 22\%$, and the price of jazz decreased by $4/18 = 22\%$. Hence the elasticity is (minus) one.

3. There has been no change in the purchase of snowboarding, therefore the cross price elasticity at this set of prices is zero.

6.14 With movies on the Y axis and public transport on the X, the higher income equilibrium will lie to the north-west of the lower income equilibrium.

Movies

At higher income level less
public transport is purchased

Initial equilibrium

Public
transport
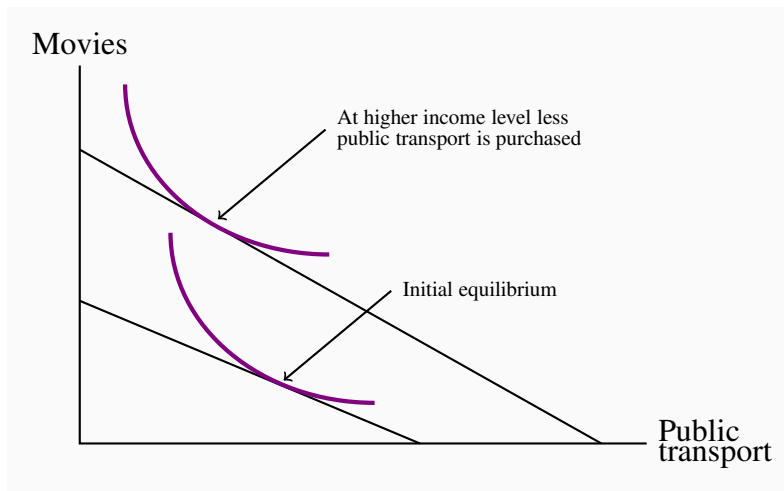
6.15 Where more 'other goods' are purchased they are complements; where less of such goods are purchased they are substitutes.

SOLUTIONS TO EXERCISES FOR CHAPTER 7

7.1 The dollar outcomes for the three games are: $10,000, $30,000 and $20,000. The average utilities are: 99.7, 173.2 and 141.

7.2 If there is no medical exam then it is probable that less healthy individuals will avail of it. Knowing this, the firm should choose its benefit/payout structure to reflect a high cost clientele. It will have lower payouts and/or higher premiums. Therefore a healthy individual would likely not obtain favourable insurance terms.

7.3   1. Spreading.

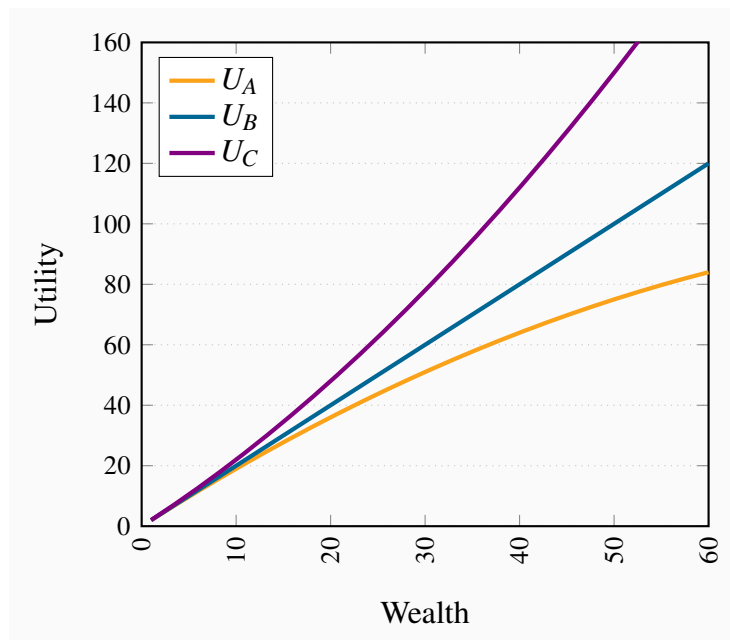2. Pooled.

3. Spreading.

4. Spreading and pooling.

7.4   1. See below.

2. Utility A is risk averse; Utility B is rish neutral; Utility C is risk loving.

3. A displays diminishing MU, B displays constant MU, C displays increasing MU.

7.5 Alone the average utility is 35.35; pooled the average utility is 42.7.

7.6 If each asset has a 10% return with probability 1/2 and zero with probability 1/2, then if $50 is invested in such an asset the variance is $1/2(55 - 52.5)^2 + 1/2(50 - 52.5)^2 = 6.25$. With 4 such assets each having the same variance then the variance of the portfolio is 25 when the returns on each asset are independent of the returns on the others.

7.7   1. See below.

   2. If income falls to $1 then utility from that outcome is the square root of 1. Hence we need to figure out x such that $0.5 \times 1 + 0.5 \times \sqrt{(x)} = 4$. It follows that $x = 70$. You can check that outcomes of 1 and 70 with equal probability yield an expected utility of 4.
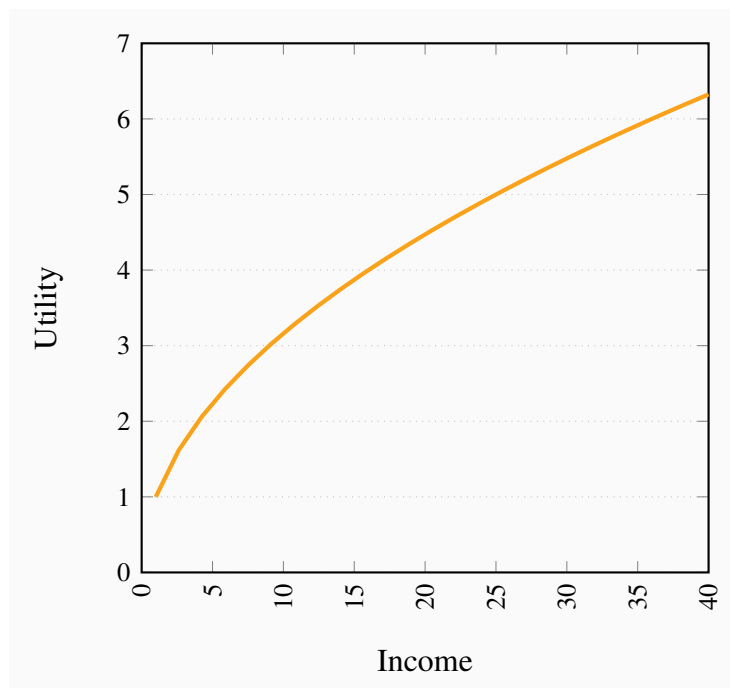
7.8   1. His expected utility is $0.5 \times 0 + 0.5 \times \sqrt{25} = 2.5$.

   2. Expected utility becomes $0.5\sqrt{9} + 0.5 \times \sqrt{16} = 3.5$.

7.9 He should smooth his income completely and save 12.5 each good time period.

7.10 See below. Clearly this displays diminishing marginal utility.
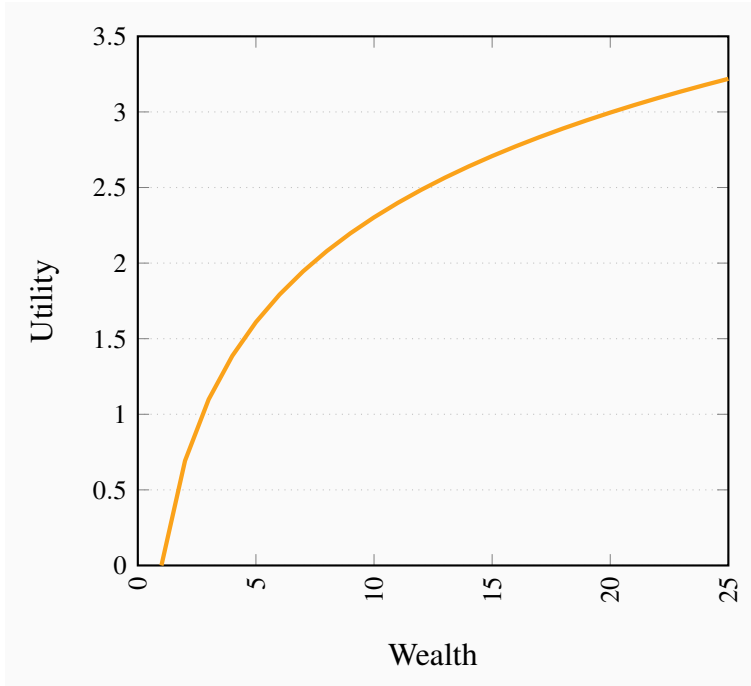
SOLUTIONS TO EXERCISES FOR CHAPTER 8

8.1   1. For $1 = 1$ through 9 the output produced is 5.0, 7.07, 8.66, 10.0, 11.18, 12.25, 13.23, 14.14, 15.0.

2. See the figure below.

3. Note that total output increases at a diminishing rate – the *MP* is declining.
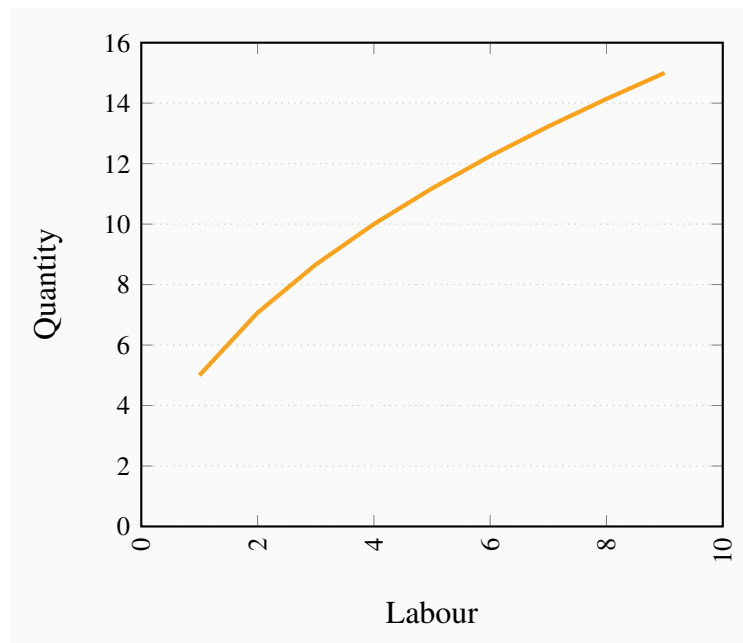
8.2 For each level of labour used, its *AP* is: 1.0, 3.0, 4.0, 5.0, 6.0, 7.0, 7.57, 7.5, 7.33, 7.0. and the *MP* is: 1, 5, 6, 8, 10, 12, 11, 7, 6, 4. The *AP* and *MP* are graphed below. If the *MP* cuts the *AP* at the latter's maximum, your graph is likely correct.
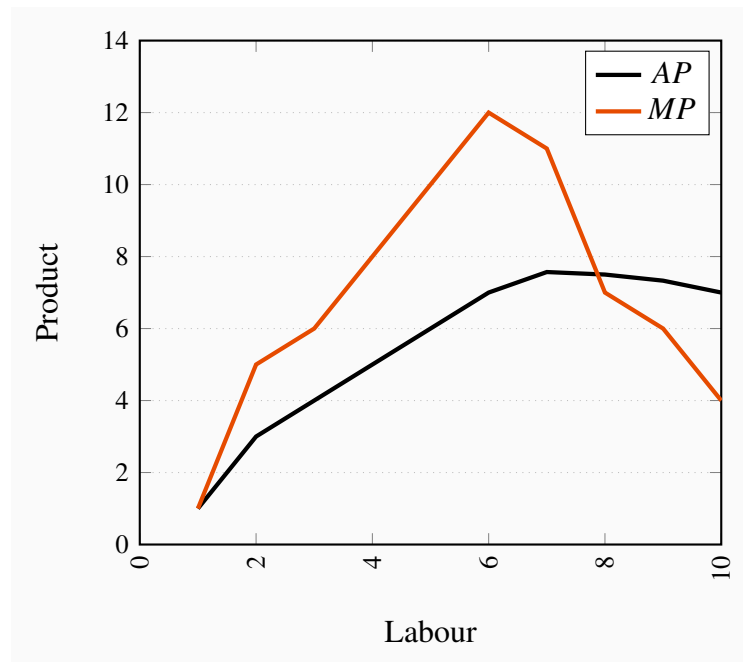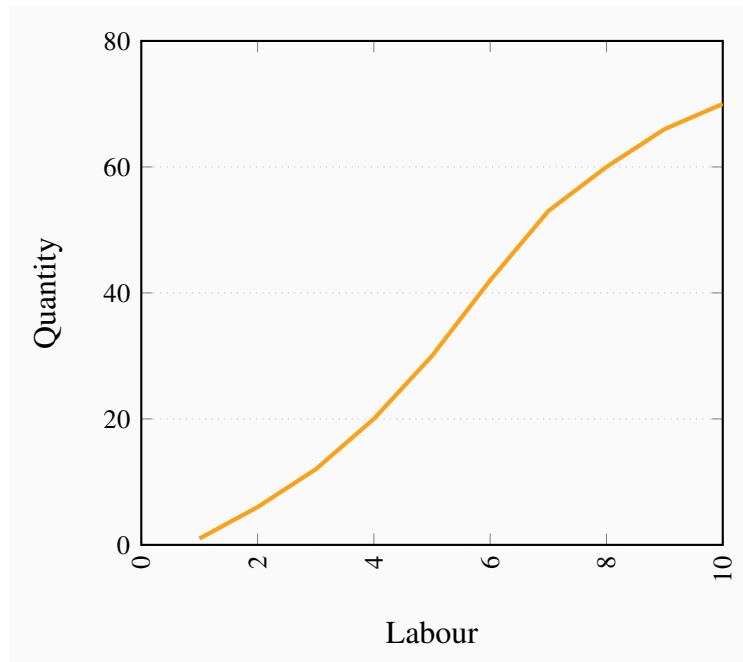
8.3 The *AP* schedule is 5.0, 3.54, 2.89, 2.5, 2.24, 2.04, 1.89, 1.77, 1.67. The *MP* schedule is: 5.0, 2.07, 1.59, 1.34, 1.18, 1.07, 0.98, 0.91, 0.86.

