Department of Economics
University of Toronto

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SOLUTIONS

ECO 100Y
INTRODUCTION TO ECONOMICS
Midterm Test # 3

LAST NAME _____

FIRST NAME _____

STUDENT NUMBER _____

INSTRUCTIONS:

1. The total time for this test is 1 hour and 50 minutes.
2. Aids allowed: a simple calculator.
3. Write with pen instead of pencil.

DO NOT WRITE IN THIS SPACE

Part I 1. _____/10

2. _____/10

3. _____/15

4. _____/15

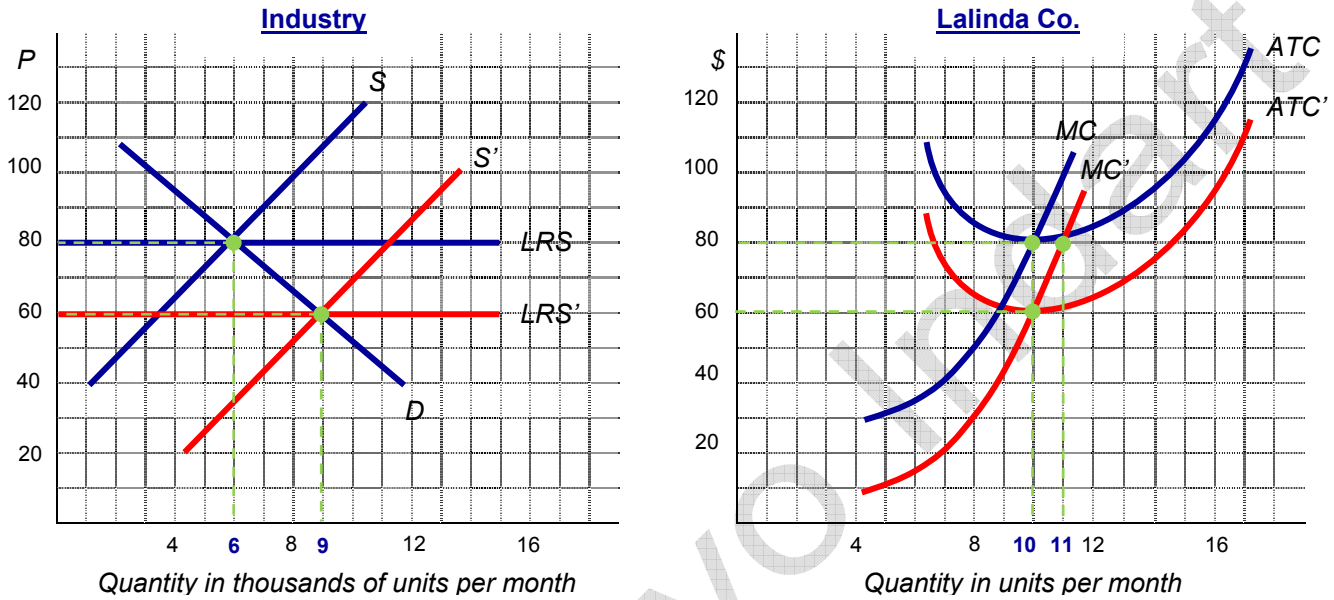
Part II _____/30

TOTAL _____/80

PART I (50 marks)

Instructions: Answer all four questions in the space provided.

1. **(10 marks)** Consider a perfectly competitive, constant cost industry with "n" identical firms. The diagrams below depict the market demand and short-run supply curves for this industry and the *ATC* and *MC* curves of a representative firm — Lalinda Company. This industry is initially in long-run equilibrium.



a) Show in the diagram above the industry's equilibrium price and output and Lalinda's equilibrium output. Draw the industry's long-run supply curve (*LRS*). **(1 mark)** What's the number of firms in this perfectly competitive industry? Briefly explain. **(1 mark)**

Since market equilibrium is at P = \$80 and Q = 6,000 units and at P = \$80 a firm's output is 10 units (i.e., q = 10 at $P = MC$), then the number of firms in the industry is Q/q = 6,000/10 = 600.

