Answers to quantitative 'Test your understanding' questions

Test your understanding 1.9

1 a from A to B: opportunity cost = 5 microwave ovens
b from D to C: gain = 11 microwave ovens; opportunity cost = 6 computers
c from C to B: gain = 9 microwave ovens; opportunity cost = 8 computers

Test your understanding 2.6

1 a excess supply since S > D (surplus) = 12 – 4 = 8 thousand chocolate bars per week
b excess supply since S > D (surplus) = 10 – 6 = 4 thousand chocolate bars per week
c market equilibrium since S = D, no surplus or shortage
d excess demand since D > S (shortage) = 10 – 6 = 4 thousand chocolate bars per week
e excess demand since D > S (shortage) = 12 – 4 = 8 thousand chocolate bars per week

Test your understanding 2.8

5 a Consumer surplus $= \frac{(12-6)\times 6}{2} = \frac{6\times 6}{2} = \frac{36}{2} = 18$

Producer surplus $= \frac{(6-2)\times 6}{2} = \frac{4\times 6}{2} = \frac{24}{2} = 12$

b Consumer surplus $= \frac{(12-3)\times 9}{2} = \frac{9\times 9}{2} = \frac{81}{2} = 40.5$

Producer surplus $= \frac{(9-4)\times 3}{2} = \frac{13\times 3}{2} = \frac{39}{2} = 19.5$

c Final consumer surplus minus initial consumer surplus = 40.5 – 18 = 22.50 increase
Final producer surplus minus initial producer surplus = 19.5 – 12 = 7.5 increase

Test your understanding 3.1

3 $\%\ Q = \frac{120-100}{100} \times 100 = 20\%$

$\%\ P = \frac{12-16}{16} \times 100 = -25\%$

$PED = -0.8$; taking the absolute value, $PED = 0.8$

4 $PED = \frac{-8\%}{10\%} \times -0.8 = 20\%$; taking the absolute value, $PED = 0.8$

5 $0.8 = \frac{-x}{15}$ $\quad -x = 0.8 \times 15 = -12$ $\quad -12\%$; decrease in quantity demanded of 12%

6 $1.5 = \frac{30}{-x}$ $\quad -1.5x = 30$ $\quad x = -20$ $\quad -20\%$; decrease in price of 20%

Test your understanding 3.3

1 a From a to b: $PED = \frac{\frac{-10}{80}}{\frac{5}{10}} = \frac{\frac{-1}{8}}{\frac{1}{2}} = \frac{-2}{8} = -0.25$; taking the absolute value, $PED = 0.25$

b From c to d: $PED = \frac{\frac{-10}{50}}{\frac{5}{25}} = \frac{\frac{-1}{5}}{\frac{1}{5}} = -1.0$; taking the absolute value, $PED = 1.0$

c From e to f: $PED = \frac{\frac{-10}{20}}{\frac{5}{40}} = \frac{\frac{-1}{2}}{\frac{1}{8}} = \frac{-2}{8} = -4$; taking the absolute value, $PED = 4.0$

d At high prices and low quantities, demand is price elastic (the absolute value of $PED > 1$); at low prices and large quantities, demand is price inelastic (the absolute value of $PED < 1$). At the mid-point of the demand curve, PED is unit elastic (the absolute value of $PED = 1$). The explanation for this relates to how PED is calculated, and is explained on page 90 of the coursebook.

Test your understanding 3.5

3 a When P = \$4, Q = 10 so TR = 4×10 = \$40

When P = \$5, Q = 5 so TR = 5×5 = \$25

Final TR minus initial TR = \$25 – \$40 = –\$15 therefore TR decreased by \$15.

b When P = \$1, Q = 25 so TR = 1×25 = \$25

When P = \$2, Q = 20 so TR = 2×20 = \$40

Final TR minus initial TR = \$40 – \$25 = \$15 therefore TR increased by \$15.

c When P increases from \$4 to \$5, $PED > 1$. When P increases from \$1 to \$2, $PED < 1$.

d When P increases from \$4 to \$5, Q decreases from 10 to 5, therefore

$PED = \frac{\frac{5-10}{10}}{\frac{5-4}{4}} = \frac{\frac{-5}{10}}{\frac{1}{4}} = \frac{-20}{10} = -2$; taking the absolute value $PED = 2$, therefore $PED > 1$.

When P increases from \$1 to \$2, Q decreases from 25 to 20, therefore

$PED = \dfrac{\dfrac{20-25}{25}}{\dfrac{2-1}{1}} = \dfrac{\dfrac{-5}{25}}{\dfrac{1}{1}} = \dfrac{-5}{25} = -0.2$; taking the absolute value $PED = 0.2$, therefore $PED < 1$.

These calculations confirm the answer to part **c**.

4 a When P = \$10, Q = 80 so TR = \$800

When P = \$15, Q = 70 so TR = \$1050

Final TR minus initial TR = 1050 – 800 = \$250 therefore TR increased by \$250.

b When P = \$40, Q = 20 so TR = \$800

When P = \$45, Q = 10 so TR = \$450

Final TR minus initial TR = 450 – 800 = \$350 therefore TR decreased by \$350.

c *PED* changes along the length of a downward sloping straight line demand curve, becoming increasingly smaller, starting from elastic at the top left, becoming unitary in the middle, then becoming inelastic at the bottom right. Along the elastic portion of the demand curve, which is in the upper left part, increases in P lead to decreases in TR because the fall in Q demanded is proportionately larger than the increase in P. Along the inelastic portion of the demand curve which is on the bottom right, increases in P lead to increases in TR because the fall in Q demanded is proportionately smaller than the increase in P.

Test your understanding 3.7

3 a Pizza: $YED = \dfrac{\dfrac{4}{8}}{\dfrac{200}{1000}} = \dfrac{\dfrac{1}{2}}{\dfrac{1}{5}} = \dfrac{5}{2} = 2.5$

Cheese sandwiches: $YED = \dfrac{\dfrac{-5}{15}}{\dfrac{200}{1000}} = \dfrac{\dfrac{-1}{3}}{\dfrac{1}{5}} = \dfrac{-5}{3} = -1.67$

b Pizzas are normal goods; cheese sandwiches are inferior goods.

c The demand curve for pizzas shifts to the right; the demand curve for cheese sandwiches shifts left.

4 a Good A: $\dfrac{10\%}{15\%} = 0.67$; income-inelastic.

Good B: $\dfrac{20\%}{15\%} = 1.33$; income-elastic.

b Good A is a necessity; good B is a luxury.

Test your understanding 3.8

3 a $\dfrac{\dfrac{7-4}{4}}{\dfrac{150-100}{100}} = \dfrac{\dfrac{3}{4}}{\dfrac{50}{100}} = \dfrac{3}{2} = 1.5 > 1$

b $\dfrac{\dfrac{9-7}{4}}{\dfrac{250-150}{150}} = \dfrac{\dfrac{2}{7}}{\dfrac{100}{150}} = \dfrac{3}{7} = 0.43 < 1$

c $\dfrac{0}{\dfrac{350-250}{250}} = 0$

d $\dfrac{\dfrac{7-9}{9}}{\dfrac{450-350}{350}} = \dfrac{\dfrac{-2}{9}}{\dfrac{100}{350}} = -\dfrac{7}{9} = -0.78 < 0$

e When income is \$100–\$150 hot dogs are a luxury since $YED > 1$; as income increases in this range consumption of hotdogs increases proportionately more.

When income increases to \$150–\$250, hot dogs become a necessity since $YED < 1$; as income increases in this range consumption of hotdogs increases proportionately less.