8.4   1. Fixed cost is $12.

2. See below.

3. See below.

Q	TC	AFC	AVC	ATC	MC
0	12				
1	27	12.00	15.00	27.00	15
2	40	6.00	14.00	20.00	13
3	51	4.00	13.00	17.00	11
4	61	3.00	12.25	15.25	10
5	70	2.40	11.60	14.00	9
6	80	2.00	11.33	13.33	10
7	91	1.71	11.29	13.00	11
8	104	1.50	11.50	13.00	13
9	120	1.33	12.00	13.33	16

4. See below.
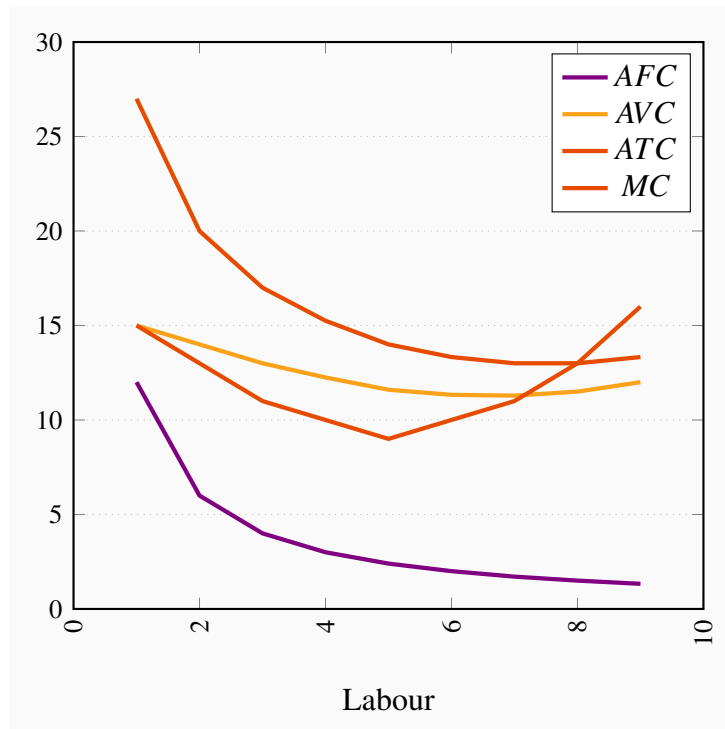
8.5 See table below. By this point you should be able to take these data and put them into Excel, or some spreadsheet tool, and plot.

L	Q_s	Q_m	Q_l	AP_s	AP_m	AP_l	MP_s	MP_m	MP_l	ATC_s	ATC_m	ATC_l
1	15	20	22	15	20.00	22.00	15.00	20.00	22.00	10.67	10.00	10.91
2	30	40	46	15	20.00	23.00	15.00	20.00	24.00	7.33	6.50	6.52
3	48	64	70	16	21.33	23.33	18.00	24.00	24.00	5.83	5.00	5.14
4	56	74	80	14	18.50	20.00	8.00	10.00	10.00	6.07	5.14	5.25
	100	140	180									

8.6 The *ATC* for each plant size is given in the table accompanying the preceeding question. Each one has a U shape.

8.7 Since the minimum point on the *ATC* curve of the large plant size lies above the minimum point on the *ATC* curve for the medium plant size in the table above, diminishing returns to scale eventually set in.

8.8 1. The least cost method can be ascertained from the table below.

2. The *TC* will have the cost points 33, 64 and 96, corresponding to the output levels 4, 8, 12. The *ATC* will have the values $8.25, 8.0, 8.0. These values can be plotted easily.

K	L	Q	TC
4	5	4	33
2	6	4	34
7	10	8	64
4	12	8	68
11	15	12	97
8	16	12	96

8.9 The total cost column is now 37, 36; 71, 72; 108, 104, and the relevant least-cost values are therefore 36, 71, 104. The new LR *ATC* will lie everywhere above the LR *ATC* defined for the lower price of capital.

8.10 1. The costs are given in the table below.

2. Firm A experiences decreasing returns to scale at high outputs, whereas B does not.

Q	TC_A	LAC_A	TC_B	LAC_B
1	40	40.00	30.00	30.00
2	52	26.00	40.00	20.00
3	65	21.67	50.00	16.67
4	80	20.00	60.00	15.00
5	97	19.40	70.00	14.00
6	119	19.83	80.00	13.33
7	144	20.57	90.00	12.86

8.11 MC curve data are given in the table below. Firm B has constant marginal costs in the LR; hence never encounters decreasing returns to scale. Firm A's LR MC intersects its LR ATC at an output between 5 and 6 units, where the ATC is at a minimum. Firm A's MC lies everywhere below its ATC.

Output	1	2	3	4	5	6	7
MC **Firm A**	40	12	13	15	17	22	25
MC **Firm B**	30	10	10	10	10	10	10

8.12 The table and graphic that answer all parts of this question are given below.

| Output	ATC	TC	MC
1	3.125	3.125	3.125
2	2.25	4.50	1.38
3	2.04	6.13	1.625
4	2.00	8.00	1.875
5	2.03	10.13	2.125
6	2.08	12.50	2.375
7	2.16	15.13	2.625
8	2.25	18.00	2.875
9	2.35	21.13	3.125
10	2.45	24.50	3.375
11	2.56	28.13	3.625
12	2.67	32.00	3.875
13	2.78	36.13	4.125
14	2.89	40.50	4.375
15	3.01	45.13	4.625
16	3.13	50.00	4.875
17	3.24	55.13	5.125
18	3.36	60.50	5.375
19	3.48	66.13	5.625
20	3.60	72.00	5.875
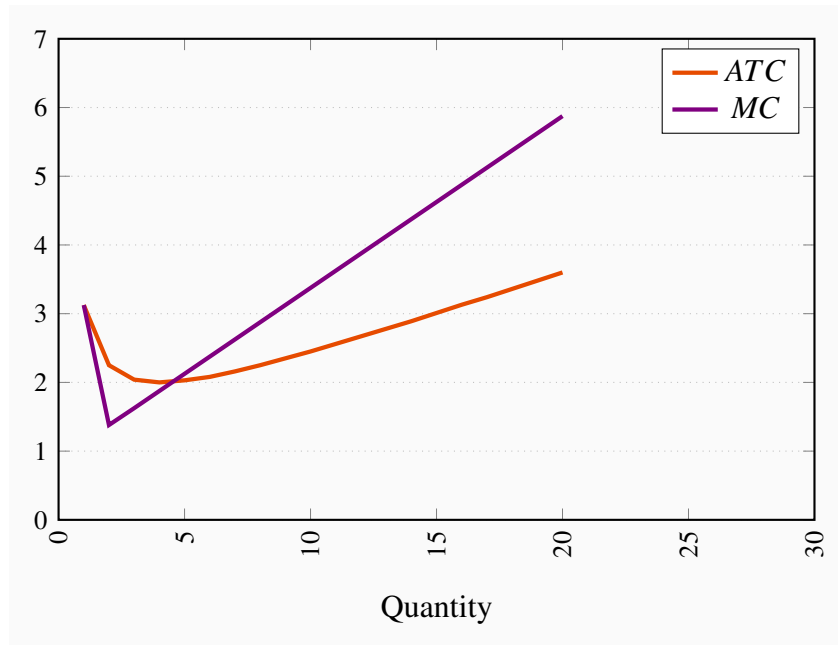
8.13   1. See graphic below.

2. Decreasing returns to scale.

3. As q becomes infinitely large the second term tends to zero, hence ATC tends to \$.

4. $LMC = 4$.
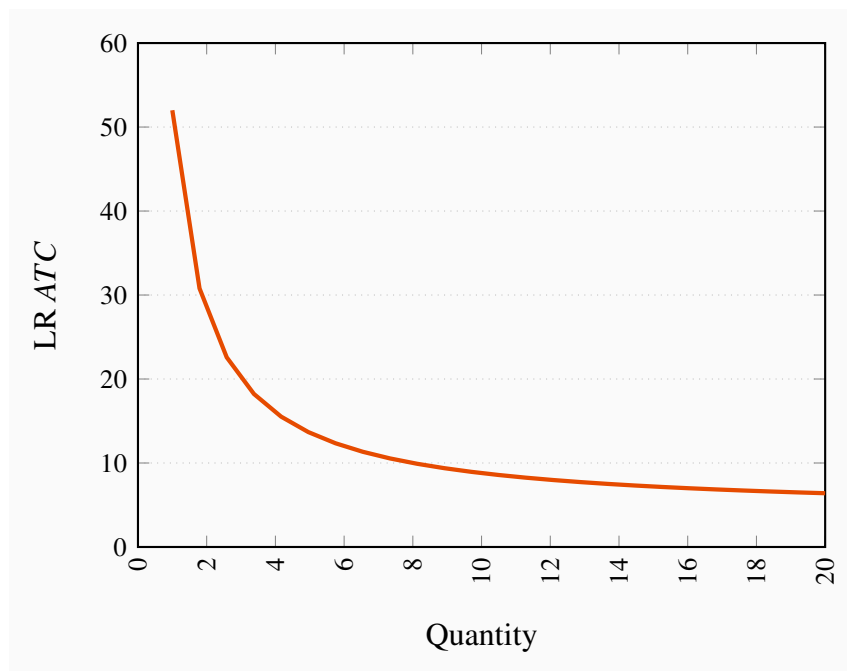
SOLUTIONS TO EXERCISES FOR CHAPTER 9

9.1   1. The *MC* is $32.