Since the industry is in long-run equilibrium, then each firm is making zero economic profits and producing at the minimum of the *LRAC* curve. (Note that the *LRAC* is not shown in the diagram above.) Since this is a constant cost industry, then the *LRS* is horizontal at the level of the minimum *LRAC*, i.e., at P = \$80.

b) Lalinda Co. invents a new process that reduces the cost of production by \$20 per unit at all levels of output. Lalinda patents this new process, thus preventing other firms from using the new technology. In the short run, which of the curves in your diagram above will be affected by this reduction in Lalinda's costs of production? Briefly explain. **(1 mark)** Draw the new curves in the above diagram. **(1 mark)**

Since Lalinda reduces the cost of production at all levels of output, then Lalinda's *MC* and *ATC* curves shift down by \$20 at all levels of output. This is shown in the diagram above.

Since this is a perfectly competitive industry, the changes in Lalinda's cost schedule and the corresponding change in Lalinda's supply curve have a negligible impact in the industry as a whole — and thus the industry *S* and *LRS* curves are not affected in the short run.

c) What happens in the short run? What is the industry short-run equilibrium price? **(1 mark)** What is the level of Lalinda's output in the new short-run equilibrium? **(1 mark)** What happens to Lalinda's profits in this new equilibrium? Briefly explain. **(1 mark)**

As indicated above, since this is a perfectly competitive firm (and thus there is a large number of firms in the industry), no firm can affect by itself the market equilibrium price. Therefore, price remains at $80.

Since Lalinda's *MC* curve shifts down and the *MC* curve above the minimum of the *AVC* represents the firm's supply curve, Lalinda's supply increases and at P = $80 Lalinda now produces 11 units of output (i.e., q = 11 at $P = MC'$).

Since *P* remained constant but Lalinda's *ATC* decreased, then Lalinda is now making positive economic profits (i.e., at q = 11, $P > ATC'$). This can be seen in the diagram above.

d) What happens in the long run when the patent expires and other firms are free to use the new technology? Briefly explain. Draw the new *LRS* curve (*LRS'*). **(1 mark)** What are the industry price and output in the new long-run equilibrium? **(1 mark)** What are Lalinda's output and profits in this new long-run equilibrium? **(1 mark)**

In the long run, new firms will be attracted into this industry and all will adopt the new technology. Therefore, the short-run supply curve will continuously shift to the right and the market price will continuously decrease until all firms cease to make economic profits, i.e., until market price drops to $60. At this point, a new long run equilibrium is achieved — all firms are making zero economic profits and producing at the minimum of the (new) *LRAC*.

Since this is a constant cost industry, then the *LRS* is horizontal at the level of the minimum *LRAC*, i.e., at P = $60. This is shown in the diagram above.

The industry equilibrium output is determined by demand and supply, and $LRS = D$ at P = $60 and 9,000 units of output per month. This is shown in the diagram above.

At P = $60, Lalinda's output is 10 units per month (i.e., q = 10 at $P = MC'$). This is shown in the diagram above.

2. **(10 marks)** Consider a perfectly competitive, constant cost industry with "n" identical firms. The industry demand and supply curves are defined by the following expressions:

$$P = 70 - 0.04Q$$
$$P = 10 + 0.02Q.$$

Further suppose that the marginal cost equation for each firm is $MC = 10 + 2q$.

a) What are the competitive equilibrium price and quantity in this market? **(2 marks)**

Equilibrium is determined by demand and supply, i.e., at the point where D = S:

70 – 0.04Q = 10 + 0.02Q

0.06Q = 60

Q* = 60 / 0.06 = 1,000

And by plugging this value for Q into the equation for the D or S curves we obtain:

P* = 70 – 0.04 (1,000) = 30

b) What is the output of the individual firm in this market? **(2 marks)**

A profit-maximizing firm will produce the level of output at which P = MC:

30 = 10 + 2q → 2q = 20 → q* = 20/2 = 10

c) Suppose now that the competitive firms wish to establish a cartel. What output maximizes the profit of the cartel? **(2 marks)** What price will the cartel charge? **(1 mark)**

Firms will behave now as a monopoly and will maximize the profits of the cartel by producing the level of output at which MR = MC for the cartel.

