

There are 100 points on this exam. You have 55 minutes.

Answers

1. Comment: "A seller has an incentive to make its product fall apart quickly so that people have to replace it, raising demand for the product and increasing profit." [5 points]

False. The more quickly a product falls apart, the lower the price that people are willing to pay for it.

2. Comment: "A firm in a perfectly competitive industry chooses a quantity to produce so that marginal cost equals the price." [3 points]

True. $MR = P$ for a price-taking seller.

3. What is a Pareto improvement? Explain why a change in the economy can be economically efficient even if it is not a Pareto improvement. [4 points]

A change is a Pareto improvement if at least one person gains and no one loses. A change is economically efficient if the winners *could* compensate the losers by enough to make the change a Pareto improvement. If you gain \$10 from a change and I lose \$4, and no one else is affected, then the change is economically efficient, but not a Pareto improvement because I lose.

4. Suppose that the interest rate is 10 percent per year. [6 points total]

(a) What is the discounted present value of \$600 paid one year from now?

$\$600/1.10$

(b) What is the discounted present value of \$600 paid two years from now?

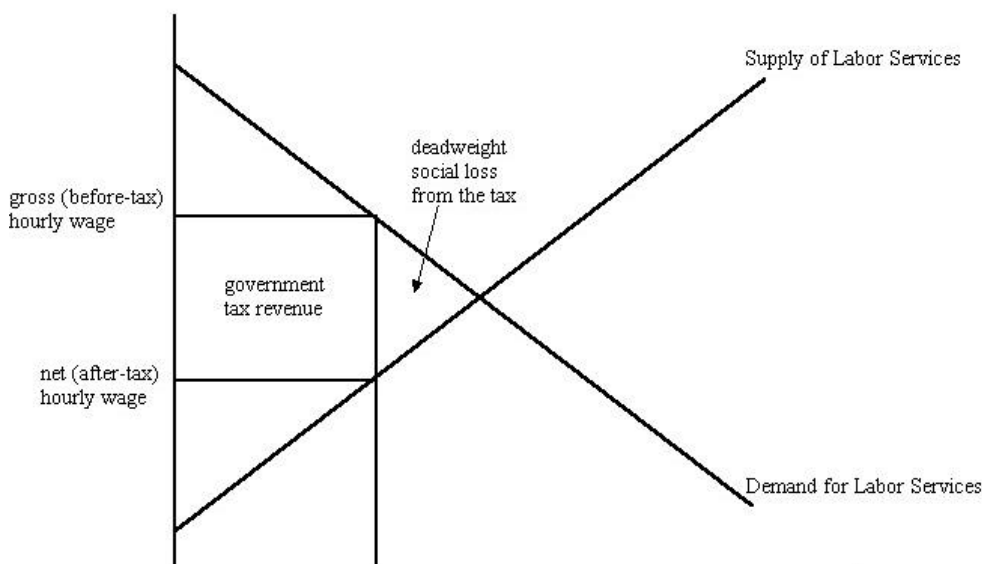
$\$600/1.10^2 = \$600/1.21$

(c) What is the discounted present value of \$600 paid every year forever?