2. Her break-even level of output is 25 units.

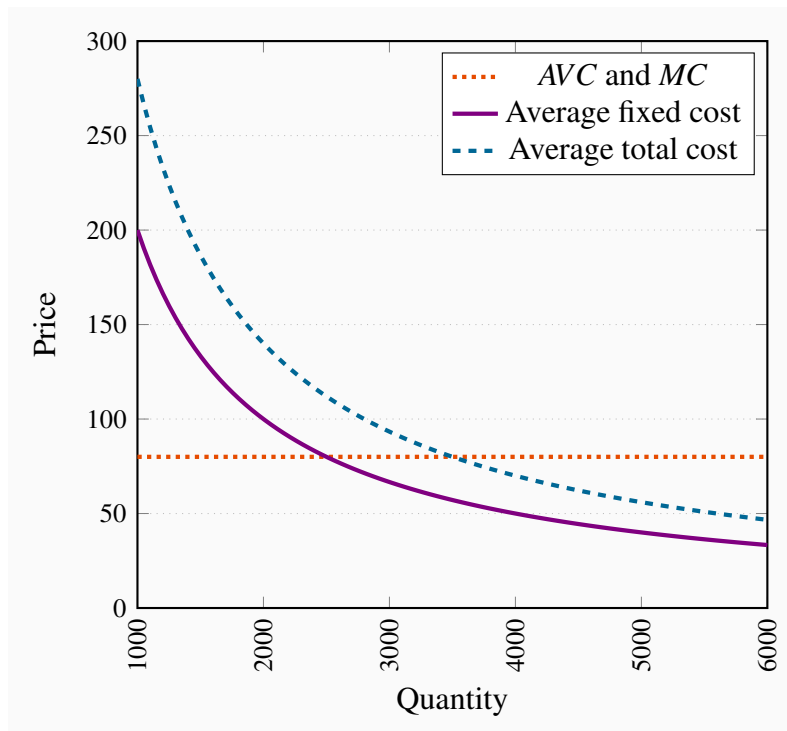3. No, because she can cover her variable costs. $TVC = \$320$; $TR = \$360$.

9.2 For total revenue to equal total cost it must be the case that $130 \times Q = 200,000 + 80 \times Q$. Therefore $Q = 4,000$.

9.3   1. The *MC* is horizontal at $80.

2. See diagram below.

3. See diagram below.

4. The *MC* would have to increase at some point.

9.4 The market supply curve goes through the origin with a slope of 2/3. This follows from the fact that we can write the supply curves as $q_A = P$ and $q_B = 0.5P$. Hence $Q = q_A + q_B = 1.5P$; or $P = (2/3)Q$.

9.5 Since the costs per unit are declining with output, they are producing on the downward-sloping segment of the *LATC*. To see this we need just calculate *ATC* at each output.

9.6   1. See the table.

2. See the figure below.

3. $Q = 7$. At this output $MC = MR$.

4. Price is fixed.

Q	0	1	2	3	4	5	6	7	8	9	10
TC	10	18	24	31	39	48	58	69	82	100	120
TR	0	11	22	33	44	55	66	77	88	99	110
Profit	−10.00	−7.00	−2.00	2.00	5.00	7.00	8.00	8.00	6.00	−1.00	−10.00
MR		11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00
MC		8.00	6.00	7.00	8.00	9.00	10.00	11.00	13.00	18.00	20.00
AFC		10.00	5.00	3.33	2.50	2.00	1.67	1.43	1.25	1.11	1.00
AVC		8.00	7.00	7.00	7.25	7.60	8.00	8.43	9.00	10.00	11.00
ATC		18.00	12.00	10.33	9.75	9.60	9.67	9.86	10.25	11.11	12.00
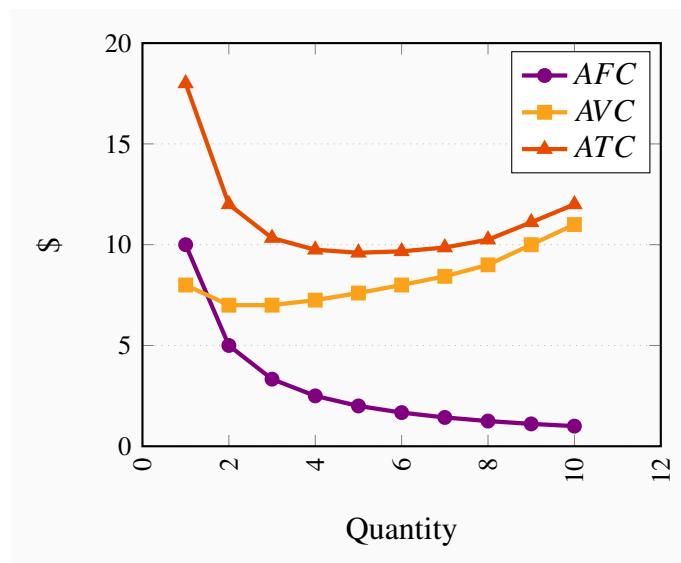
9.7   1. The equilibrium price is $40 and the equilibrium quantity is 6,000. The price intercept for the demand equation 50, the quantity intercept 30,000. The price intercept for the supply equation is 10 and the quantity intercept 2,000.

2. With a perfectly competitive structure, this new firm cannot influence the price. Therefore it maximizes profit by setting $P = MC$. That is $40 = 10 + 0.5q$. Solving this equation yields a quantity value $q = 60$.

9.8   1. If each firm produces 60 units then there must be 100 firms.

2. The ATC is of the form $ATC = 400/q + 10 + q/4$. Thus at an output of 60, $ATC = 400/60 + 10 + 60/4 = 31.67$.

3. Profit is $(P - ATC) \times q = 60 \times (40 - 31.67) = \$500$.

4. ATC must slope upwards because MC is greater than ATC here.

9.9   1. Entry will take place in view of supernormal profits.

2. Since this is a competitive industry the price in the LR equilibrium must equal the minimum of the LR ATC. Hence $P = 30$. From the demand curve it follows that $Q = 12,000$.

3. At a $MC = ATC = \$30$, it follows that $q = 40$ for each firm. Hence there will be 300 firms.

9.10   1. In a competitive industry the LR price equals the minimum of the LR ATC curve. Hence $P = \$25$. From the demand curve above it follows that quantity demanded at this price is 15,000.

2. Each firm will produce where its $MC = P$. Hence equating $MC = P$ yields $10 + 0.5q = 25$ implying $q = 30$.

3. With a total quantity demand of 15,000 at this price there will be 500 firms. The reason we have more firms is that, with lower fixed costs, each firm attains the minimum of its ATC at a lower level of output.

9.11   1. Each ATC curve must intersect the MC at the minimum of the ATC.

2. The breakeven price for each firm is the minimum of the firm's ATC.

3. The price in the market will be forced down to the level at which the most efficient producers can supply the market. Consequently the producer with the higher fixed cost will either have to adopt the technology of the lower-cost producer or exit the industry.

4. The total variable cost is the part of the total cost excluding the fixed component. Since the terms '400' and '225' are independent of output then the total variable cost curves for these firms are $10q + (1/4)q^2$.

SOLUTIONS TO EXERCISES FOR CHAPTER 10

10.1 This is a standard diagram for the monopolist. See the figure below. Equating $MC = MR$ yields $Q = 18$, $P = \$64$.
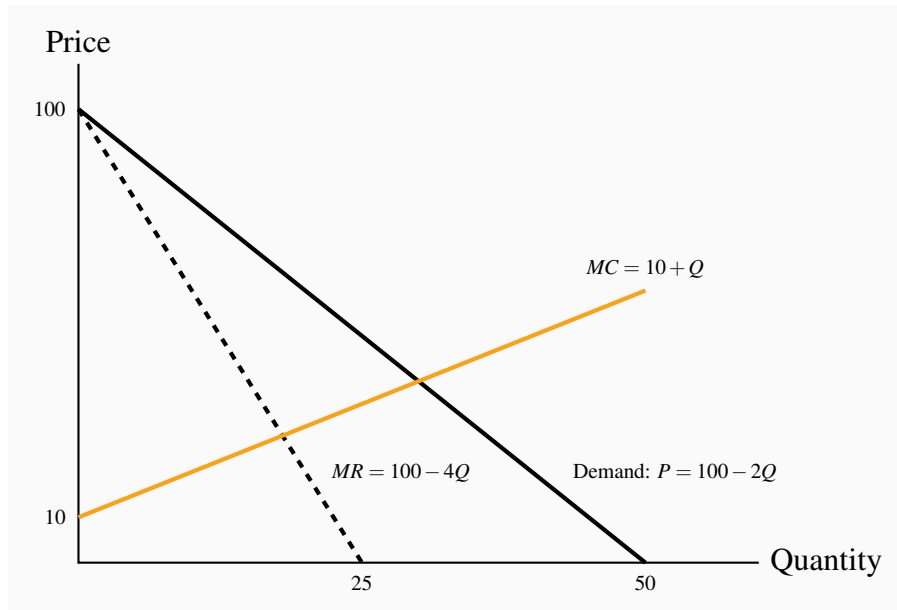

10.2   1. See below.

2. Total revenue is a maximum where MR becomes zero. This is at $P = \$36$ and $Q = 36$.

3. TR under revenue maximization is $36 \times 36 = \$1,296$. Under profit maximization the optimal output is where $MC = MR$ – an output $Q = 30$. Using the demand curve, this output of 30 units will be sold at a price of $42. Hence $TR = 30 \times 42 = \$1,260$.

4. Profit here is $864 since total cost is $12 per each of the 36 units ($432) and revenue is $1,296.

Price

72

$MR = 72 - 2Q$ Demand: $P = 72 - Q$

12    $MC = 12$

Quantity

36   72
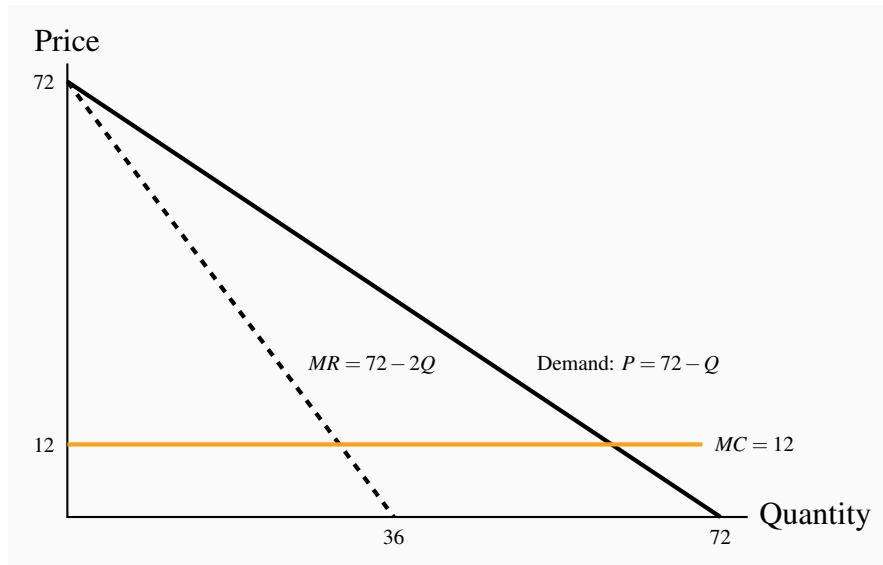
10.3 1. Equating $MC = MR$ yields $72 - 2Q = Q$. Therefore $Q = 24$. Substituting this into the demand curve yields a price of $P = \$48$.