The MR of a competitive firm is equal to P, but the MR of a monopoly is not. Given that the demand curve is given by the expression P = 70 – 0.04Q, the MR for the cartel is given by the expression MR = 70 – 0.08Q and the MC for the cartel is given by the expression for the market supply curve. Therefore, the profit-maximizing level of output of the cartel is:

MR = MC → 70 – 0.08Q = 10 + 0.02Q → 0.1Q = 60 → Q* = 60/0.1 = 600

And thus P* = 70 – 0.04 (600) = 46.

d) What output must each firm produce to establish the maximum cartel profit? **(1 mark)**

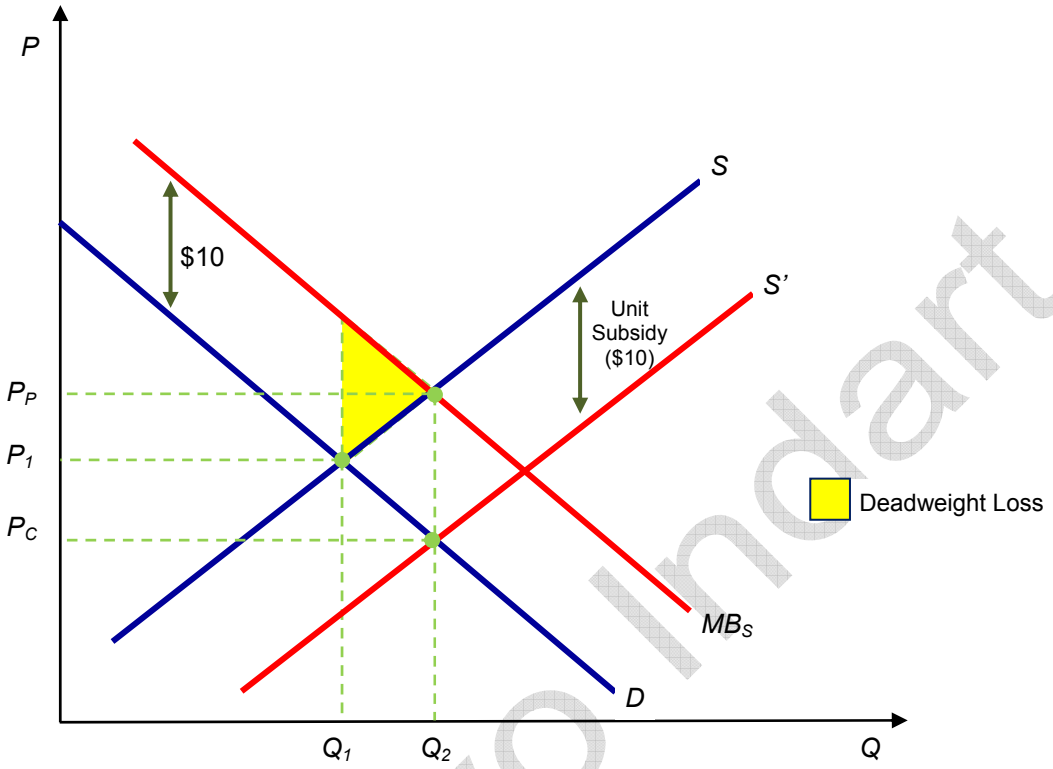
Cartel profits are maximized when Q = 600, i.e., when total output is decrease from the competitive equilibrium of 1,000 units to 600 units. That is, the cartel's profit-maximizing output is 60% of that of the competitive equilibrium. Therefore, each firm will have to produce an output equal to 60% of its perfectly competitive equilibrium output, i.e., 60% of 10 units or 6 units of output.