When income increases to \$250–\$350, consumption of hot dogs remains constant as it neither increases nor decreases.

When income increases to \$350–\$450, hotdogs become an inferior good since $YED < 0$; as income increases in this range consumption of hotdogs fall.

Test your understanding 3.10

5 a First week: $PES = 0$

b Second week: $PES = \dfrac{\dfrac{2000}{10\,000}}{\dfrac{5}{10}} = \dfrac{\dfrac{1}{5}}{\dfrac{1}{2}} = \dfrac{2}{5} = 0.4$

c Third week: $PES = \dfrac{\dfrac{8000}{10\,000}}{\dfrac{5}{10}} = \dfrac{\dfrac{4}{5}}{\dfrac{1}{2}} = \dfrac{8}{5} = 1.6$

6 a The longer the time period, the larger the *PES*.

b See Figure 3.14 (coursebook, page 106).

Test your understanding 4.2

2 a Shortage = 8 – 4 = 4 or 4000 units

b Consumer expenditure before the price ceiling = 40 × 6 = 240 or €240 000

Consumer expenditure after the price ceiling = 30 × 4 = 120 or €120 000

Change = €120 000 – €240 000 = €120 000 decrease

c Producer revenue before the price ceiling = 40 × 6 = 240 or €240 000

Producer revenue after the price ceiling = 30 × 4 = 120 or €120 000

Change = €120 000 – €240 000 = €120 000 decrease; *note this is the same as consumer expenditure*.

d Consumer surplus before the price ceiling $= \dfrac{[(70-30)+(50-30)]\times 4}{2} = \dfrac{[(70-40)]\times 6}{2} = \dfrac{180}{2}$ or €90 000

Consumer surplus after the price ceiling $= \dfrac{[(70-30)+(50-30)]\times 4}{2} = \dfrac{240}{2} = 120$ or €120 000

Change in consumer surplus = 120 – 90 = 30 or €30 000 increase

e Producer surplus before the price ceiling $= \frac{[(40-10)]\times 6}{2} = \frac{180}{2} = 90$ or €90 000

Producer surplus after the price ceiling $= \frac{[(30-10)]\times 4}{2} = \frac{80}{2} = 40$ or €40 000

Change in producer surplus = 40 – 90 = –50 or €50 000 decrease

f Welfare loss $= \frac{[(50-30)(6-4)]}{2} = \frac{(20\times 2)}{2} = 20$ or €20 000

Note that this can also be found by comparing social surplus before and after the price ceiling.

Social surplus before the price ceiling = €90 000 + €90 000 = €180 000

Social surplus after the price ceiling = €120 000 + €40 000 = €160 000

Therefore, there has been a decrease in social surplus of €20 000 which is equal to welfare loss.

Test your understanding 4.4

2 **a** Surplus = 8 – 4 = 4 or 4000 units

b Consumer expenditure before the price floor = 40 × 6 = 240 or €240 000

Consumer expenditure after the price floor = 50 × 4 = 200 or €200 000

Change = 200 – 240 = –40 or €40 000 decrease

c Producer revenue before the price floor = 40 × 6 = 240 or €240 000

Producer revenue after the price floor = 50 × 8 = 400 or €400 000

Change = 400 – 240 = 160 or €160 000 increase

d Consumer surplus before the price floor $= \frac{[(70-40)]\times 6}{2} = \frac{180}{2} = 90$ or €90 000

Consumer surplus after the price floor $= \frac{[(70-50)]\times 4}{2} = \frac{80}{2} = 40$ or €40 000

Change = 40 – 90 = –50 or €50 000 decrease

e Producer surplus before the price floor $= \frac{[(40-10)]\times 6}{2} = \frac{180}{2} = 90$ or €90 000

Producer surplus after the price floor $= \frac{[(50-10)]\times 8}{2} = \frac{320}{2} = 160$ or $\frac{180}{2} = 90$ or €160 000

Change = 160 – 90 = 70 or €70 000 increase

f Welfare loss $= [(8-4)\times 50] - \frac{[(8-4)(50-40)]}{2} = 200 - 20 = 180$ or €180 000.

Note that this can also be found by taking the change in social surplus and subtracting the amount of government spending on the price floor.

Social surplus before the price floor = €90 000 + €90 000 = €180 000

Social surplus after the price floor = €40 000 + €160 000 = €200 000

Therefore there has been an increase in social surplus of €20 000.

From this we must subtract the government spending on the price floor of $(8-4)\times 50 = 200$ or €200 000.

Therefore €20 000 – €200 000 = –€180 000 which is what was found above for welfare loss.

Test your understanding 4.7

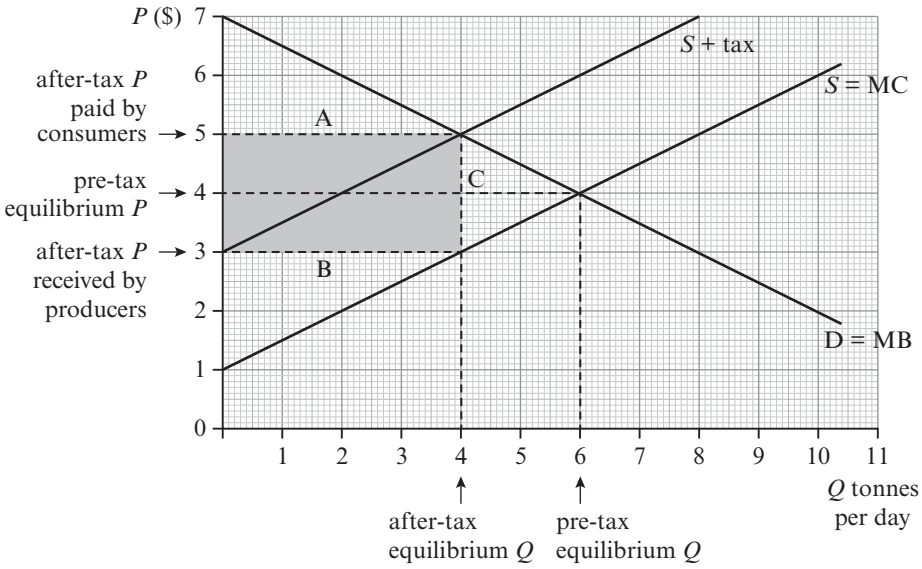
2 a You are given two points on each curve (vertical intercept and point of intersection), so you can draw the two curves directly and identify their point of intersection (equilibrium P and Q; see the figure below).

b Label the axes ($ and tonnes per day). The tax of $2 per tonne shifts the S curve upward by $2, measured along the vertical axis (see Figure 4). After the tax is imposed:

price paid by consumers is P = $5

price received by producers is P = $3

new equilibrium quantity is Q = 4 tonnes per day



c The price paid by consumers increases by $1 (from $4 to $5) whereas the tax is $2 per tonne. The reason the price paid by consumers increases by less than the tax per tonne is that part of the tax is paid by producers ($1 per tonne).

d *Consumer expenditure:*

Before the tax: $4 × 6 tonnes = $24 per day

After the tax: $5 × 4 tonnes = $20 per day

Consumer expenditure fell by $4 per day.

Firm revenue:

Before the tax: $4 × 6 tonnes = $24 per day

After the tax: $3 × 4 tonnes = $12 per day

Firm revenue fell by $12 per day.