2. Equating $MC = MR$ yields $60 - (2/3)Q = Q$. Solving yields $Q = 36$. This quantity will sell at a price derived from the demand curve: $P = 60 - (1/3) \times (36)$; therefore $P = 48$. Hence both demand curves yield an equilibrium price of \$48, but different quantities.

10.4 1. Where demand equals MC, we obtain $72 - Q = 12$. Therefore $Q = 60$.

2. From the demand curve, if $Q = 60$ then $P = \$12$.

3. The efficiency gain in going from a profit maximizing monopoly ($Q = 30$) to perfect competition ($Q = 60$) is given by the area under the demand curve and above the MC curve between these output levels. This is $q/2 \times 30 \times 30 = \$450$.

10.5 1. Setting $MC = MR$ yields $Q = 12$ and from the demand curve, $P = \$40$. See the figure below.

2. Where MC equals demand the output is $Q = 24$. In moving from the output level $Q = 24$ to $Q = 12$, the DWL is the area bounded by the demand curve and the MC between these output levels: $1/2 \times 12 \times 24 = \$144$.

3. With the subsidy the monopolist's new MC is $MC = 12$. Equating the MC to this MR yields: $12 = 64 - 4Q$. Therefore the new profit maximizing level is $Q = 13$. The new deadweight loss is the area below the demand curve and above the actual MC curve between the outputs $Q = 13$ and $Q = 24$: $1/2 \times (24 - 13) \times (38 - 16) = 11 \times 22 = \$121$.
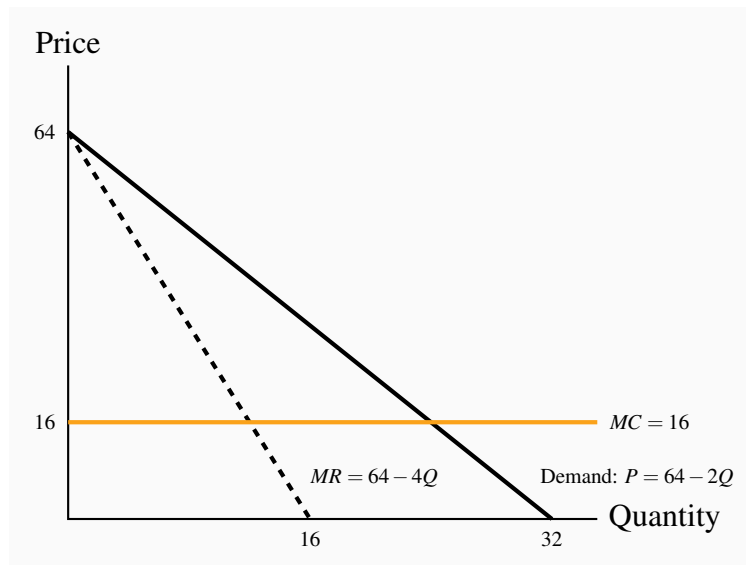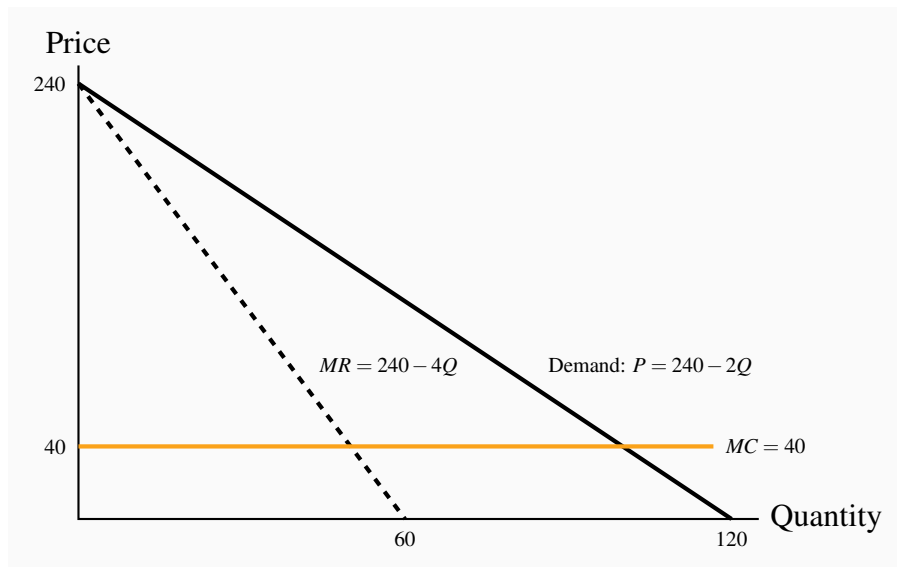
10.6 The buyers' reservation prices are given in row P. The cost of producing each unit is given in row MC. The profit on the first unit is therefore $\$(14-2) = \$12$; on the second unit is $\$(12-3) = \$9$, etc. On the fifth unit the additional profit is zero. Therefore, four units should be produced and sold. Total profit is $\$12 + \$9 + \$6 + \$3 = \$30$.

10.7   1. See figure below. The profit maximizing outcome is $Q = 24$ and $P = \$48$ – obtained from $MC = MR$.

2. With perfect price discrimination the monopolist's revenue is the area under the demand curve. He should continue to produce and sell as long as the demand price greater than MC. Where the demand price equals MC profit is maximized. This occurs at $P = \$24$, $Q = 48$.

3. Profit is $TR - TC$ at $Q = 24$. This is $\$576$. In (b) the profit is the area under the demand curve up to the output $Q = 48$ minus the area under the MC curve up to this same output. This is $\$1152$.
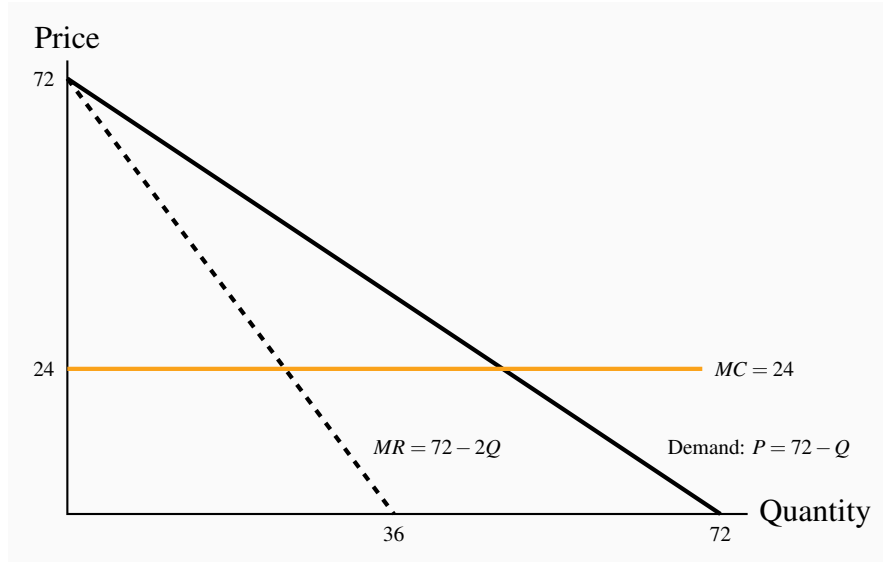
10.8   1. Profit maximizing output is where $MC = MR$ in each market. The MRs are $MR_A = 20 - (1/2)Q_A$, $MR_B = 14 - (1/2)Q_B$. Equating each of these in turn to $MC = 4$ yields $Q_A = 32$ and $Q_B = 20$. These outputs can be sold at a price obtained from their demand curves: $P_A = \$12$ and $P_B = \$9$.

2. Total profit is the sum of profit in each market: $(P_A \times Q_A - TC_A) + (P_B \times Q_B - TC_B) = \$256 + \$100 = \$356$.

10.9   1. Profit maximizing output is where $MC = MR$: $Q = 50$. Therefore, from the demand curve, $P = \$140$. TR is thus $\$7{,}000$ and $TC = 500 + 50 \times 40 = \$2{,}500$. Profit is thus $\$4{,}500$.

2. Here the profit maximizing outcome is obtained by setting the MR curve equal to the new MC curve: $240 - 4Q = 32$. This yields $Q = 52$, $P = \$136$. Profit is obtained as before – total revenue minus the sum of the variable cost plus (higher) fixed cost. Total revenue is $52 \times 136 = \$7{,}072$ and total cost is $750 + 52 \times 32 = \$2{,}414$. Profit is therefore $\$4{,}658$. Yes, she should outsource.

Price

240

$MR = 240 - 4Q$ Demand: $P = 240 - 2Q$

40 ————————————————————————————— $MC = 40$

Quantity

60   120

10.10   1. Yes, this lobbying is a fixed cost and her profits are more than enough to cover it.

2. The total of her profits – normal profits are included in the cost structure.

10.11   1. The diagram here is equivalent to the one in Figure 10.10 in the text. The first segment, up to an output of 40 units, has a price of $60; the second, from an output of 40 to 110, has a price of $40.

2. The MC curve runs along the horizontal axis – after the fixed cost is incurred, the MC is zero. The demand curve is the MR curve here, composed of the two horizontal segments.

3. A price of $60 can be charged to 40 buyers, and a price of $40 charged to 70 buyers. Hence $TR = \$5,200$. Since $TC = \$3,500$, profit is $1,700.

4. Yes; 110 buyers at $40 each yields a $TR = \$4,400$. Subtract the TC to yield a profit of $900.
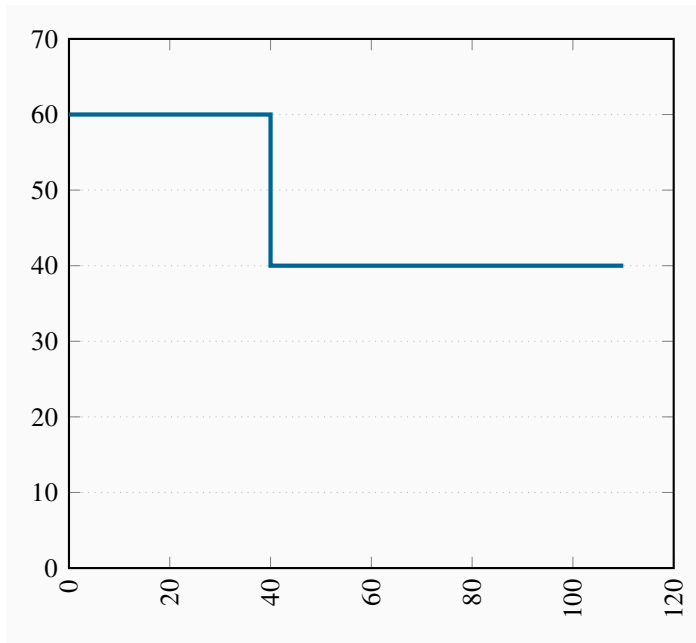
SOLUTIONS TO EXERCISES FOR CHAPTER 11

11.1 The three-firm ratios are 0.14, 0.49, 0.80, 0.94. The four-firm ratios are 0.15, 0.54, 0.82, 0.95.

11.2   1. See graph below.