e) Given the cartel's price, what output would a firm produce if it tried to maximize its own profits with no concern for its effect on the cartel (i.e., if it could cheat on the agreement without being caught)? **(2 marks)**

If a firm could produce any output without any concern for its effect on the cartel — i.e., if it could cheat without being caught — it would produce the level of output at which $P = MC$. Given $P = 46$, the firm will produce:

$46 = 10 = 2q \rightarrow 2q = 36 \rightarrow q = 18$.

3. **(15 marks)** The diagram below depicts the demand and supply curves of the perfectly competitive market for fire extinguishers.



a) Indicate in the diagram above the equilibrium price (P_1) and equilibrium output (Q_1) in this market. **(1 mark)**

b) Why might fire extinguishers exhibit positive externalities in consumption? Briefly explain. **(2 mark)**

Fire extinguishers not only contribute to reduce the cost a fire could cause to the buyer (and user) of the fire extinguisher but also to reduce the possible cost the fire could inflict on others if it were to spread.

c) Suppose that the external benefit per extinguisher is $10. Draw in the diagram above the corresponding curve depicting society's marginal benefit (MB_S). **(1 mark)** Indicate in your diagram the efficient level of output (Q_2)? **(1 mark)**

d) Briefly explain why the efficient level of output (Q_2) differs from the market equilibrium output (Q_1). **(2 marks)**

At the level of output determined by the market (Q_1), $MB_S > MC$. Therefore, from society's point of view it would pay to increase output up to the point where $MB_S = MC$, i.e., up to Q_2. Therefore, the market equilibrium is not optimal from society's point of view; in the face of positive externalities in consumption, market output is always lower than the social optimum.

At Q_2, the last fire extinguisher sold in the market increases the benefit to society (MB_S) by the same amount it increases the cost to society (MC).

e) Show in your diagram the area corresponding to the deadweight loss of the market equilibrium. **(2 marks)** What does it represents in terms of efficiency? Briefly explain. **(2 marks)**

As indicated above, if there are positive externalities the market output is lower than the social optimum because the net benefit to society — i.e., the difference between total benefit and total cost — is not maximized. Put it differently, in this case the total surplus to society is not maximized. The loss in total surplus to society by not producing the social optimum indicates the level of allocative inefficiency of the market output — and this is what we call the deadweight loss.

f) Describe a government policy that would result in the efficient level of output (Q_2). **(2 marks)** Who benefits from this government policy and how? Briefly explain. **(2 marks)**

In order to sell in the market an output Q_2, the government should give a subsidy equal to the external benefit of $10 to either consumers or producers of fire extinguishers. In the diagram above we assume that the subsidy is given to producers. Therefore, as a result of the subsidy the minimum price producers are willing to accept for each additional unit is reduced by $10, i.e., the supply curve shifts down to S'.