Government revenue:

Increased due to the tax by $2 per tonne × 4 tonnes per day = $8 per day

Consumer surplus:

Before the tax: $\frac{(7-4)\times 6}{2} = \frac{18}{2} = \$9$

After the tax: $\frac{(7-5)\times 4}{2} = \frac{8}{2} = \$4$

Consumer surplus decreased by $5 (= $9 – $4)

Producer surplus:

Before the tax: $\frac{(4-1)\times 6}{2} = \frac{18}{2} = \$9$

After the tax: $\frac{(3-1)\times 4}{2} = \frac{8}{2} = \$4$

Producer surplus decreased by \$5 (= \$9 – \$4)

Welfare loss:

Is equal to: $\frac{(5-3)\times(6-4)}{2} = \frac{2\times 2}{2} = \$2$

e *In the figure above:*

Triangle A = consumer surplus after the tax

Triangle B = producer surplus after the tax

Shaded rectangle = government revenue

Triangle C = welfare loss

f At the new after-tax equilibrium $MB > MC$ indicating allocative inefficiency arising from under-allocation of resources to the production of this good. Too little is produced relative to the social optimum, as consumers attach a greater value to the last unit produced than it costs to produce that unit.

Test your understanding 4.9

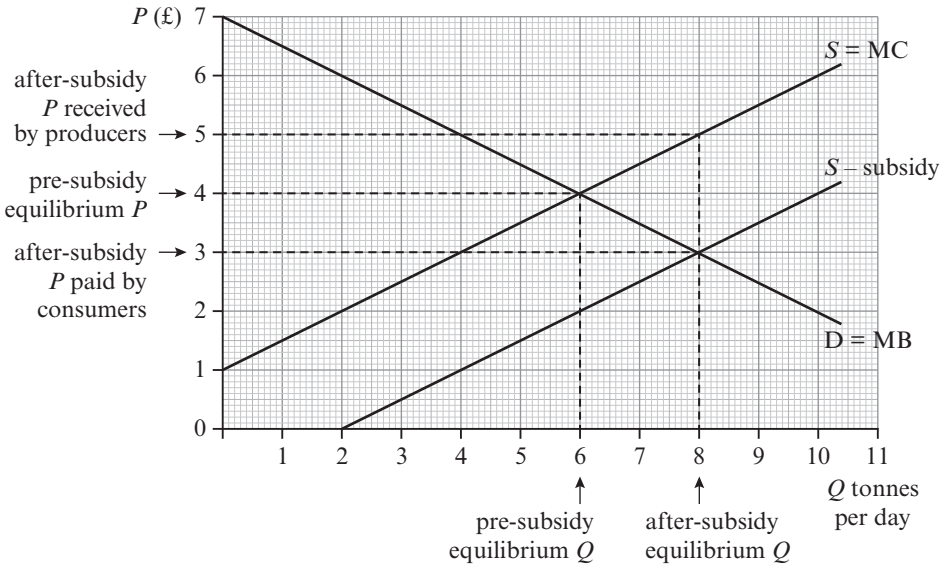
2 a You are given two points on each curve (vertical intercept and point of intersection), so you can plot the two curves directly and identify their point of intersection (equilibrium P and Q; see the figure below).

b Label the axes (£ and tonnes per day). The subsidy of £2 per tonne shifts the *S* curve downward by £2, measured along the vertical axis (see Figure 5). After the subsidy is granted:

price paid by consumers is P = £3

price received by producers is P = £5

new equilibrium quantity is Q = 8 tonnes per day



c *Consumer expenditure:*

Before the subsidy: £4 × 6 tonnes = £24 per day

After the subsidy: £3 × 8 tonnes = £24 per day

There is no change in consumer expenditure (but note that consumers now pay a lower price and buy a larger quantity).

Firm revenue:

Before the subsidy: £4 × 6 tonnes = £24 per day

After the subsidy: £5 × 8 tonnes = £40 per day

Firm revenue increased by £16 per day.

Government expenditure:

Is £2 per tonne × 8 tonnes per day = £16 per day

Consumer surplus:

Before the subsidy: $\frac{(7-4)\times 6}{2} = \frac{18}{2} = £9$

After the subsidy: $\frac{(7-3)\times 8}{2} = \frac{32}{2} = £16$

Consumer surplus increased by £7 (= £16 – £9)

Producer surplus:

Before the subsidy: $\frac{(4-1)\times 6}{2} = \frac{18}{2} = £9$

After the subsidy: $\frac{(5-1)\times 8}{2} = \frac{32}{2} = £16$

Producer surplus increased by £7 (= £16 – £9)

Welfare loss:

Is equal to: $\frac{(5-3)(8-6)}{2} = \frac{2\times 2}{2} = £2$

d government expenditure = A + B + C + D + E

welfare loss = E

increase in consumer surplus = C + D

increase in producer surplus = A + B

e At the new after-tax equilibrium $MB < MC$ indicating allocative inefficiency rising from overallocation of resources to the production of this good. Too much is produced relative to the social optimum, as consumers attach a smaller value to the last unit produced than it costs to produce that unit.

Test your understanding 7.2

2 **Important note:** The Quantity figures in this question should be in units (not thousand units).

Price ($)	Quantity (units)	TR ($)	MR ($)	AR ($)
5	0	**0**	**0**	**0**
5	1	**5**	**5**	**5**
5	2	**10**	**5**	**5**
5	3	**15**	**5**	**5**
5	4	**20**	**5**	**5**

3 **Important note:** The Quantity figures in this question should be in units (not thousand units).

Price ($)	Quantity (units)	TR ($)	MR ($)	AR ($)
8	2	**16**	—	**8**
7	3	**21**	**5**	**7**
6	4	**24**	**3**	**6**
5	5	**25**	**1**	**5**
4	6	**24**	**–1**	**4**
3	7	**21**	**–3**	**3**
2	8	**16**	**–5**	**2**

4 **a** When the firm has no control over price, price is constant for all units of output. This occurs when a firm is producing under highly competitive conditions. When the firm has some control over price, there is a negative relationship between price and quantity, so that as price falls, quantity increases (and vice versa). This occurs when conditions in the market are less competitive and the firm has some market power.

b Price and average revenue are the same, in both the cases where the firm has no control over price and the cases where the firm has some control over price.

5 **Important note:** The Quantity figures in this question should be in units (not thousand units).
Since AR is the same as price, you can use the AR figures to calculate TR, and then MR.

Quantity (units)	AR ($)	TR ($)	MR ($)	Price ($)
1	20	**20**	**20**	**20**
2	18	**36**	**16**	**18**
3	16	**48**	**12**	**16**
4	14	**56**	**8**	**14**
5	12	**60**	**4**	**12**
6	10	**60**	**0**	**10**

6 **Important note:** The Quantity figures in this question should be in units (not thousand units).
Since you are given MR, you can calculate TR, and then use TR and Q to find AR and therefore P.

