- This exam contains 11 pages (including this cover page) and 16 questions. Check to see if any pages are missing.

- The exam is scheduled for 2 hours.

- The total score is 40 points.

- This is a closed-book, closed-note, no calculator exam.

- Answer each multiple-choice question by filling in the bubble for the answer you select. Make sure that the bubble is clearly filled in, or it will be marked incorrect.

- Write your answers to the short answer questions in the spaces provided for them. Do not write your answers outside of the boxes.

- Do not remove any pages or add any pages. No additional paper is supplied

- Show your work when asked. Label all graphs carefully.

- This exam is given under the rules of Penn's Honor system.

My signature certifies that I have complied with the University of Pennsylvania's Code of Academic Integrity in completing this examination.

Please sign here _____ Date _____

Multiple Choice Questions (best 12 out of 13: 18 points)

1. (1.5 points) Jim must decide how often to go to the gym every month. He has purchased a yearly membership that costs him $30 per month. The gym does not offer refunds. When he works out, Jim also spends $100 on protein shakes. Every month, Jim also goes to a reading club that collects a fee of $10 at the start of each session. What are Jim's sunk costs at the beginning of each month?

   ○ $10
   √ $30
   ○ $40
   ○ $130

2. (1.5 points) Suppose Javiera consumes only coffee and donuts.

   I. If coffee and donuts are complements for Javiera, then they must be normal goods.

   II. If Javiera consumes less coffee when it is more expensive, then it must be a normal good for Javiera.

   √ **Only I.**
   ○ Only II.
   ○ Both I. and II.
   ○ Neither I. nor II.

3. (1.5 points) Jack is in the holiday spirit and is planning to do some decorating. He heads to the store where he intends to purchase 8 wreaths and 40 feet of tinsel. But when he gets to the store, he finds that the price of tinsel has increased from $2 to $4 per foot! Considering the new prices he decides to purchase 6 wreaths and 30 feet of tinsel. Which of the following <u>can</u> be true for Jack?

   I. Tinsel is a luxury good

   II. Wreaths are a substitute for tinsel

   III. Jack's demand for tinsel is elastic between these two prices

   √ **I.**
   ○ II.
   ○ III.
   ○ I. and II.
   ○ I. and III.
   ○ II. and III.
   ○ I., II., and III.
   ○ None must be true

4. (1.5 points) Javi's food truck is operating in a monopolistically competitive market, facing the demand and average total cost curves described in the graph below.
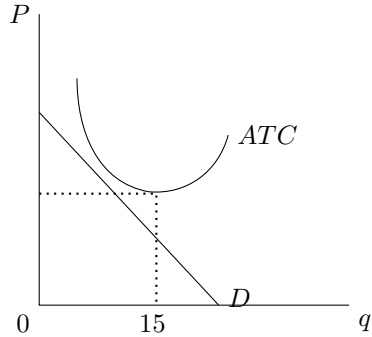
Which of the following statements is true **in the long run**, assuming Javi stays in the market?

- ○ Javi's ATC curve will shift in.
- ○ Javi's demand curve will become flatter.
- ○ Javi will be producing 15 units.
- ○ All of the above.
- ✓ **None of the above.**

5. (1.5 points) Suppose a perfectly competitive firm is producing at its profit-maximizing quantity and the following is true at its production point: P = 10, ATC = 15, AVC = 5. Which of the following is true?

I. The firm will shut down in the short run because it is suffering losses.

II. This firm may be making economic profits.

- ○ Only I
- ○ Only II
- ○ Both I and II
- ✓ **Neither I nor II**

6. (1.5 points) Suppose the inverse demand and supply for Christmas ornaments are given by $P = 120 - 2Q_D$ and $P = 10Q_S$, respectively. The government imposes a price floor of $110 per unit. Which of the following is true?

I. After the price floor is imposed, producers want to sell 5 units more than what is demanded

II. There's a DWL of 150

III. A price ceiling of $90 would lead to the same quantity outcome as the price floor

- ○ Only I.
- ✓ **Only II.**
- ○ Only III.
- ○ Only I. and II.
- ○ Only II. and III.
- ○ I., II. and III.

7. (1.5 points) The citizens of Philadelphia love to eat cheesesteaks. Market demand for cheesesteaks is $P = 200 - Q_D$, and market supply is $P = Q_S$. When a new study comes out showing that cheesesteaks can damage the health of Philadelphians, the government decides to place a tax on cheesesteak consumption to encourage consumers to eat fewer. In order to reduce total cheesesteak consumption by 20%, what should be the value of the per-unit tax t that the government of Philadelphia implements?