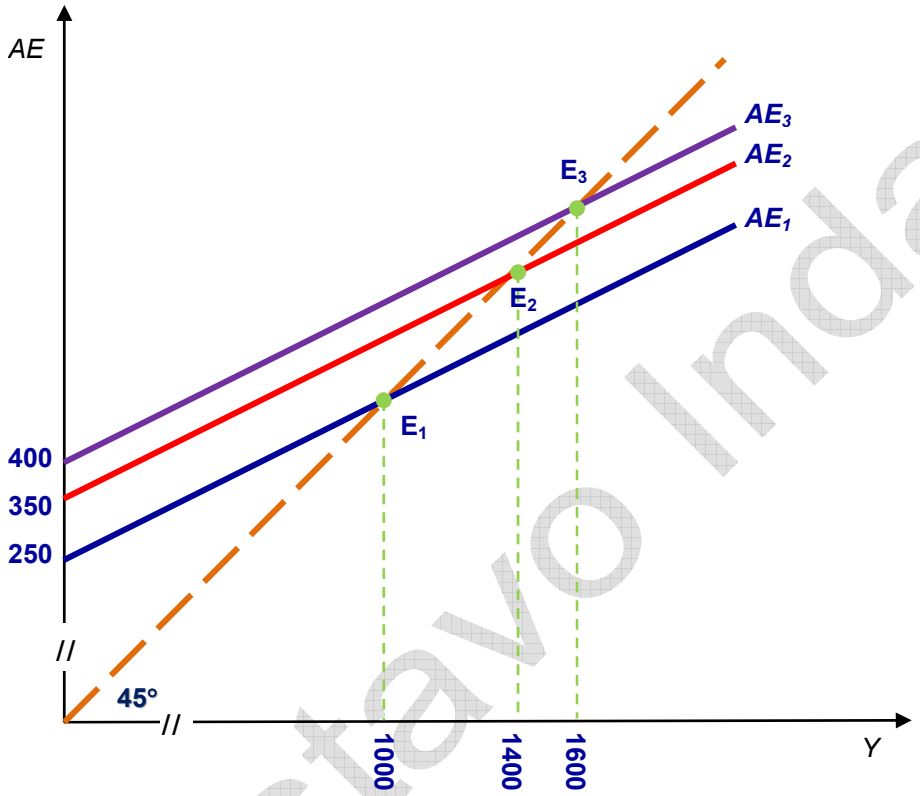
Both consumers and producers benefit as a result of the subsidy. Consumers are paying now a lower price (P_C) than before, and producers (P_P) are receiving a higher price than before. Therefore, both the consumer surplus and the producer surplus have been increased as a result of the subsidy.

4. **(15 marks)** Consider an economy characterized by the following equations:

$$C = 50 + 0.75Y + 0.05W$$

$$I = 150$$

where C is desired consumption, I is desired investment, W is household wealth, and Y is national income.



a) If W = 1 000, what is the expression for the corresponding aggregate expenditure (AE) curve? **(1 mark)** What is the equilibrium level of income? Show <u>all</u> your work. **(2 marks)** Draw the AE curve (AE_1) in the diagram above and show the equilibrium level of income. **(1 mark)**

If W = 1 000, then $C = 50 + 0.75Y + 0.05\ (1\ 000) = 100 + 0.75\ Y$ and thus the expression for the AE curve is:

$AE = C + I = 100 + 0.75Y + 150 =$ **$250 + 0.75Y$**.

In equilibrium, $Y = AE$ and thus:

$Y = 250 + 0.75Y \rightarrow 0.25Y = 250 \rightarrow Y = 250 / 0.25 =$ **1 000**

b) Define the marginal propensity to spend. **(1 mark)** What is the value of the marginal propensity to spend in this economy? **(1 mark)** What is the value of the multiplier? **(1 mark)**

The marginal propensity to spend is the fraction of any additional dollar of income that economic agents spend on the purchase of goods and services produced in the economy. In other words, the marginal propensity to spend is $\Delta AE / \Delta Y$ and thus it is equal to the slope of the *AE* curve. In this economy, therefore, the marginal propensity to spend is 0.75.

The multiplier is equal to:

$$\beta_{AE} = \frac{1}{1 - \text{slope of } AE \text{ curve}} = \frac{1}{1 - 0.75} = \frac{1}{0.25} = 4$$

c) Using your answer from part b), what would be the change in equilibrium income if desired investment increased from 150 to 250? **(1 mark)** What is the expression for the new *AE* curve? **(1 mark)** Draw the new *AE* curve (AE_2) in the diagram above and show the new equilibrium level of income. **(1 mark)**

Since $\Delta Y = \beta_{AE} \Delta AE$ and $\Delta AE = \Delta I = 100$, then $\Delta Y = \beta_{AE} \Delta AE = 4\ (100) =$ **400**

And the expression for the new *AE* curve is:

$AE = C + I = 100 + 0.75Y + 250 =$ **$350 + 0.75Y$**.

d) Now suppose that, in addition to the increase in desired investment of part c), household wealth increases from 1000 to 2000. What happens to the *AE* curve? Briefly explain. **(2 mark)** What is the expression for the new *AE* curve? **(1 mark)** By how much does national income change? **(1 mark)** Draw the new *AE* curve (AE_3) in the diagram above and show the new equilibrium level of income. **(1 mark)**

Since the *C* curve will shift up by $0.05\Delta W = 0.05\ (1\ 000) = 50$, the *AE* curve will also shift up by 50.

Since $C = 50 + 0.75Y + 0.05\ (2\ 000) = 150 + 0.75Y$, the expression for the new *AE* curve is:

$AE = C + I = 150 + 0.75Y + 250 = 400 + 0.75Y$.

Given that $\beta_{AE} = 4$ and $\Delta AE = 50$, $\Delta Y = \beta_{AE} \Delta AE = 4\ (50) =$ **200**.

PART II (30 marks)

Instructions:

- Multiple choice questions are to be answered using a black pencil or a black or blue ball-point pen on the separate SCANTRON sheet being supplied.
- Be sure to fill in your name and student number on the SCANTRON sheet!
- Write the version of your paper — either **A** or **B** — on the SCANTRON sheet where it says "DO NOT WRITE IN THIS SPACE."
- Each question is worth 2 marks. No deductions will be made for incorrect answers.
- Write your answers to the multiple choice questions ALSO in the table below. You may use this question booklet for rough work, and then transfer your answers to each multiple choice question to the table AND onto the separate SCANTRON sheet. Your answers must be on the SCANTRON sheet. In case of a disagreement, the answer to be marked is the one on the SCANTRON sheet.

1	2	3	4	5	6	7	8
A	B	D	B	C	D	C	A
9	10	11	12	13	14	15	16
A	B	D	C	D	D	D	E

1. A perfectly competitive industry is in long-run equilibrium. Under these conditions, which one of the following statements is correct?
   a) Marginal revenue, marginal cost, average revenue and average cost are equal.
   b) Marginal revenue equal marginal cost but not average revenue and average cost.
   c) Marginal revenue equals average revenue but not marginal cost and average total cost.
   d) Marginal revenue equals average total cost but not marginal cost and average revenue.
   e) None of the preceding statements is correct.

2. Suppose a typical competitive firm has the following data in the short-run equilibrium: price = \$10; output = 100 units; *TC* = \$1200; *TVC* = \$700. Which of the following statements is correct?
   a) In the long run the industry will expand because of economic profits.
   b) In the long run the industry will contract because firms are suffering losses.
   c) The size of the industry will remain the same in the long run.
   d) Price will fall in the long run.
   e) There is not enough information to formulate an answer about the long run.

3. A publisher has a monopoly in the production economic textbooks. The publisher has agreed to pay the author of a new textbook 10 percent of the total revenues from the sale of the book. Given the above, which one of the following statements is correct?
   a) Both the publisher and the author would agree to produce the quantity of textbooks at which $P = MC$.
   b) Both the publisher and the author would agree to produce the quantity of textbooks at which $MR = MC$.
   c) The publisher would like to produce the quantity of textbooks at which $MR = MC$ but the author would like to produce the quantity of textbooks at which $P = MC$.
   d) The publisher would like to produce the quantity of textbooks at which $MR = MC$ but the author would like to produce the quantity of textbooks at which $MR = 0$.
   e) None of the above is correct.

4. A perfectly competitive industry is in long-run equilibrium with an *increasing* cost industry supply curve. The government then provides a permanent subsidy to every firm of $10 per unit of output. As a result, which one of the following statements is correct in the long run?
   a) Consumer price will decrease by $10 and industry output will rise.
   b) Consumer price will decrease by less $10, and industry output will rise.
   c) Industry output will decrease and consumer price will be unchanged.
   d) Industry output will increase and consumer price will increase.
   e) None of the preceding statements is correct.