Quantity (units)	MR ($)	TR ($)	AR ($)	Price ($)
1	14	**14**	**14**	**14**
2	12	**26**	**13**	**13**
3	10	**36**	**12**	**12**
4	8	**44**	**11**	**11**
5	6	**50**	**10**	**10**
6	4	**54**	**9**	**9**

Test your understanding 7.3

2

Quantity (units)	TC (€)	AC (€)	MC (€)
2	300	**150**	–
5	400	**80**	**33.33**
9	500	**55.55**	**25**
14	600	**42.86**	**20**
18	700	**38.89**	**25**
21	800	**38.10**	**33.33**
23	900	**39.13**	**50**
24	1000	**41.67**	**100**

3

Quantity (units)	AC (€)	TC (€)	MC (€)
1	180	180	–
2	140	280	100
3	133	399	119
4	135	540	141
5	140	700	160

4

Quantity (units)	MC (£)	TC (£)	AC (£)
1	14	14	14
2	12	26	13
3	10	36	12
4	12	48	12
5	14	62	12.4

Test your understanding 7.4

3 Use the information in the question to calculate TR and economic profit for each level of output.

Q (units)	P ($)	TR ($)	TC ($)	Economic profit ($)
1	5	**5**	15	**–10**
2	5	**10**	18	**–8**
3	5	**15**	20	**–5**
4	5	**20**	21	**–1**
5	5	**25**	23	**+2**
6	5	**30**	26	**+4**
7	5	**35**	30	**+5**
8	5	**40**	35	**+5**
9	5	**45**	41	**+4**
10	5	**50**	48	**+2**

a Profit is maximum when the firm produces 7 or 8 units of output.

b Profit = $5.

c When Q = 3, the firm makes a loss of $5 (negative economic profit).
When Q = 6, the firm earns economic profit of $4.
When Q = 10, the firm earns economic profit of $2.

4 You can find *MR* and *MC* from the information in question 3.

Q (units)	MR ($)	MC ($)
1	**5**	**–**
2	**5**	**3**
3	**5**	**2**
4	**5**	**1**
5	**5**	**2**
6	**5**	**3**
7	**5**	**4**
8	**5**	**5**
9	**5**	**6**
10	**5**	**7**

a The firm maximises profit where $MR = MC$; this is where Q = 8 units of output.

b The profit-maximising level of output is the same. (Note that you must use the larger of the two values found by the TR and TC approach; see the note in the coursebook, page 206.)

5

Q (units)	P ($)	TR ($)	TC ($)	Economic profit ($)
1	10	**10**	15	**–5**
2	9	**18**	18	**0**
3	8	**24**	20	**+4**
4	7	**28**	21	**+7**
5	6	**30**	23	**+7**
6	5	**30**	26	**+4**
7	4	**28**	30	**–2**
8	3	**24**	35	**–11**

a The firm maximises profit by producing 4 or 5 units of output.

b It will make profit of $7.

c When Q = 2, the firm earns normal profit (zero economic profit).
When Q = 3, the firm earns economic profit of $4.
When Q = 8, the firm makes a loss of $11 (negative economic profit).

6 You can find *MR* and *MC* from the information in question 5.

Q (units)	MR ($)	MC ($)
1	**10**	**–**
2	**8**	**3**
3	**6**	**2**
4	**4**	**1**
5	**2**	**2**
6	**0**	**3**
7	**–2**	**4**
8	**–4**	**5**

a The firm maximises profit when $MR = MC$, or when it produces 5 units of output.

b The profit-maximising level of output is the same. (Note that you must use the larger of the two values found by the TR and TC approach; see the note in the coursebook, page 206.)

Test your understanding 7.7

2 a $9 – $8 = $1 = abnormal profit per unit; $1 × 200 units = $200 = total abnormal profit

b $13 – $15 = –$2 = loss per unit; $2 × 250 units = $500 = total loss

c $17 – $17 = 0 profit = normal profit

3 a $P = MR = €6$. By the $MR = MC$ profit-maximisation rule, the firm will produce 9 units of output. At this level of output, $AC = €4.44$. Therefore profit per unit = $P – AC = €6.00 – €4.44 = €1.56$. Total profit = profit per unit × number of units sold = €1.56 × 9 = €14.04.

b $P = MR = €4$. By the $MR = MC$ profit-maximisation (loss-minimisation) rule, the firm will produce 7 units of output (Note that there are two levels of output where $P = MC$ (1 unit and 7 units). When this occurs, the firm will choose to produce the larger quantity of output, which is 7 units.) At this level of output $AC = €4.14$; therefore $P < AC$, and the firm would be making a loss. Loss per unit = $AC – P$ = €4.14 – €4.00 = €0.14, and total loss = loss per unit × number of units sold = €0.14 × 7 = €0.98.

Test your understanding 7.10

3 a

Q (units)	Price ($)	TR ($)	MR ($)	AC ($)	MC ($)
1	10	**10**	**10**	14.0	4
2	9	**18**	**8**	8.5	3
3	8	**24**	**6**	6.3	2
4	7	**28**	**4**	5.0	1
5	6	**30**	**2**	4.4	2
6	5	**30**	**0**	4.2	3
7	4	**28**	**–2**	4.1	4
8	3	**24**	**–4**	4.3	5

b By the $MR = MC$ rule, the profit-maximising level of output is 5 units (where $MR = MC = \$2$).

c 5 units of output will be sold at $6 per unit.

d Profit per unit = $P - ATC = \$6 - \$4.4 = \$1.6$. Total profit = profit per unit × number of units sold = $\$1.6 \times 5 = \$8.0$.

Test your understanding 8.4

1 GDP = C + I + G + (X – M)

125 + 35 + 46 + (12 – 17) = 201

GDP = Ftl 201 billion

2 GNI = GDP + income from abroad – income sent abroad

201 + 4.5 – 3.7 = 201.8

GNI = Ftl 201.8 billion

4 a Base year is 2016.

b

	2015	2016	2017	2018	2019
Real GDP, billion Lkl (in 2007 Lkl)	20.2	20.7	21.4	21.0	21.5

c Real GDP is the same as nominal GDP in 2016, because 2016 is the base year.

d Nominal GDP is calculated in nominal prices, while real GDP is calculated in constant (2016) prices. Real GDP fell because the amount of output produced in 2018 valued in constant (2016) prices actually fell relative to the amount of output produced in 2017, i.e. a smaller amount of output was produced. Nominal GDP, on the other hand, increased because prices on average increased (this can be seen in the increase in the GDP deflator) making the value of nominal output greater.

e Real GDP increased because the amount of output produced in 2019 valued in constant (2016) prices actually increased relative to the amount of output produced in 2018, i.e. a larger amount of output was produced. Nominal GDP, on the other hand, fell because prices on average fell (this can be seen in the decrease in the GDP deflator) lowering the value of output in nominal terms.

f To find real GDP per capita divide real GDP found in 4(b) by the size of the population.

2015	2016	2017	2018	2019
16 833.33	17 107.44	17 540.98	17 073.17	16 929.13

g The reason is that the population grew faster than real GDP, therefore real GDP per capita fell.

This can be seen by calculating the rates of increase. The rate of increase for the population was $\frac{1.27 - 1.23}{1.23 \times 100} = 3.25\%$ while for real GDP it was $\frac{21.5 - 21.0}{21.0 \times 100} = 2.38\%$

Test your understanding 10.1

5 0.62×57.7 million = 35.77 million is the labour force

labour force – number of employed = number of unemployed

35.77 – 32.9 = 2.87 so 2.87 million is the number of unemployed

$$\text{unemployment rate} = \frac{\text{number of unemployed}}{\text{labour force}} \times 100$$

$$\text{unemployment rate} = \frac{2.87}{35.77} \times 100 = 8.02\%$$

Test your understanding 10.3

3 **a** 2016

b 2016–2017: 5% (= 105 – 100)

2016–2018: 7% (= 107 – 100)

c 2014–2015: $\frac{95 - 97}{97} \times 100 = \frac{-2}{97} \times 100 = -2.06\%$

2015–2016: $\frac{100 - 95}{95} \times 100 = \frac{5}{95} \times 100 = 5.26\%$

2017–2018: $\frac{107 - 105}{105} \times 100 = \frac{2}{105} \times 100 = 1.90\%$

d 2014 to 2015, because the price index falls from 97 to 95; the price level fell by 2.06%.

e The rates of inflation calculated above are

2014–2015: –2.06%

2015–2016: 5.3%

2016–2017: 5%

2017–2018: 1.9%

Therefore disinflation occurred in 2016–2017 and in 2017–2018 because in both cases the rate of inflation is lower than in the previous year.