2. Equating MC to MR yields $Q = 36$ and therefore, from the demand curve, $P = \$30$ when $Q = 30$.

3. TR is $\$1,080$, total cost is $\$432$ and therefore profit is $\$648$.

4. Profits plus freedom of entry will see new firms take some of this firm's market share, and therefore reduce profit.
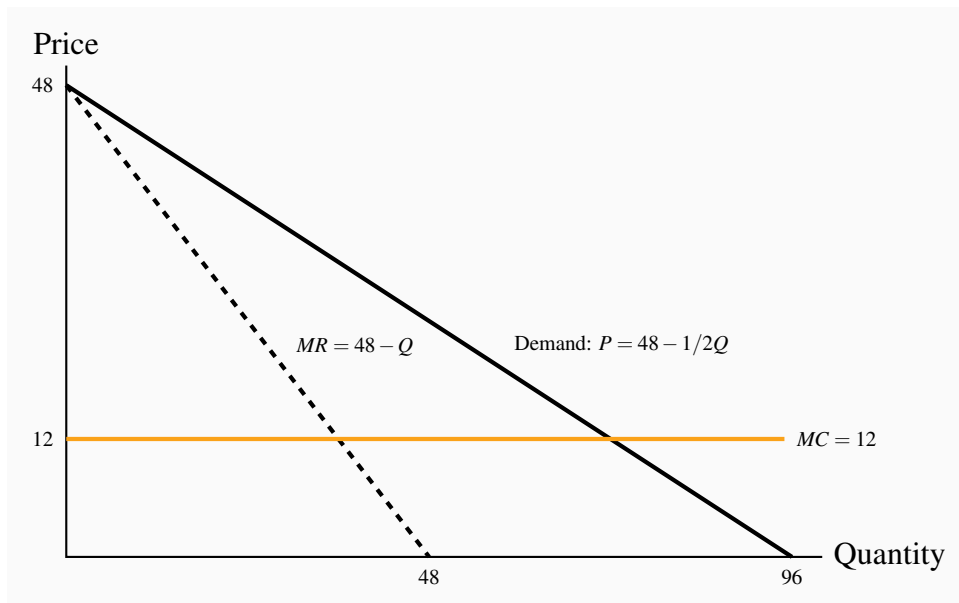
11.3   1. The diagram here is similar to the one above.

2. Acting as a monopolist they would set $MR = MC$, hence $Q = 90$, $P = \$70$.

3. Combined profit is $\$90 \times (70 - 40) = \$2,700$. Individual profit is half of this amount.

11.4   1. 55 units.

2. If the cheater intends to sell 55 units then the total sold is 100 units. This necessitates a price of 66.67.

3. One firm makes $\$(66.67 - 40) \times 45 = \$1,200$; the other makes $\$(66.67 - 40) \times 55 = \$1,467$.

4. It must be less since the cartel profit maximizing output is globally profit maximizing.

5. By increasing its output.

11.5   1. Yes. If A confesses then B's best strategy is also to confess. If A denies, B's best strategy is also to confess. Hence, either way B's best choice is to confess – this is a dominant strategy. The same reasoning applies to A.

2. The Nash Equilibrium is that they both confess.

3. Yes.

4. If the crooks could communicate with each other they could cooperate and agree to deny. This would be better for each.

11.6   1. Each firm has a 'high output' dominant strategy, since their profit is greater here regardless of the output chosen by the other firm.

2. From (a) it follows that high/high is the Nash Equilibrium.

3. Since low/low yields more profit for each firm, a cartel is an attractive possibility. But it may not be sustainable, given that each player has the incentive to renege on the cartel agreement.

11.7   1. The reaction functions are of the standard type illustrated in the figure below.

2. Solving the two functions yields $q_A = 8$ and $q_B = 48$.

3. Since the reaction functions are not symmetric the cost structures are different if they face the same demand.
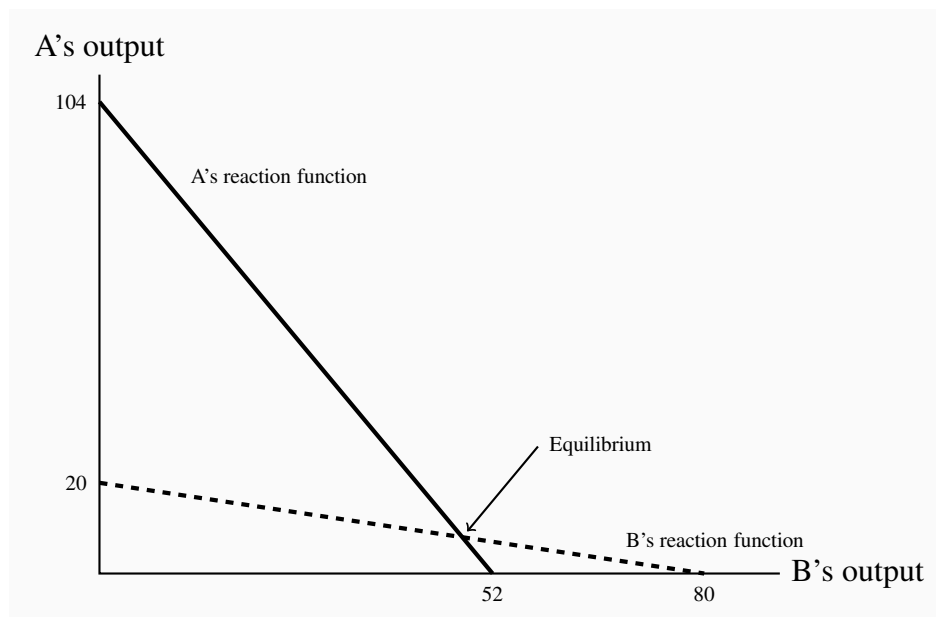
11.8   1. The reaction functions are obtained in the normal manner – by equating MR to MC for each player, conditional upon some output being produced by the other player. Since demand is given by $P = 24 - Q$, this process yields $Q_A = 10 - 1/2Q_B$ as A's reaction function, and $Q_B = 8 - 1/2Q_A$ as B's reaction function. Solving yields $Q_A = 8$ and $Q_B = 4$.

2. The combined output is as before: 12 units.

3. The price in the market remains at $12, since the total output is still 12 units. Combined profit is $96.

4. The producer with the lower production cost can now gain a larger market share.

11.9   1. Equating price to MC yields $Q = 11,200$.

2. Equating MR to MC yields $Q = 5,600$.

3. Using the formula $Q = n/(n+1) \times$ (perfectly competitive output) yields market $Q = 2/3 \times 11,200 = 7,466.67$.

11.10   1. Profit under perfect competition is zero (only normal profit). Under monopoly the price charged is $1,800. Cost per unit is $400, and quantity produced is 5,600. Hence profit $= 5,600 \times (1,800 - 400) = \$7.84$m. Since the output in the duopoly market is 2/3 times the perfectly competitive output, then $Q = 7,466.67$. The price is thus $P = 3,200 - (1/4) \times 7,466.67 = \$1,333.33$. Profit per unit is thus $933.33, and total profit is $6.97m.

2. Since the unit costs are constant we could have any number of firms producing in this market.

11.11   1. While Ronnie can threaten to lower its price if Flash enters the market it would not be profitable for Ronnie to do that because a higher price, even with Flash in the market, yields a superior profit to Ronnie. Hence Flash should enter.

2. The issue here is that the threat to lower price is not credible.

11.12   1. Equating the slope of the demand curve to the slope of the ATC curve yields $Q = 2$.

2. Clearly $P = 2.25$ from the demand curve.

3. Equating $MC = MR$ again yields $Q = 2$, as illustrated in Figure 11.2.

4. Equating MC to the ATC yields $Q = 4$.

SOLUTIONS TO EXERCISES FOR CHAPTER 12

12.1 At $L = 4$ the VMP of labour is \$400, which is also the wage rate. Therefore this is the profit maximizing output level. The table below contains the calculations.

Labour	Output	MP Labour	VMP Labour	TR	TC	Profit
0	0					
1	20	20	400	400	400	0
2	50	30	600	1000	800	200
3	75	25	500	1500	1200	300
4	95	20	400	1900	1600	300
5	110	15	300	2200	2000	200
6	120	10	200	2400	2400	0

12.2   1. $L = 8$. The value of the MP of labour equals the wage rate where 8 units are employed.

   2. Having computed the VMP of labour you will see that the VMP of the sixth employee is \$500. Hence if the supply curve is vertical at $L = 6$ and the demand curve is the VMP of labour it follows that the equilibrium wage is \$500.

| Labour	Output	MP Labour	VMP Labour
0	0		
1	100	100	1000
2	190	90	900
3	270	80	800
4	340	70	700
5	400	60	600
6	450	50	500
7	490	40	400
8	520	30	300
9	540	20	200
10	550	10	100
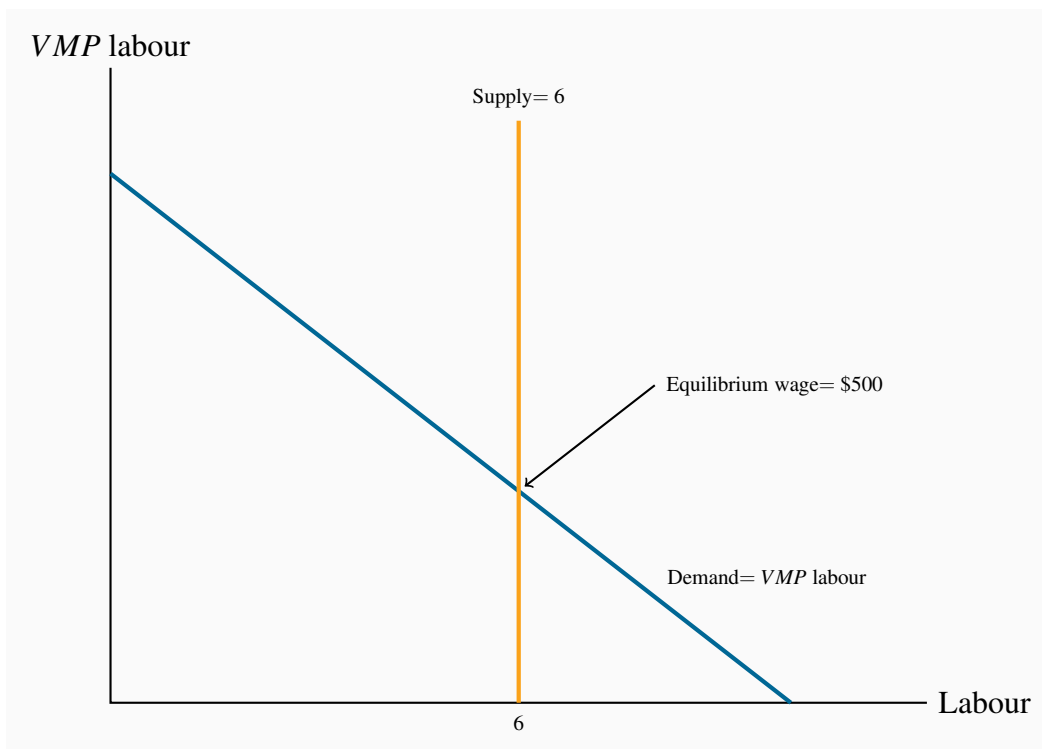
12.3 Here you must calculate the additional cost of each employee. The first costs $250; the second $350 ($300 plus an additional $50 to the first employee); the third $450; the fourth $550, etc. The additional revenue from each employee is the VMP of labour. As long as this exceeds the MC of hiring another employee then that employee should be hired. The answer is thus $L = 3$.