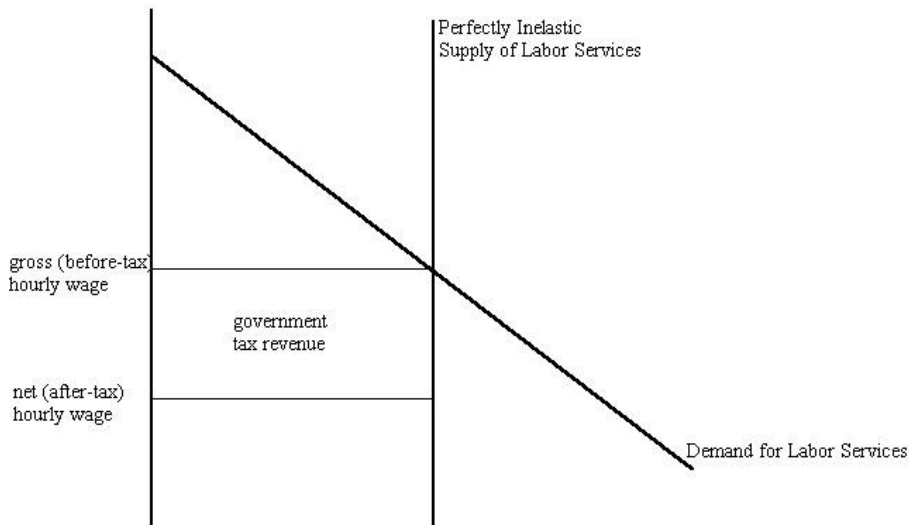
$\$600/.10 = \6000 .

5. [12 points] Draw a graph of labor demand and labor supply to show the effects of an income tax on: (a) the gross (before-tax) hourly wage; (b) the net (after-tax) hourly wage; (c) the equilibrium quantity of labor services (total hours worked per year). Also show on your graph: (d) the revenue the government collects from the tax, and (e) the deadweight social loss from the tax. (f) How would your answers to parts (a)-(e) change if the supply of labor were perfectly inelastic?

The usual tax graph will answer parts (a)-(e):



If the supply of labor were perfectly inelastic, then the tax would leave the gross wage unchanged, and reduce the net (after-tax) wage by the full amount of the tax; it would leave the equilibrium quantity of labor services unaffected and cause NO deadweight social loss:



6. [24 points] Draw a graph to show consumer and producer surplus (a) without international trade, and (b) with international trade. (c) How large are the gains or losses from international trade to consumers in the exporting country? Producers in the exporting country? Consumers in the importing country? Producers in the importing country? (d) What would be the deadweight social loss from a law prohibiting international trade?

(a) - (c) See page 221. (d) In the diagram on page 221, the deadweight social loss from a law prohibiting international trade would be the areas of C and G.

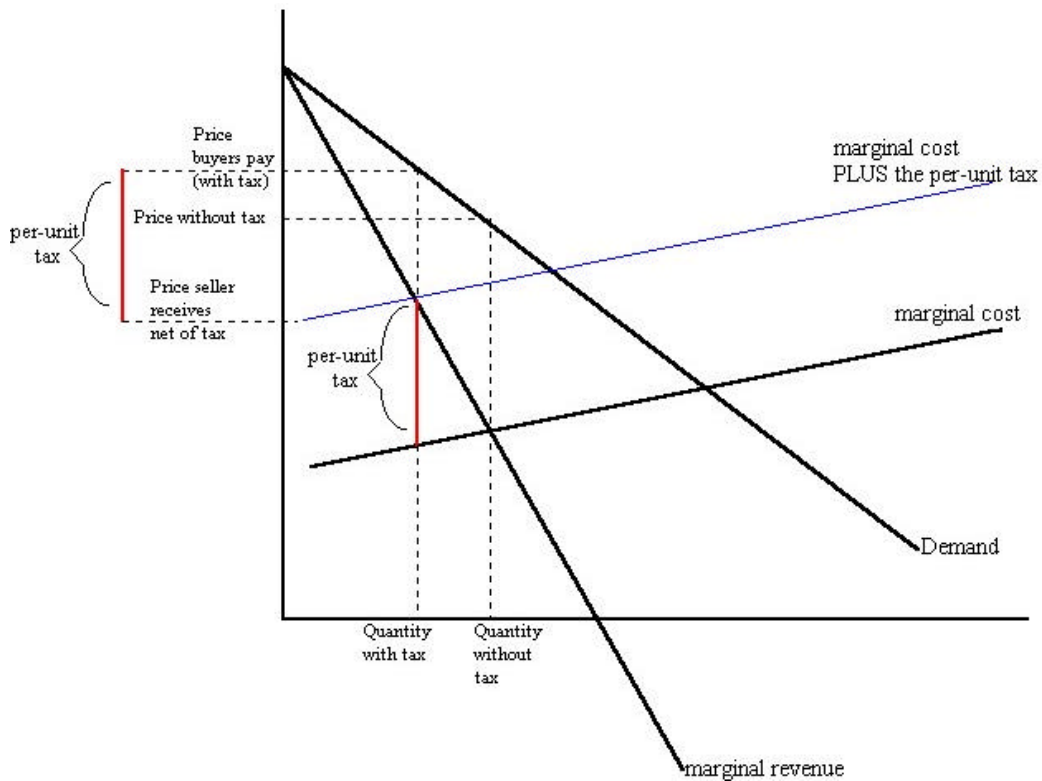
7. [10 points] (a) What is monopolistic competition? (b) Draw a graph to show long-run equilibrium in an industry with monopolistic competition.