5 **a** Construct a consumer price index using 2016 as the base year.

	Quantity in basket	P (£) 2015	Value of basket 2015	P (£) 2016	Value of basket 2016	P (£) 2017	Value of basket 2017	P (£) 2018	Value of basket 2018
Pizzas	25	7	**175**	6	**150**	7	**175**	6	**150**
DVDs	9	15	**135**	17	**153**	18	**162**	18	**162**
Bus rides	47	2	**94**	4	**188**	4	**188**	3	**141**
Total value			**404**		**491**		**525**		**453**

Price index:

2015: $\frac{404}{491} \times 100 = 82.3$

2016: 100 (since this is the base year)

2017: $\frac{525}{491} \times 100 = 106.9$

2018: $\frac{453}{491} \times 100 = 92.3$

b The weights here are the quantity (number of units) of each good in the basket, appearing in the first column of the table.

c 2015–2016: $\frac{100 - 82.3}{82.3} \times 100 = 21.5\%$

2016–2017: 6.9% (we can 'read' this off directly from the price index)

2017–2018: $\frac{92.3 - 106.9}{106.9} \times 100 = -13.7\%$

d Inflation occurred in 2015–2016 and 2016–2017 because there was an increase in the average price level.

Deflation occurred in 2017–2018 because there was a decrease in the average price level.

Disinflation occurred in 2016–2017 because the rate of inflation (6.9%) was lower than in the previous year (21.5%).

e Use the same method as in part (a) (and in the coursebook, page 310) to calculate the price index:

2015: 76.9

2016: 93.5

2017: 100

2018: 86.3

f You should find that the rates of inflation/deflation are the same as those you have calculated in part (c) above (any small difference is due to rounding).

g See part (f) above.

h No, it would not make sense. Each price index is calculated relative to a particular base year, and the index numbers make sense only in relation to that base year. (You can see this by comparing the index numbers of the two price indices you calculated above.) While the same rates of inflation arise from using different base years, as the above example has shown, the index numbers themselves are not directly comparable.

Test your understanding 10.6

2 a Real income falls by 3% (= 5 – 8).

b Real income falls by 13% (= –10 – 3).

c Real income remains unchanged (= 7 – 7).

Test your understanding 10.7

2 a Real income increases by 8% (= 5 + 3)

b Real income falls by 8% (= –10 + 2)

c Real income increases by 1% (= –3 + 4)

Test your understanding 11.1

4 a $\frac{1611-1579}{1579} \times 100 = 2.03\%$

b $\frac{1597-1611}{1611} \times 100 = -0.87\%$

c 2018–2019

6 % change in real GDP per capita 2.2% – 1.5% = 0.7%

Test your understanding 12.6

1 a Zero income tax.

b Income between $10 001 and $25 000 is taxed at 9%.
$15 700 – $10 000 = $5700
$5700 × 0.09 = $513 is the amount of income tax paid.

c Income between $10 001 and $25 000 is taxed at 9%; therefore tax paid is $15 000 × 0.09 = $1350
Income above $25 000 and less than $55 000 is taxed at 22%:
$31 000 – $25 000 = $6000
$6000 × 0.22 = $1320
Therefore total income tax is $1350 + $1320 = $2670

d For income between $10 001 and $25 000, income tax is $1350 (see part (**c**)).
Income above $25 001 and less $55 000 is taxed at 22%:
$48 000 – $25 000 = $23 000
$23 000 × 0.22 = $5060
Therefore total income tax is $1350 + $5060 = $6410

e For income between $10 001 and $25 000, income tax is $1350.
For income between $25 001 and $55 000, income tax is $30 000 × 0.22 = $6600
For income between $55 001 and $115 000, income tax is $60 000 × 0.40 = $24 000
For income above $115:
$120 000 – $115 000 = $5000
$5000 × 0.55 = $2750
Therefore total income tax is $1350 + $6600 + $24 000 + $2750 = $34 700

2 a Average income tax rates:
$6500: 0

$15 700: $\frac{\$513}{\$15\,700} \times 100 = 3.27\%$

$31 000: $\frac{\$2679}{\$31\,000} \times 100 = 8.61\%$

$48 000: $\frac{6410}{\$48\,000} \times 100 = 13.35\%$

$120 000: $\frac{\$34700}{\$120\,000} \times 100 = 28.92\%$

b The average tax rate increases as income increases because this is a progressive tax system.

c Marginal tax rates:

$6500: 0

$15 700: 9%

$31 000: 22%

$47 000: 22%

$120 000: 55%

3 a The income tax paid on $48 000 was found to be $6410, therefore disposable income is $48\,000 - 6410 = \$41\,590$.

The family spends 85% of disposable income therefore the amount of spending is $0.85 \times 41\,590 = \$35\,351.50$.

To find the amount of spending on the indirect tax of 17% use the formula in the text:

$$\frac{17}{100} \times \frac{35\,351.50}{1 + \frac{17}{100}} = 0.17 \times \frac{35\,351.50}{1.17} = \$5136.54$$

b Average indirect tax rate $= \frac{5136.54}{48\,000} = 10.70\%$

c Total average tax rate = 13.35 + 10.70 = 24.05%

Test your understanding 13.3

1 b Real interest rate = 5 – 3 = 2%

c Real interest rate = 4 – 7 = –3%

Test your understanding 13.8

3 $\text{multiplier} = \frac{1}{1 - MPC}$

a $MPC = \frac{4}{5}$: $\text{multiplier} = \frac{1}{1 - \frac{4}{5}} = \frac{1}{\frac{1}{5}} = 5$

b $MPC = \frac{3}{4}$: $\text{multiplier} = \frac{1}{1 - \frac{3}{4}} = \frac{1}{\frac{1}{4}} = 4$

c $MPC = \frac{2}{3}$: $\text{multiplier} = \frac{1}{1 - \frac{2}{3}} = \frac{1}{\frac{1}{3}} = 3$

d $MPC = \frac{1}{2}$: $\text{multiplier} = \frac{1}{1 - \frac{1}{2}} = \frac{1}{\frac{1}{2}} = 2$

4 The larger the *MPC*, the larger the multiplier; the smaller the *MPC*, the smaller the multiplier. The reason is that if the *MPC* is large, there are small leakages (withdrawals) from the spending stream; therefore the consumption spending that feeds back into the spending stream is larger, making the multiplier larger.

5 a $MPS + MPT + MPM = 0.1 + 0.1 + 0.1 = 0.3$

therefore the multiplier = $\frac{1}{0.3} = 3.33$

b $MPS + MPT + MPM = 0.13 + 0.12 + 0.15 = 0.4$

therefore the multiplier = $\frac{1}{0.4} = 2.5$

6 The larger the leakages the smaller the multiplier because the *MPC* is smaller. Therefore the consumption spending that feeds back into the spending stream is smaller, making the multiplier smaller.

7 If the $MPC = \frac{2}{3}$ the multiplier = 3.

a $2 billion × 3 = $6 billion increase in real GDP, so the final value of real GDP = $50 billion + $6 billion = $56 billion

b –$3 billion × 3 = $9 billion or a fall in real GDP of $9 billion, so the final value of real GDP = $50 billion
– $9 billion = $41 billion

c $7 billion × 3 = $21 billion increase in real GDP, so the final value of real GDP = $50 billion + $21 billion = $71 billion

d –1.52 billion × 3 = $4.5 billion or a fall in real GDP of $4.5 billion, so the final value of real GDP = $50 billion – $4.5 billion = $45.5 billion (This presupposes that the change in consumption is autonomous, or independent of income.)