Labour	Output	MP Labour	VMP Labour	Marginal Wage	MC Labour
0	0				
1	20	20	400	250	250
2	50	30	600	300	350
3	75	25	500	350	450
4	95	20	400	400	550
5	110	15	300	450	650

12.4   1. The equilibrium is $L = 20$, $W = \$14$. See figure below.

2. Transfer earnings are the area under the supply curve up to $L = 20$; rent is the triangle above the supply curve and below the wage line $W = \$14$.

3. Total wage bill is $280, of which transfer earnings account for $240 and rent $40.
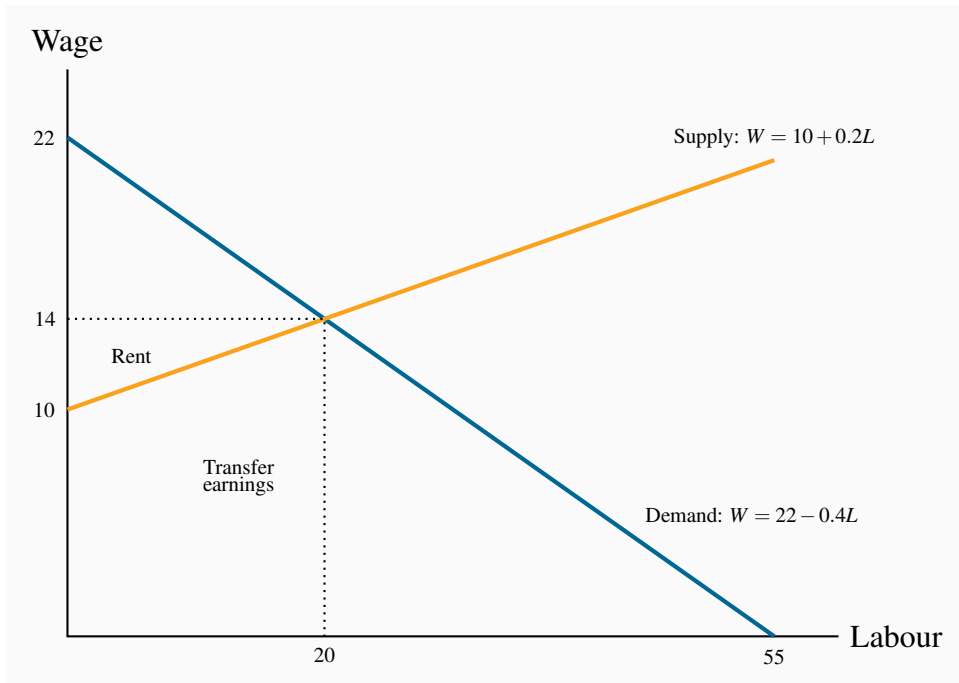
12.5 1. The demand curve has a regular downward-sloping form, while the supply curve is vertical at $L = 300$. See figure below.

2. At $L = 300$ the demand curve indicates that the wage is $26.

3. At $W = \$30$, the corresponding demand is $L = 250$.
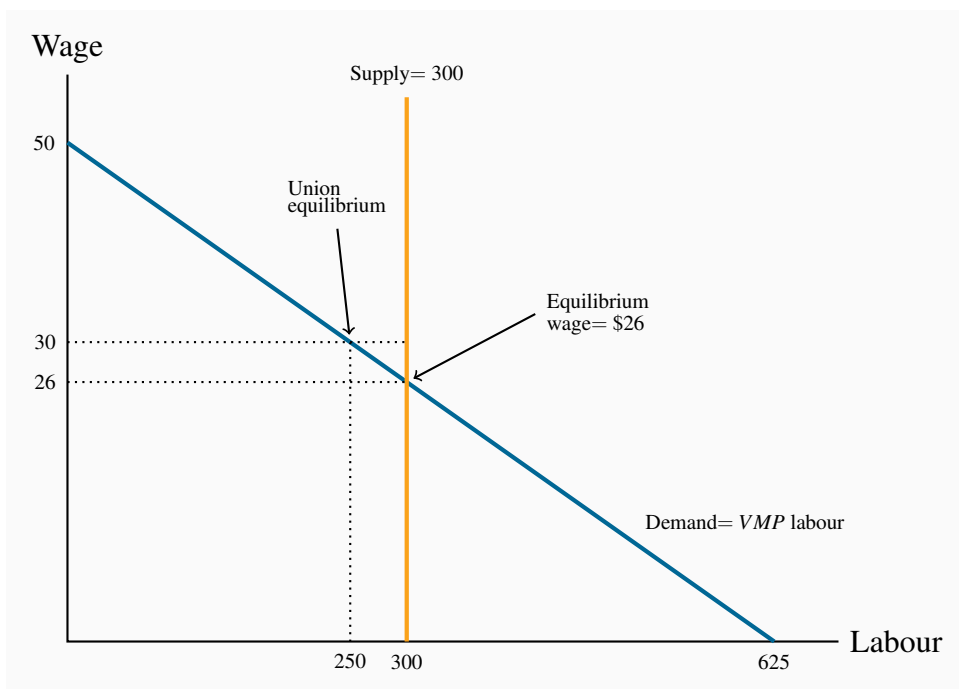
12.6 The present values of the three streams are: $33,470; $2,522; $12,277. Therefore only the third project should be adopted because it alone generates revenue in excess of costs.

12.7 Only the first plot generates sufficient revenue to yield a profit.

12.8   1. You would hold it for 5 years because the wine is appreciating by more than the cost of borrowing for each of the first five years. The sixth year the wine grows in value by the same as the borrowing cost.

    2. In this case the carrying has increased to 7% per year. So it would be profitable to hold the wine for three years – until the growth in the value of the wine equals the carrying cost.

12.9   1. The marginal cost of each unit of output will be $4 – each worker costs $8 but produces two units of output.

    2. Equate the MC to the MR and the answer is: $4 = 100 - 4Q$, implying $Q = 24$.

    3. At this output the demand curve indicates that the price will be $52.

    4. 24 units of output will require 12 units of labour.

12.10   1. Equating the price to MC yields $4 = 100 - 2Q$, implying $Q = 48$.

    2. $L = 24$.

SOLUTIONS TO EXERCISES FOR CHAPTER 13

13.1   1. Solving the demand and supply involves equating $Q = 40 - 40f$ to $f = 0.5$. Thus the equilibrium premium is 20, which is interpreted in percentage terms. See figure below.

2. If demand shifts upwards to $W = 60 - 60f$, the new equilibrium is 30 percent, as illustrated in the figure below again.

13.2   1. See diagram below.

2. See diagram below.

3. In the long run the relative supply is $W = 40f$, and equating this with demand yields a 24 percent premium rather than a 30 percent premium and $f = 0.6$.
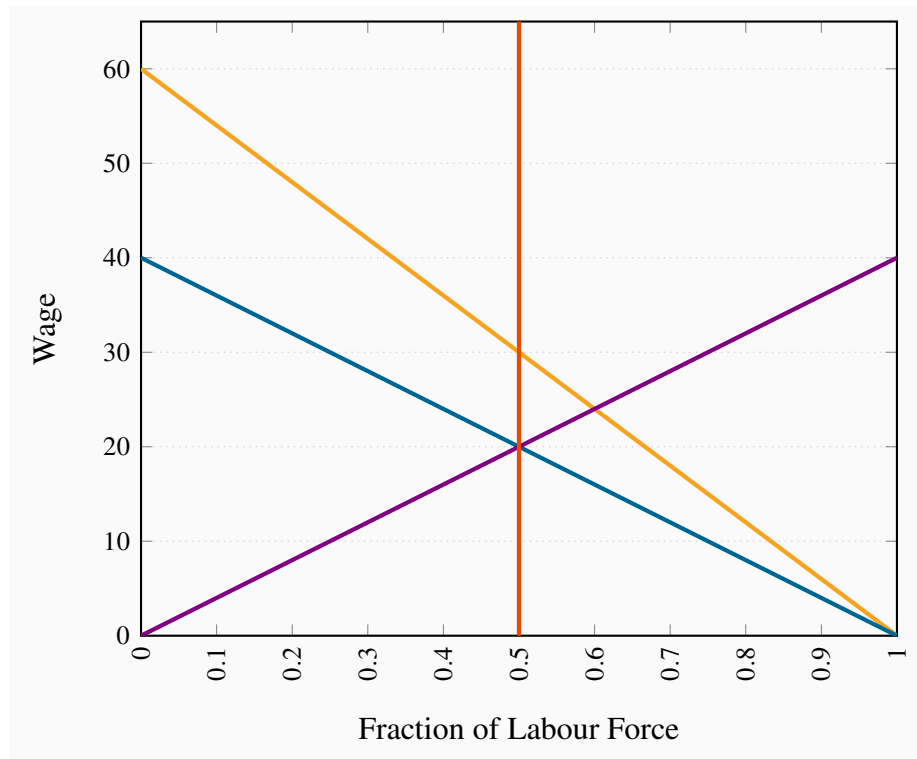
13.3 Here the supply curves are horizontal at wage of $10 for low skill workers and wage of $18 for high skill workers. The two demands are such that the demand for the high skill worker is above the demand for the low skill workers. The equilibrium for the high skill type is where the demand and supply for high skill workers intersect; likewise for the low skill equilibrium.
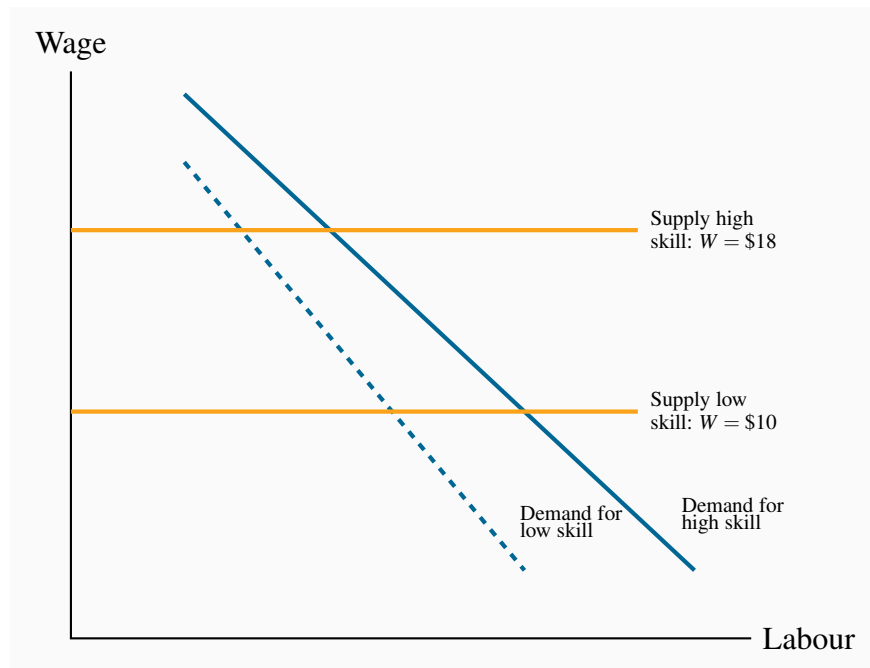
13.4   1. The present value of going to university is higher at an interest rate of 10%. If you discount the first stream of values you will obtain −20,000, 36,360 and 41,320 yielding a net present value of 57,680. With 20,000 dollars each period in contrast, the net present value is 54,710 dollars.