(a) Monopolistic competition means that each seller sells a differentiated product; many sellers compete with each other, so that when one seller changes its price, each other seller loses only a small fraction of its sales; and the industry has free entry.

(b) See Figure 2b on page 354.

8. [10 points] Draw a graph to show the effects of a tax on production by a monopoly seller. (Be careful and think about how to do this.)

Suppose the monopoly seller has to send the tax money to the government. Then we can treat the tax as part of the seller's cost of production, so MC rises vertically by the per-unit tax. As a result, the price that buyers pay rises, the price that sellers receive falls, and the equilibrium quantity falls, as in the following graph.



(Alternatively, we could instead consider the case in which buyers have to send the tax money to the government, in which case the demand curve falls vertically downward by \$1. In that case, the MR curve would also fall vertically downward by \$1, but the MC curve would not change. So the answer for the equilibrium quantity would be the same as in the figure above.)

Still another way to graph this problem would be to draw a \$1 vertical line segment as a wedge between the MR curve and the MC curve, as in the graph, without drawing the shift in the MC curve or the MR curve.

9. [26 points total] A monopoly seller can offer student discounts on its product. Its marginal cost of production equals **\$4 per unit** at all quantities (its total cost is \$4 times its output). The following table shows demand for the product by students and by non-students.

Price	Quantity Demanded by Students	TR - students	MR - students	Quantity Demanded by Non-Students	TR - others	MR - others	TOTAL D with no discrim.	TR - no discrim.	MR - no discrim.
\$13	0	0		0	0		0	0	
\$12	2	24	12 each	3	36	12 each	5	60	12 each
\$11	4	44	10 each	4	44	8	8	88	28/3 each
\$10	6	60	8 each	5	50	6	11	110	22/3 each
\$9	8	72	16 each	6	54	4	14	126	16/3 each
\$8	10	80	4 each	7	56	2	17	136	10/3 each
\$7	12	84	2 each	8	56	0	20	140	4/3 each
\$6	14	84	0	9	54	-2	23	138	-2/3 each
\$5	16	80	-2 each	10	50	-4	26	130	-8/3 each
\$4	18	72	-4 each	11	44	-6	29	116	-14/3 each
\$3	20	60	-6 each	12	36	-8	32	96	-20/3 each

(a) What prices does the monopoly charge students and non-students to maximize its profits? How many units does it sell to each group? [8 points]

It sells 10 units to students at \$8 each, and 6 units to non-students at \$9 each.

To see why, fill in the table as above -- to find MR (marginal revenue) when the monopoly sells to students, and MR when it sells to others (non-students). Notice that in the case of students, the quantity demanded rises by 2 units every time the price falls by \$1. The monopoly chooses a quantity to sell to students so that $MR=MC$. Since $MC = \$4$, the monopoly sells 10 units to students, charging a price of \$8. (The marginal revenue from the 9th and 10th units is \$4 each, raising total revenue from \$72 if it sold 8 units to \$80 if it sells 10 units.)