5. Which of the following statements about single-price monopolists is NOT true?
   a) The average revenue curve coincides with the demand curve.
   b) *MC* = *MR* if the firm is at the profit-maximizing point.
   c) Price equals marginal cost at the profit-maximizing level of output.
   d) Price elasticity of demand will be greater than one if the firm is profit-maximizing.
   e) *AR* is greater than *MR*.

6. A single-price monopolist is currently producing an output level where *P* = $20, *MR* = $13, *ATC* = $15, and *MC* = $14. In order to maximize profits, this monopolist should
   a) shut down.
   b) not change his output level, because he is currently at the profit-maximizing output level.
   c) increase production and reduce price.
   d) decrease production and increase price.
   e) there is insufficient information to make a recommendation.

7. If an unregulated, single-price monopolist's marginal revenue is *MR* = 12 – 2*Q* and its marginal cost is *MC* = 3, then the monopolist will maximize profits when charging a price of
   a) $12.
   b) $8.
   c) $7.5.
   d) $6.
   e) None of the above is correct.

8. Suppose a monopolist can sell 10 units of output at a price of $5 each and 11 units of output for $4.80 each. The marginal revenue for the 11^{th} unit sold is
   a) $2.80.
   b) -$0.20.
   c) $4.80.
   d) $0.20.
   e) None of the above is correct.

9. One reason movie theatres charge a lower admission price to senior citizens is that
   a) senior citizens have a more elastic demand than other movie-goers.
   b) the government sets the price policies.
   c) movie-theatre owners don't maximize their profits.
   d) senior citizens have higher incomes than other people.
   e) None of the above is correct.

10. For an entire economy, allocative efficiency requires that
   a) price equals average cost for all goods.
   b) *MC* = *P* for all goods.
   c) goods are allocated equitably across markets.
   d) *MP* is equated for all factors of production.
   e) None of the above is correct.

11. Which one of the following statement is true for a production process that involves a positive externality?
    a) A per unit tax could be imposed on the producer to achieve the socially optimum level of production.
    b) Marginal social cost is more than marginal private cost.
    c) Marginal social benefit is less than marginal private benefit.
    d) A subsidy to producers could increase production to the socially optimum level.
    e) Without government intervention the market will produce too much of this good.

12. Which one of the following is NOT considered an investment item when calculating *GDP*?
    a) Construction of a new school.
    b) Purchase of a new canning machine by Campbell Soup Co.
    c) Purchase of shares of Bell Canada stock.
    d) Increase in unsold goods in Walmart's warehouse.
    e) Both c) and d) are not included in the calculation of *GDP*.

13. A rancher produces animal skins, which she sells to the tanner for $400. The tanner then transforms these animal skins into leather, which he sells to the shoemaker for $700. The shoemaker then makes shoes with this leather, which she sells to consumers for $1,200. The contribution of all these transactions to *GDP* is
    a) $2,500.
    b) $1,000.
    c) $2,300.
    d) $1,200.
    e) none of the above.

14. The change in the country's capital stock during a year is equal to
    a) gross investment.
    b) gross fixed investment.
    c) capital consumption allowance.
    d) net investment.
    e) net change in inventories plus capital consumption allowance.

15. Consider a very simple model of the economy without a government sector ($G = 0$) and without an external sector ($NX = 0$). If $C = 100 + 0.8Y$ and $I = 200$, the multiplier will be _____ and the equilibrium level of income will be _____.
    a) 4; 500.
    b) 4; 1500.
    c) 5; 1000.
    d) 5; 1500.
    e) None of the above is correct.

<u>Bonus question</u> (an additional 2 marks):

16. Price discrimination by a monopolist tends to
    a) reduce the deadweight loss.
    b) increase economic efficiency.
    c) lead to output closer to that of the competitive firm.
    d) reduce the gap between marginal revenue and price.
    e) all of the above.