2. By performing the same set of calculations using the 2% discount rate, you will find that university is still preferred.

3. At an interest rate above 15% the 'no university' option will yield a higher net present value. Try discounting the two income streams using a rate of 16% and you will see.

13.5   1. Using the same discounting techniques as in the previous question you will see that the present value of the income from law exceeds that from economics when the interest rate is 2%: 100,721 for law and 91,690 for economics.

2. Law should still be chosen at a rate of 30%, but only just.

13.6 These two distributions have intersecting Lorenz curves, so it is difficult to say which is more unequal without further analysis.
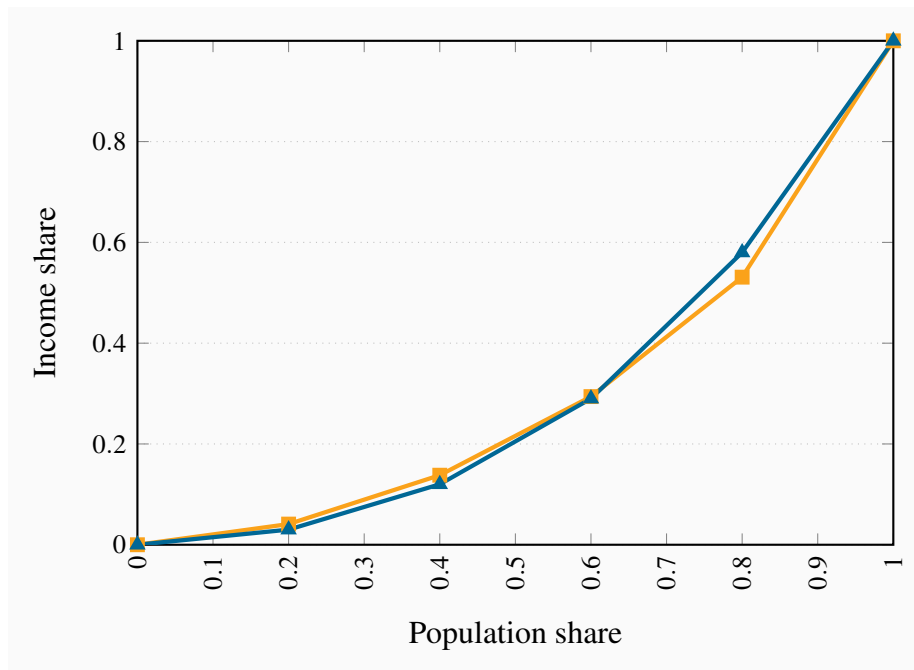
13.7   1. The coordinates on the vertical axis measured in percentages are: 4, 15, 34, 60, 100. See the figure below for the graphic.

2. The new coordinates are: 5.4, 18.9, 40.5, 66.2, 100.

3. The coordinates for post government income are: 13, 29, 50, 72, 100. The three Lorenz curves are plotted below.
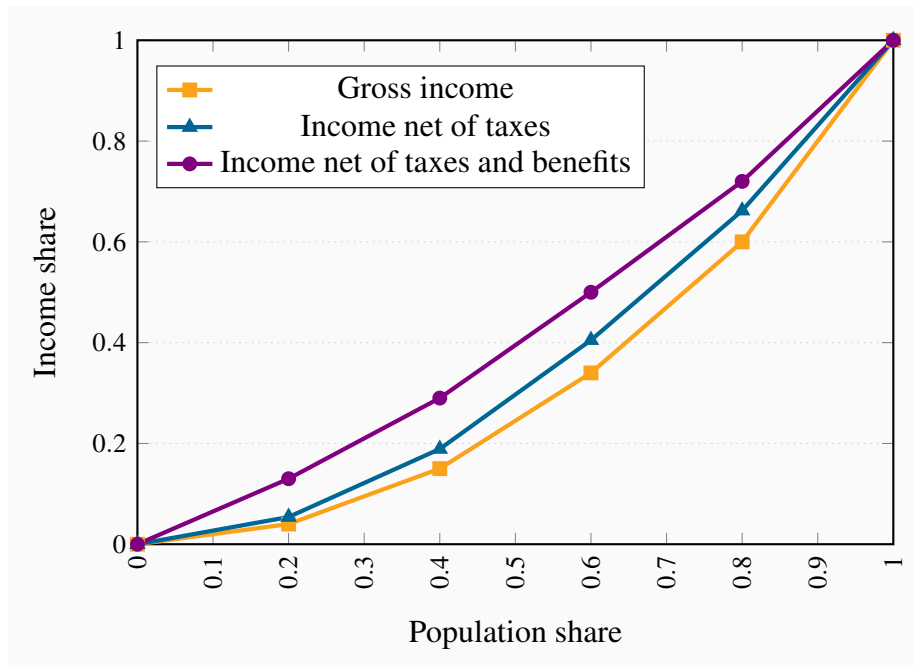
13.8 The profiles are shown in the figure below. John passes Ivan about year ten.
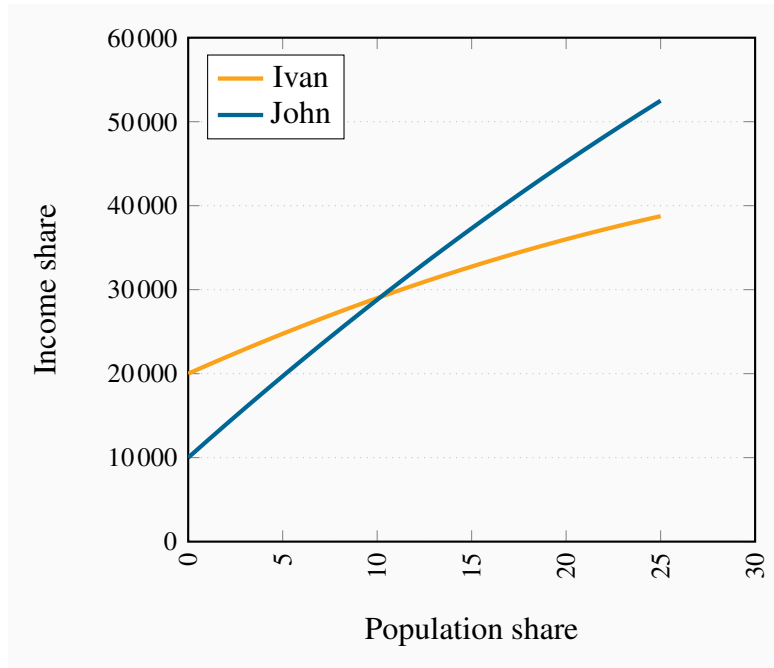
SOLUTIONS TO EXERCISES FOR CHAPTER 14

14.1 1. See figure below.

2. The total demand for the public good has a vertical intercept of 20 and a horizontal intercept of 24. The form of the equation is therefore $P = 20 - (5/6)Q$.

3. Equate the MC of $5 to the total demand curve to obtain $Q = 18$. This is the 'optimal' output – where the cost of the last unit produced equals the value placed on it by both individuals. At this quantity the individual valuations (the price that each is willing to pay) are obtained from the individual demand curves. Substituting $Q = 18$ into each yields $3 and $2.
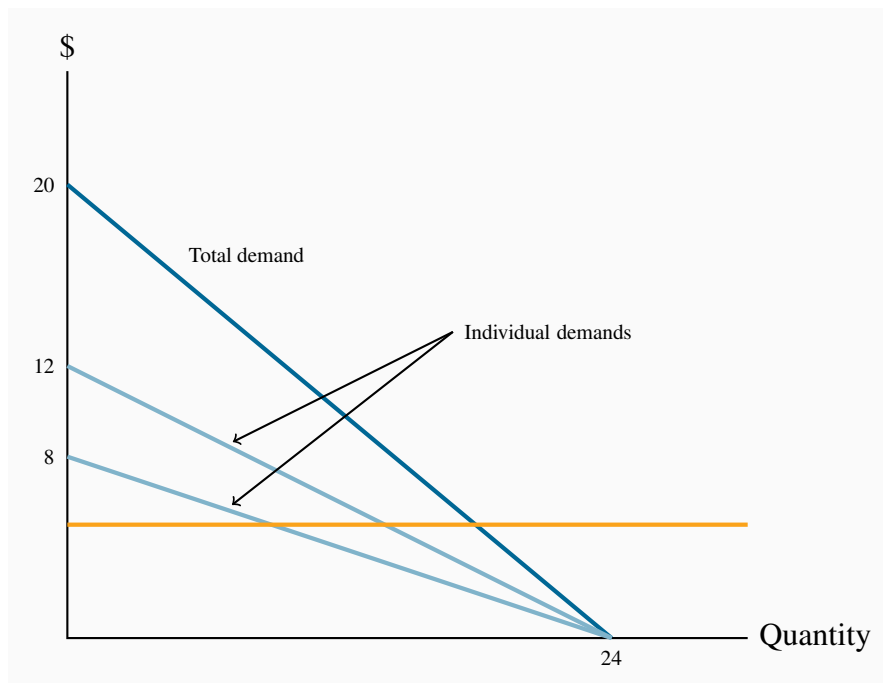
14.2 1. The demand curve in the economy becomes $P = 30 - (5/4)Q$. Equating this to the $MC = 5$ yields $Q = 20$.

2. The answer here is the area under the demand curve up to an output of 20 units, which equals $350.

3. The net value to society is $350 minus the supply cost of $100=$250.

14.3 1. The demand, MR, and MC all have straightforward shapes. The ATC curve falls from a value of 192 where $Q = 1$, to a value of $4 when Q becomes very large. For example when $Q = 4$, $ATC = 51; when $Q = 94$, $ATC = 6; etc. This function curves downwards and approaches a value of $4 asymptotically.

2. The efficient output is where the $MC = P$, as given by the demand curve. Hence equating demand to MC yields $Q = 96$. He would maximize profit by producing where $MC = MR$, which occurs at $Q = 48$.

3. He would choose a price of $52 from the demand equation at an output of 48 units. At this output the ATC is $(4 + 188/48)$. Hence profit is $\$(52 - (4 + 188/48)) \times 48 = \$2,116$.

14.4   1. Equating the ATC to the demand curve yields $100 - Q = 4 + 188/Q$. The solution is $Q = 94$.

2. The deadweight loss when acting as a monopoly is $0.5 \times 48 \times 48 = \$1,152$. When regulated, the DWL is $0.5 \times 2 \times 2 = \$2$.

14.5 An efficient output is where $P = MC$, that is $Q = 96$. At this output he charges a price of $4. Hence his loss per unit is the difference between price and ATC which is 188/96. Since he produces 96 units, then charging a price of just $4 leads to a revenue shortfall of $96 \times (188/96) = \$188$. This amount would have to be spread as a charge over the number of buyers in the market as a fixed cost associated with purchasing. In essence each buyer would have to pay a certain entry fee just to purchase the good.

SOLUTIONS TO EXERCISES FOR CHAPTER 15

15.1 1. Northland has an absolute advantage in the production of both goods, as it has lower labour requirements for each.