8 If the $MPS + MPT + MPM = \frac{1}{4}$, then the multiplier = 4.

a $2 billion × 4 = $8 billion increase in real GDP, so the final value of real GDP = $50 billion + $8 billion = $58 billion

b –$3 billion × 4 = $12 billion or a fall in real GDP of $12 billion, so the final value of real GDP = $50 billion – $12 billion = $38 billion

c $7 billion × 4 = $28 billion increase in real GDP, so the final value of real GDP = $50 billion + $28 billion = $78 billion

d –$1.5 billion × 4 = $6 billion or a fall in real GDP of $6 billion, so the final value of real GDP =$50 billion × $6 billion = $44 billion (This presupposes that the change in consumption is autonomous, or independent of income.)

Test your understanding 14.3 – 14.4

1 a Before trade 0 units are exported.

After trade 55 – 25 = 30 million units are exported.

b Before trade export revenues are 0.

After trade export revenues = 30 million × $9 = $270 million

c Before trade producer revenue = 40 million × $7 = $280 million

After trade producer revenue = 55 million × $9 = $495 million

Change = 495 – 280 = $215 million increase

d Before trade consumer expenditure = 40 million × $7 = $280 million; *note it is the same as producer revenue*

After trade consumer expenditure = 25 million × $9 = $225 million

Change = 225 – 280 = –$55 million; decrease of $55 million

2 a Before trade 0 units are imported.
After trade 60 – 20 = 40 million units are imported.

b Before trade import expenditures are 0
After trade import expenditures = 40 million × $4 = $160 million

c Before trade producer revenue = 40 million × $7 = $280 million
After trade producer revenue =20 million × $4 = $80 million
Change = 80 – 280 = –$200 million; decrease of $200 million

d Before trade consumer expenditure = 40 million × $7 = $280 million; *note it is the same as producer revenue*
After trade consumer expenditure = 60 million × $4 = $240 million
Change = 240 – 280 = –$40 million; decrease of $40 million

Test your understanding 14.5

4 a **Coffenia:**

opportunity cost of coffee: $\frac{4 \text{ robots}}{8 \text{ units of coffee}} = \frac{1}{2}$

opportunity cost of robots: $\frac{8 \text{ units of coffee}}{4 \text{ robots}} = 2$

Robotia:

opportunity cost of coffee: $\frac{6 \text{ robots}}{3 \text{ units of coffee}} = 2$

opportunity cost of robots: $\frac{3 \text{ units of coffee}}{6 \text{ robots}} = \frac{1}{2}$

b The results show that Coffenia has a comparative advantage in coffee and Robotia a comparative advantage in robots. At the same time, each country has an absolute advantage in the same two goods. However, this in no way affects the conclusion that each country should specialise in the production of the good in which it has a comparative advantage.

7 a

	Country A	Country B
Good X	8	2
Good Y	2	4
Opportunity cost of X	$\frac{2}{8} = \frac{1}{4}$	$\frac{4}{2} = 2$
Opportunity cost of Y	$\frac{8}{2} = 4$	$\frac{2}{4} = \frac{1}{2}$

Country A had a comparative advantage in good X and Country B in good Y.

	Country A	Country B
Good X	8	2
Good Y	6	4
Opportunity cost of X	$\frac{6}{8} = \frac{3}{4}$	$\frac{4}{2} = 2$
Opportunity cost of Y	$\frac{8}{6} = 1\frac{1}{3}$	$\frac{2}{4} = \frac{1}{2}$

Country A has a comparative advantage in good X and Country B in good Y.

	Country A	Country B
Good X	1	4
Good Y	2	2
Opportunity cost of X	$\frac{2}{1} = 2$	$\frac{2}{4} = \frac{1}{2}$
Opportunity cost of Y	$\frac{1}{2}$	$\frac{3}{2} = 2$

Country A has a comparative advantage in good Y and Country B in good X.

	Country A	Country B
Good X	6	3
Good Y	3	1
Opportunity cost of X	$\frac{3}{6} = \frac{1}{2}$	$\frac{1}{3}$
Opportunity cost of Y	$\frac{6}{3} = 2$	$\frac{3}{1} = 3$

Country A has a comparative advantage in good Y and Country B in good X.

	Country A	Country B
Good X	1	2
Good Y	2	4
Opportunity cost of X	$\frac{2}{1} = 2$	$\frac{4}{2} = 2$
Opportunity cost of Y	$\frac{1}{2}$	$\frac{2}{4} = \frac{1}{2}$

Opportunity costs are the same in Country A and Country B; no country has a comparative advantage in good X or good Y.

Test your understanding 14.7

To answer questions 1 and 2, draw a diagram as in Figure 14.6(a) (coursebook, page 445) and label P_w = \$300, Q_1 = 100 000 units and Q_2 = 200 000 units, as given in question 1. (The diagram does not have to be drawn to scale.)

1 i Lakeland is an importer of computers because the world price is below the domestic price with no trade, indicating that Lakeland has a comparative disadvantage in the production of computers, therefore should import them from countries that can produce them at a lower opportunity cost.

ii a The new price paid by consumers is the world price plus the tariff = \$300 + \$50 = \$350

b The new price received by domestic producers is the same as that paid by consumers, i.e. \$350.

c Computer sales before the tariff = domestic production + number of units imported = 100 000 + 250 000 = 350 000 units (Q_4, as in Figure 14.6(a)).

d Computer sales after the tariff = domestic production + quantity of imports = 200 000 + 70 000 = 270 000 units (Q_3 as in Figure 14.6(a)).

2 a Consumer expenditure before the tariff $= \$300 \times 350\,000 = \$105\,000\,000$ (= \$105 million).

Consumer expenditure after the tariff $= \$350 \times 270\,000 = \$94\,500\,000$ (= \$94.5 million).

Therefore consumer expenditure decreased by \$10.5 million after the imposition of the tariff.

b Before the tariff import expenditure $= 250\,000 \times \$300 = \$75\,000\,000$ (= \$75 million).

After the tariff import expenditure $= 70\,000 \times \$350 = \$24\,500\,000$ (= \$24.5 million).

Therefore import expenditure decreased by $75 - 24.5 = \$50\,500\,000$ (= \$50.5 million)

c Producer revenue before the tariff $= \$300 \times 100\,000 = \$30\,000\,000$ (= \$30 million).

Producer revenue after the tariff $= \$350 \times 200\,000 = \$70\,000\,000$ (= \$70 million).

Therefore producer revenue increased by \$40 million after the imposition of the tariff.

d The government's revenue from the tariff increased from zero to $50 \times 70\,000$ units of imports = \$3 500 000 (= \$3.5 million).

e Before the tariff, foreign producers exported 250 000 units to Lakeland; after the tariff they exported 70 000 units.

Therefore their exports fell by 180 000 units.

f Before the tariff, foreigners' computer export revenues were $\$300 \times 250\,000$ units = \$75 000 000 (= \$75 million).

After the tariff, these export revenues fell to $\$300 \times 70\,000$ units = \$21 000 000 (= \$21 million).