Go through the same reasoning for sales to non-students: the monopoly chooses a quantity to sell to non-students so that $MR=MC$. Since $MC = \$4$, the monopoly sells 6 units to non-students, charging a price of \$9. (In other words, the monopolist sets a price of \$9 and gives a \$1 student discount.)

(b) How large is the monopoly's profit be? How large is total consumer surplus (for all buyers)? [4 points]

Profit is \$70 and consumer surplus is \$32.

To see why, note that the monopoly earns TR (total revenue) of \$80 from selling 10 units to students, and its total cost of producing those 10 units is $(10)(\$4) = \40 . In addition, the monopoly earns TR (total revenue) of \$54 from selling 6 units to non-students, and its total cost of producing those 6 units is $(6)(\$4) = \24 . So its total revenue is $\$80+\$54 = \$134$ and its total cost is $\$40+\$24 = \$64$, so its total profit is $\$134-\$64 = \$70$.

Consumer surplus to students is $(\$12 - \$8)(2) + (\$11 - \$8)(2) + (\$10-\$8)(2) + (\$9-\$8)(2) = \$20$.

Consumer surplus to non-students is $(\$12 - \$9)(3) + (\$11 - \$9)(1) + (\$10-\$9)(1) = \$12$. So total consumer surplus is \$32.

(c) If the monopoly had to charge the same price to all buyers (so it could not give student discounts), what price would it charge, how much would it sell? How large would its profit be? How large would consumer surplus be? [8 points]

It would sell 14 units at \$9 each. Its profit would be \$70 and consumer surplus would be \$24.

To see why, fill in the last 3 columns of the table as above -- to find MR (marginal revenue) when the monopoly sells at the same price to all buyers. There is NO quantity at which $MR = MC$, but the monopoly gains from selling all units for which MR exceeds MC, and loses from selling units for which MR is less than MC. Since $MC = \$4$, the monopoly sells 14 units, charging a price of \$9. Its TR is \$126 and its total cost is $(\$4)(14) = \56 , so its profit is $\$126-\$56 = \$70$. Consumer surplus is $(\$12 - \$9)(5) + (\$11 - \$9)(3) + (\$10-\$9)(3) = \$24$.

(d) What is the economically efficient level of production of this product? [2 points] **The economically efficient level of production occurs at the quantity at which $MC = \text{price}$, which is 29 units.**

(e) What is the deadweight social loss from this monopoly if it gives student discounts? What is the deadweight social loss without student discounts? [4 points]

\$22 and \$30.

To see why, note that the firm would sell the economically efficient level of output if it charged all buyers \$4 per unit. In that case, people would buy 29 units. The firm would earn TR of \$116 and have TC (total cost) of \$116, so its profit would be zero. Total consumer surplus would be $(\$12 - \$4)(5) + (\$11 - \$4)(3) + (\$10-\$4)(3) + (\$9-\$4)(3) + (\$8-\$4)(3) + (\$7-\$4)(3) + (\$6-\$4)(3) + (\$5-\$4)(3) = (\$8)(5) + (\$7)(3) + (\$6)(3) + (\$5)(3) + (\$4)(3) + (\$3)(3) + (\$2)(3) + (\$1)(3) = \$124$. Therefore the total gain from trade would be \$124 with the economically efficient level of production.

With student discounts, part (b) above showed that total consumer surplus (to all buyers) is \$32 and total profit is \$70. Therefore the total gain from trade from the monopoly is $\$32 + \$70 = \$102$ in that case. Therefore the deadweight social loss from the monopoly, with student discounts, is $\$124-\$102 = \$22$.

Without student discounts, part (c) above showed that consumer surplus is \$24 and profit is \$70. Therefore the total gain from trade from the monopoly is $\$24 + \$70 = \$94$ in that case. Therefore the deadweight social loss from the monopoly, without student discounts, is $\$124-\$94 = \$30$.