2. The opportunity cost of 1 bushel of wheat is 1/2 litre of wine in Northland and 3/4 litre of wine in Southland.

3. Northland has a comparative advantage in wheat while Southland does in wine.

4. By reducing wheat production by 1 bushel, Southland can produce an additional 3/4 litre of wine.

5. Both countries can gain if Northland shifts production from wine to wheat and the countries trade wine for wheat at a rate between 1/2 litre of wine for 1 bushel of wheat and 3/4 litre of wine for one bushel of wheat.

6. By reducing wine production by 1/2 litre, Northland can increase wheat production by 1 bushel, which, at Southland's opportunity cost, exchanges for 3/4 litre of wine, giving Northland a gain of 1/4 litre of wine.

15.2 1. The US has an absolute advantage in both goods.

2. Canada has a comparative advantage in xylophones. The US has a comparative advantage in yogourt.
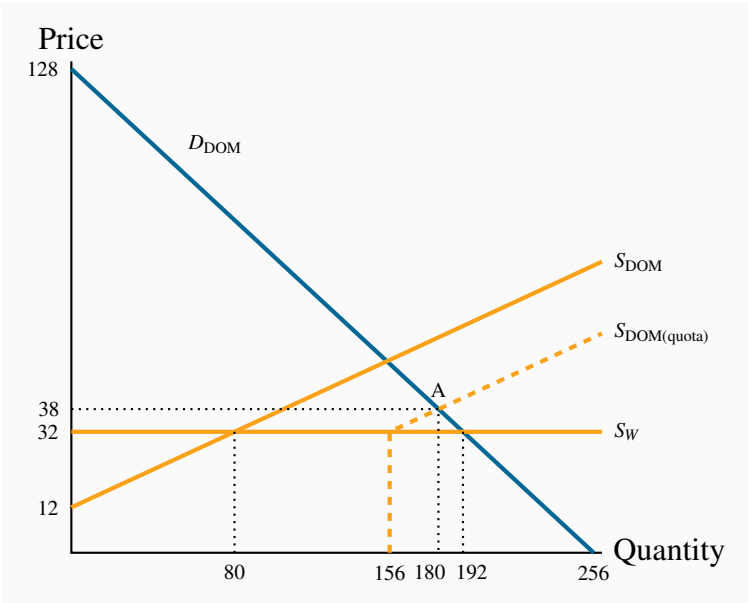
3. See diagram below.

4. See diagram below.
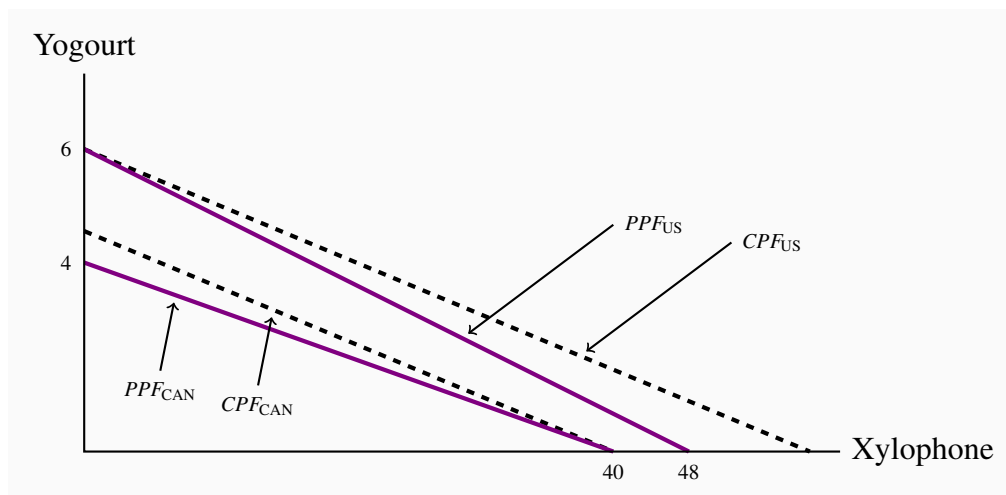
15.3   1. The diagram shows that the amount traded is 60 units; of which domestic producers supply 5 and 55 are imported.

2. In this case, the foreign supply curve SW shifts up from a price of $18 to $24. The amount traded is now 40 units, 20 of which are supplied domestically.

3. Tariff revenue is EFHI= $120.
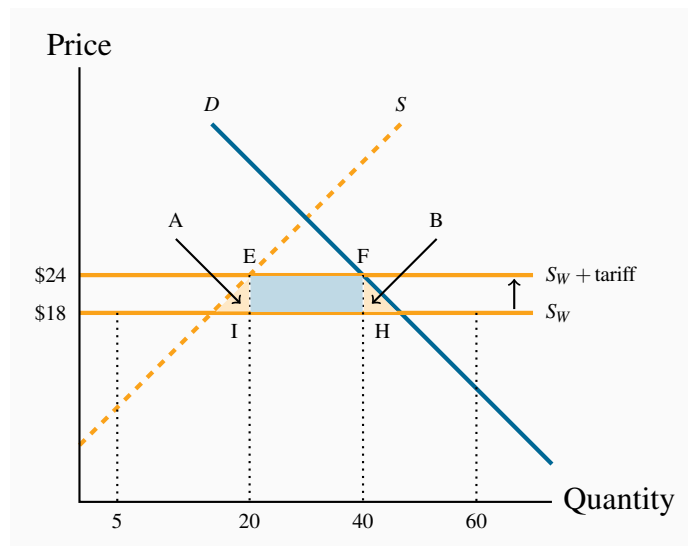
15.4   1. The deadweight losses correspond to the two triangles, A and B, in the diagram, and amount to $105.

2. The amount of additional profit for domestic producers is $75.

15.5   1. See figure below.

2. The total quantity of trade is 100 units, of which 80 are supplied domestically.

3. The subsidy shifts the domestic supply curve down by $2 at each quantity. This supply intersects the demand curve at $Q = 100$. Foreign producers are squeezed out of the market completely.

4. Cost to the government is $200.
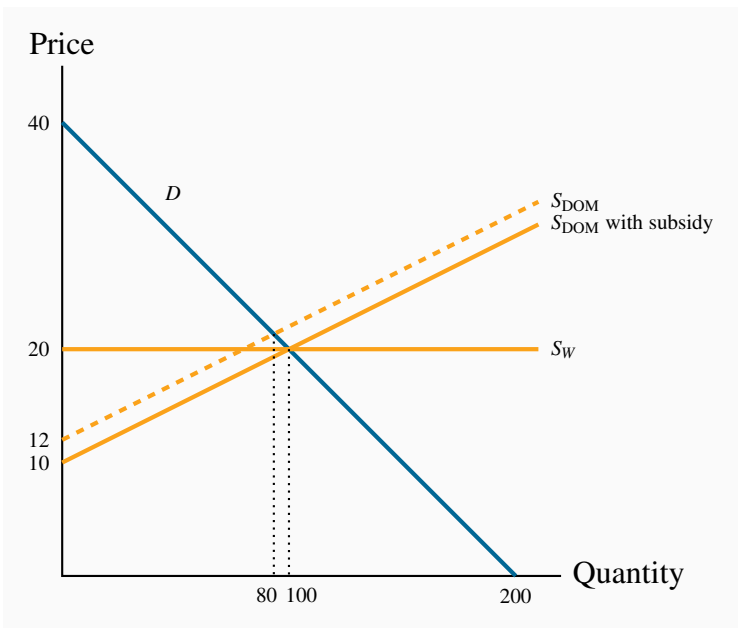
15.6   1. See diagram below.

2. Domestic producers will supply 80 and imports will be 112.

3. The equilibrium with the quota is point A in the diagram with imports equal to the quota of 76.

4. The equilibrium quantity with the quota is 180, with 76 imported and 104 supplied by domestic producers. The equilibrium market price is $38.
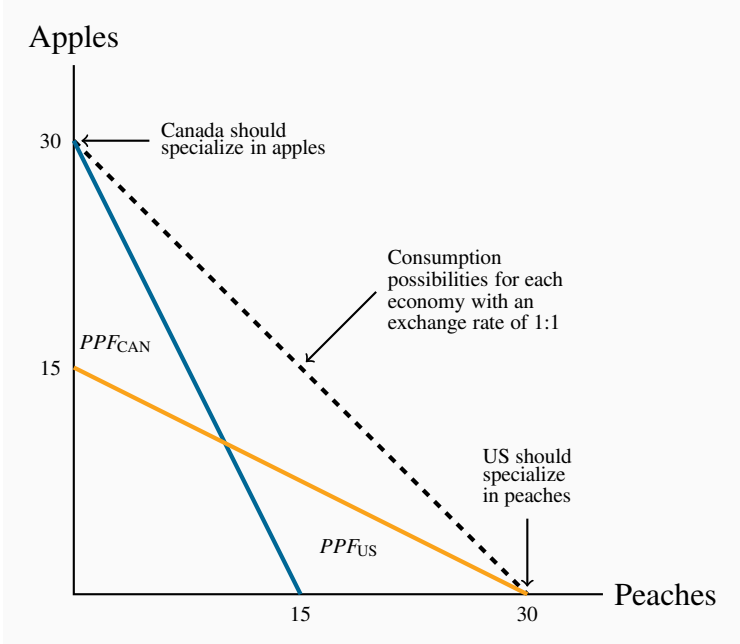
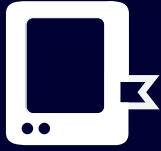**15.7**   1. See diagram below.

2. See diagram below.

3. The quantity permitted to be brought to market would be 40 units, even though the supply side would be willing to supply more at this price, buyers will demand just 40 at a price of $28.
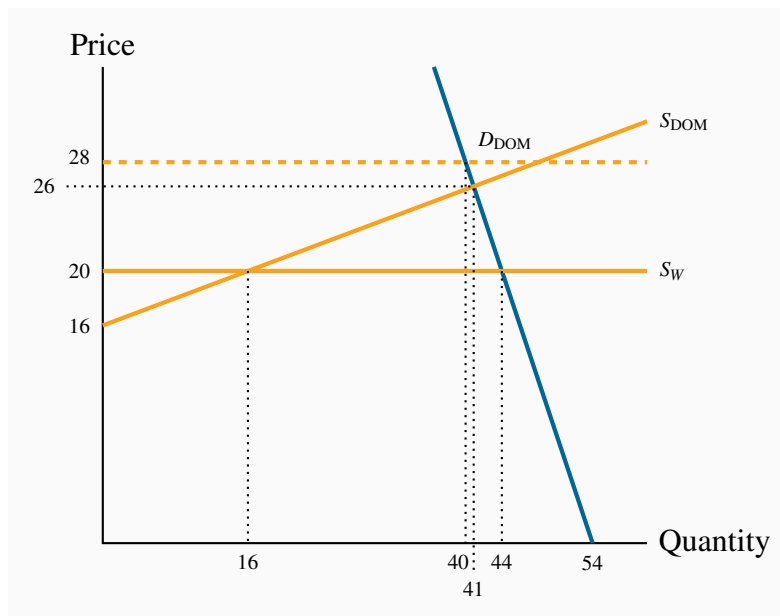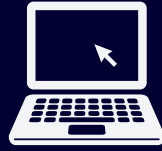

15.8 The figure below illustrates parts (a) through (f). Since the total production before trade was 20 of each, and after specialization it is 30 of each, the gain is 10 of each good.
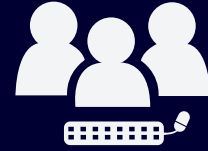
Apples

30 — Canada should
specialize in apples

Consumption
possibilities for each
economy with an
exchange rate of 1:1

PPF_{CAN}

15

US should
specialize
in peaches

PPF_{US}

Peaches

15   30