Therefore their export revenues fell by \$54 million.

g Consumer surplus decreases by the area c + d + e + f in Figure 14.6(b) in the coursebook because of (i) the increase in price from \$300 to \$350 and (ii) the decrease in quantity purchased from 350 000 to 270 000 units. This decrease can be calculated as the area of the trapezium given by the average of the two parallel sides times the height, where the top side = 270 000, the bottom side = 350 000 while the height = \$50. Therefore

$$\text{loss of consumer surplus} = \frac{350\,000 + 270\,000}{2} \times \$50 = 310\,000 \times \$50 = \$15\,500\,000 \text{ (or \$15.5 million).}$$

h Producer surplus increases by the area c in Figure 14.6(b) in the coursebook because of (i) the increase in price from \$300 to \$350 and (ii) the increase in quantity produced from 100 000 to 200 000 units. This can be calculated as the area of the trapezium given by the average of the two parallel sides times the height, where the top side = 200 000, the bottom side = 100 000 while the height = \$50. Therefore

$$\text{gain of producer surplus} = \frac{200\,000 + 100\,000}{2} \times \$50 = 150\,000 \times \$50 = \$7\,500\,000 \text{ (or \$7.5 million)}$$

i Welfare loss is equal to the area of two triangles d + f in Figure 14.6(b) in the coursebook, given by

$$\frac{(200\,000 - 100\,000) \times 50}{2} + \frac{(350\,000 - 270\,000) \times 50}{2} = \$2\,500\,000 + \$2\,000\,000 = \$4\,500\,000$$

(or \$4.5 million)

This can be confirmed by noticing that welfare loss = loss in consumer surplus – gain in producer surplus – gain in budget revenue so that

welfare loss = –15.5 + 7.5 + 3.5 = –4.5 or a loss of \$4.5 million.

Test your understanding 14.9

1 a Quantity of mobile phones produced domestically before the quota = domestic sales – quantity of imports = 700 000 – 500 000 = 200 000 units (Q_1 in the diagram).

b Quantity of mobile phones produced domestically after the quota = domestic sales – quantity of imports = 500 000 – 200 000 = 300 000 (Q_2 in the diagram).

c The quantity of imports is that specified by the quota = 200 000 units

d Draw a diagram as in Figure 14.8(a) (coursebook, page 449) (it does not have to be drawn to scale) where P_w = €100, Q_1 = 200 000, Q_2 = 300 000, Q_3 = 500 000 units and Q_4 = 700 000 units.

2 a Consumer expenditure before the quota = €100 × 700 000 = €70 000 000 (= €70 million).

Consumer expenditure after the quota = €120 × 500 000 = €60 000 000 (= €60 million).

Therefore consumer expenditure decreased by €10 million after the imposition of the quota.

b Import expenditure before the quota = €100 × 500 000 = €50 000 000 (= €50 million).

Import expenditure after the quota = €120 × 200 000 = €24 000 000 (= €24 million).

Therefore import expenditure fell by 50 – 24 = $26 million after the imposition of the quota.

c Producer revenue before the quota = €100 × 200 000 = €20 000 000 (= €20 million).

Producer revenue after the quota = €120 × 300 000 = €36 000 000 (= €36 million).

Therefore producer revenue increased by €16 million after the imposition of the quota.

d Quota revenue = increase in price due to the quota × number of units of imports = €20 × 200 000 = €4 000 000 (= €4 million).

e The change in foreign producers' quantity of exports is equal to the fall in the quantity of imports = 500 000 – 200 000 = 300 000 units.

f Foreign producers export revenues fall by €100 × 300 000 = €30 000 000 (= €30 million).

g Consumer surplus decreases by the area c + d + e + f in Figure 14.8(b) in the coursebook because of (i) the increase in price from €100 to €120 and (ii) the decrease in quantity purchased from 700 000 to 500 000 units. This decrease can be calculated as the area of the trapezium given by the average of the two parallel sides times the height, where the top side = 500 000, the bottom side = 700 000 while the height = €20. Therefore

$$\text{loss of consumer surplus} = \frac{700\,000 + 500\,000}{2} \times €20 = 600\,000 \times €20 = \$12\,000\,000 \text{ (or €12 million).}$$

h Producer surplus increases by the area c in Figure 14.8(b) in the coursebook because of (i) the increase in price from €100 to €120 and (ii) the increase in quantity produced from 200 000 to 300 000 units. This can be calculated as the area of the trapezium given by the average of the two parallel sides times the height, where the top side = 300 000, the bottom side = 200 000 while the height = €12. Therefore

$$\text{gain of producer surplus} = \frac{300\,000 + 200\,000}{2} \times €20 = 250\,000 \times €20 = €5\,000\,000 \text{ (or €5.0 million).}$$

i Welfare loss is given by the area of the trapezium d + e + f in Figure 14.8(b) in the coursebook, given by the average of the two parallel sides times the height. Therefore

$$\text{welfare loss} = \frac{(500\,000 + 200\,000)}{2} \times €20 = €7\,000\,000 \text{ (€7.0 million).}$$

This can be confirmed by noticing that welfare loss = loss in consumer surplus – gain in producer surplus, so that

welfare loss = –12 + 5 = –7 or a loss of 7 million.

3 a There is no effect on the government's budget.

b Foreign producers lose €30 million due to lower export revenues and they gain €4 million from the quota revenues. Therefore they lose by €30 million – €4 million = €26 million.

Test your understanding 14.11

To answer questions 1 and 2, draw a diagram as in Figure 14.12(a) (coursebook, page 455) (it does not have to be drawn to scale), where P_w = £200, Q_1 = 300 000, Q_2 = 900 000 and Q_3 = 550 000 units.

1 i Radioland is an importer of televisions because the world price is below the domestic price with no trade, indicating that Radioland has a comparative disadvantage in the production of televisions, therefore should import them from countries that can produce them at a lower opportunity cost.

ii a The price paid by consumers does not change; it remains at £200 (=P_w in the diagram).

b The price received by producers is £200 + £50 = £250 (=P_{w+s} in the diagram)

c The quantity of imports before the subsidy = 900 000 – 300 000 = 600 000 units

d The quantity of imports after the subsidy = 900 000 – 550 000 = 350 000 units

e The total television sales in the domestic economy do not change, and remain constant at 900 000 units.

2 a Consumer expenditure before and after the subsidy = £200 × 900 000 = £180 000 000 (= £180 million). This does not change.

b Import expenditures before the subsidy = 600 000 units of imports × £200 = £120 000 000 (£120 million).

Import expenditures after the subsidy = 350 000 units of imports × £200 =

£70 000 000 (£70 million).

Therefore import expenditures decreased by 120 – 70 = £50 million.

c Producer revenue before the subsidy = £200 × 300 000 = £60 000 000 (= £60 million).

Producer revenue after the subsidy = £250 × 550 000 = £137 500 000 (= £137.5 million).

Therefore producer revenue increased by £77.5 million after the granting of the subsidy.

d The government must pay the subsidy, which is £50 × 550 000 = £27 500 000 (= £27.5 million). Therefore the government budget is worse off by this amount.

e Foreign producers' quantity of exports to the country fall by the same amount as the quantity of imports, i.e. 600 000 – 350 000 = 250 000 units

f Foreign producers' export revenues before the subsidy and after the subsidy are equal to Radioland's import expenditures before and after the subsidy.

g Consumer surplus is not affected since they pay the same price and buy the same quantity before and after the subsidy.

h Producer surplus increases by the area a in Figure 14.12(b) in the coursebook because of (i) the increase in price from £200 to £250 and

(ii) the increase in quantity produced from 300 000 to 550 000 units. This can be calculated as the area of the trapezium given by the average of the two parallel sides times the height, where the top side = 550 000, the bottom side = 300 000 while the height = £50. Therefore

$$\text{gain of producer surplus} = \frac{550\,000 + 300\,000}{2} \times £50 = 425\,000 \times £50 = £21\,250\,000 \text{ (or £21.25 million).}$$

i Welfare loss is equal to the area of the triangle b in Figure 14.12(a) in the coursebook, given by

$$\text{welfare loss} = \frac{(550 - 300) \times 50}{2} = £6250 \text{ or } £6\,250\,000 \text{ (or £6.25 million).}$$

This can be confirmed by noticing that welfare loss = gain in producer surplus – loss in budget expenditures so that welfare loss = £21.25 – £27.5 = 6.25 or a loss of £6.25 million.

Test your understanding 14.13

To answer questions 1 and 2, draw a diagram as in Figure 14.13(a) (coursebook, page 457) (it does not have to be drawn to scale), where $P_w = \$3$, $Q_1 = 400\,000$, $Q_2 = 700\,000$, $Q_3 = 250\,000$ and $Q_4 = 900\,000$ units.

1 i Oceanland is an exporter of fish because the world price is above the domestic price with no trade, indicating that Oceanland has a comparative advantage in the production of fish, therefore should export them to countries that have a higher opportunity cost in fishing.

ii a The post-subsidy price paid by consumers is \$4 per kg.

b The post-subsidy price received by domestic producers is \$4 per kg.

c The pre-subsidy quantity of exports is 700 – 400 = 300 or 300 000 kg.

d The post-subsidy quantity of exports is 900 – 250 = 650 or 650 000 kg.

2 a Consumer expenditure before the subsidy = \$3 × 400 000 = \$1 200 000 (= \$1.2 million).

Consumer expenditure after the subsidy = \$4 × 250 000 = \$1 000 000 (= \$1 million).

Therefore consumer expenditure decreased by \$0.2 million after the grating of the subsidy.

b Producer revenue before the subsidy = \$3 × 700 000 = \$2 100 000 (= \$2.1 million).

Producer revenue after the subsidy = \$4 × 900 000 = \$3 600 000 (\$3.6 million).

Therefore producer revenue increased by \$1.5 million after the imposition of the tariff.

c Before the subsidy export revenue = \$3 × 300 000 = \$900 000 (\$0.9 million).

After the subsidy export revenue = \$4 × 650 000 = \$2 600 000 (\$2.6 million).

Therefore export revenue increased by 2.6 – 0.9 = \$1.7 or \$1 700 000 (\$1.7 million).

d The government must pay for the subsidy an amount equal to the subsidy per unit times the quantity of exports therefore government spending on subsidy = \$1 × 650 000 = \$650 000.

e Consumer surplus falls by the area a + b in Figure 14.13(a) in the coursebook due to the higher price they pay and the lower quantity they buy. This is the area of the trapezium given by the average of the two parallel sides times the height, where the top side = 250 000, the bottom side = 400 000 while the height = \$1. Therefore

$$\text{loss of consumer surplus} = \frac{250\,000 + 400\,000}{2} \times \$1 = \$325\,000$$

f Producer surplus increases by the area a+ b+ c in Figure 14.13(a) in the coursebook due to the higher price they receive and the greater quantity they produce. This is the area of the trapezium given by the average of the two parallel sides times the height, where the top side = 900 000, the bottom side = 700 000 while the height = \$1. Therefore gain of producer surplus $= \frac{900\,000 + 700\,000}{2} \times \$1 = \$800\,000$

g Welfare loss is equal to the area of two triangles b + d in Figure 14.13(a) in the coursebook, given by

$$\frac{(400\,000 - 250\,000) \times 1}{2} + \frac{(900\,000 - 700\,000) \times 1}{2} = \$75\,000 + \$100\,000 = \$175\,000$$

This can be confirmed by noticing that welfare loss = loss in consumer surplus – gain in producer surplus – loss from government spending so that

welfare loss = –325 + 800 – 650 = –175 or a loss of \$175 000.

Test your understanding 16.3

1 a 1 US dollar $= \frac{1}{0.99} = 1.01$ Canadian dollar

b 1 Japanese yen $= \frac{1}{1.84} = 0.54$ Indian rupee

c 1 Sri Lankan rupee $= \frac{1}{1.34} = 0.75$ Japanese yen

d 1 Canadian dollar $= \frac{1}{1.62} = 0.62$ British pound

2 a 1 Indian rupee = 1.84 Japanese yen

50 Indian rupees = $50 \times 1.84 = 92.00$ Japanese yen

b You must first find the value of Indian rupees in terms of Sri Lankan rupees:

1 Indian rupee = 1.84 Japanese yen

1 Japanese yen = 1.34 Sri Lankan rupees

Therefore 1 Indian rupee = 1.84×1.34 Sri Lankan rupees = 2.46 Sri Lankan rupees, and 50 Indian rupees = $50 \times 2.46 = 123.00$ Sri Lankan rupees

c *Japanese imports:*

You found above (question 2 (a)) that the price of 1 unit of X =

92.00 Japanese yen

Therefore the cost of 1000 units of X = $1000 \times 92 = 92\,000$ Japanese yen

Sri Lankan imports:

You found above (question 2 (b)) that the price of 1 unit of X = 123.00 Sri Lankan rupees

Therefore the cost of 1000 units of X = $1000 \times 123.00 = 123\,000$ Sri Lankan rupees

3 a You were given above (question 1(a)) that 1 Canadian dollar = 0.99 US dollar

Therefore 75 Canadian dollars = $75 \times 0.99 = 74.25$ US dollars

b You found above (question 1(d)) that 1 Canadian dollar = 0.62 British pound

Therefore 75 Canadian dollars = $75 \times 0.62 = 46.50$ British pounds

c *US dollars*:

From question 3(a) above, you know that the price of 1 unit of Y = 74.25 US dollars.

Therefore the cost of 5000 units of Y = $5000 \times 74.25 = 371\,250$ US dollars.

British pounds:

From question 3(b), you know that the price of 1 unit of Y = 46.50 British pounds.

Therefore the cost of 5000 units of Y = $5000 \times 46.50 = 232\,500$ British pounds.

4 a The British pound appreciated; the US dollar depreciated.

b $\frac{1.60 - 1.46}{1.46} \times 100 = 9.59\%$. The British pound appreciated by 9.59% relative to the US dollar.

c First find the value of the US dollar relative to the British pound:

1 June 2010: 1 US dollar = $\frac{1}{1.46}$ = 0.68 British pound

1 November 2010: 1 US dollar = $\frac{1}{1.60}$ = 0.62 British pound

$\frac{0.62 - 0.68}{0.68} \times 100 = -8.82\%$. The US dollar depreciated by 8.82% (–8.82%) relative to the British pound.

5 Use the same method as in question 4.

The US dollar appreciated by 6.33% relative to the euro; the euro depreciated by 6.41% (–6.41%) relative to the dollar.

Test your understanding 16.8

1 The answers appear in bold.

Current account	
Exports of goods	+310
Imports of goods	−525
Balance of trade in goods	**−215**
Exports of services	+52
Imports of services	−71
Balance of trade in services	**−19**
Income	+25
Current transfers	+73
Balance on current account	**−136**
Capital account	
Capital transfers	−3
Transactions in non-produced, non-financial assets	+7
Balance on capital account	**+4**
Financial account	
Direct investment	+107
Portfolio investment	+29
Reserve assets	−7
Official borrowing	**−129**
Balance on financial account	**+3**
Balance	**0**