   ○ t = 20

   ○ t = 30

   √ **t = 40**

   ○ t = 50

   ○ It is not possible to reduce consumption by 20%

8. (1.5 points) Tom and Peter can produce soap or brushes. Tom can produce at most 12 soap bars or 6 brushes, while Peter can produce at most 28 soap bars or 7 brushes. The world price of one brush is 3 soap bars. Suppose Tom and Peter jointly produce and then trade with the rest of the world. How many soap bars do they produce if they engage in trade with the rest of the world?

   ○ 12

   √ **28**

   ○ 40

   ○ Not enough information

9. (1.5 points) The demand and supply of strawberries in the U.S. are $Q_D = 40 - 3P$ and $Q_S = 5 + 2P$, where P is measured in dollars per pound. Suppose the trading price of strawberries in the world market is $1 per pound. Now the government decides to impose a tariff of $6 per pound on the imported strawberries. What is the tariff revenue of the U.S. government?

   ○ $50

   ○ $70

   ○ $30

   √ **$0**

10. (1.5 points) Suppose the market for cigarettes is controled by a single seller, facing market demand $P = 100 - Q_D$ and and marginal cost $MC = 2Q_S$. The consumption of cigarettes generates a marginal external cost $MEC = Q$. To achieve efficiency:

   ○ The government should impose a per unit tax

   ○ The government should impose a per unit subsidy

   √ **The government should not impose any tax or subsidy, as the monopoly is efficient**

   ○ The government should break down the monopoly and introduce perfect competition

11. (1.5 points) Zfinity is the sole provider of internet to the residents of Philadelphia. The city of Philadelphia is considering regulating Zfinity by imposing a price ceiling at its marginal cost, and giving the firm a lump-sum subsidy such that it breaks even. Demand for internet is $P = 25 - \frac{Q_D}{4}$ where P is in dollars and Q_D is in tens of thousands of residencies. Zfinity's marginal cost is $MC = 4$ and their fixed cost is $FC = 5000$. Which of the following is true?

○ Government expenditure will be greater that Zfinity's fixed cost

○ Government expenditure would be lower if they just used a subsidy to induce the efficient amount without requiring marginal cost pricing

√ **The efficient quantity of residences provided with wifi is 840,000**

○ Without regulation, Zfinity would optimally price at $P = 8$

12. (1.5 points) Gus Chung and Peely Banana are trying to one-up each other's emotes. Consider the following payoff matrix.

<div align="center">

Peely

Gus		Mew	Griddy	Default
	Mew	$0,0$	$1,-1$	$-1,1$
	Griddy	$-1,1$	$0,0$	$1,-1$
	Default	$1,-1$	$-1,1$	$0,0$

</div>

Which of the following is true?

  I. There is one Nash equilibrium

  II. Every outcome is Pareto efficient

 III. Gus Chung has a dominant strategy

○ I. only

√ **II. only**

○ III. only

○ I. and II.

○ II. and III.

○ I., II., and III.

13. (1.5 points) John, an Econ 0100 student at the University of Pennsylvania, is solving an exam question. The question is about Alice's labor supply curve. When her hourly wage is $20, Alice works 20 hours a week. Based on how much Alice works when her hourly wage goes up to $30, John concludes confidently that leisure must be a normal good for Alice. How many hours must John have seen Alice work at the $30 hourly wage to conclude that?

○ 25 hours a week

√ **18 hours a week**

○ 30 hours a week

○ 40 hours a week

○ All of the above

Short Answer Questions (22 points total)

To get any point you must show your work

14. Luis and Jamie share an apartment. It is really cold outside, and they are considering turning up the thermostat in the apartment. Assume that the cost of raising the temperature in the apartment by 1 degree is $MC = \$10$. Their individual marginal benefits (MB) are given by:

    - Luis : $MB_L = 50 - 5Q$
    - Jamie : $MB_J = 30 - 10Q$

    where Q represents the change in temperature and benefits are in dollars.

    (a) If each of them can choose individually how many degrees to raise the temperature, then:

    - Luis will raise the temperature by _____**8**_____ degrees.

    - Jamie will raise the temperature by _____**2**_____ degrees.

    > **Solution:** They will raise the temperature up to the point where their individual marginal benefit equals the marginal cost.
    >
    > $$\text{Luis} : MB_L = 50 - 5Q_L = 10 \Rightarrow Q_L = 8$$
    > $$\text{Jamie} : MB_J = 30 - 10Q_J = 10 \Rightarrow Q_J = 2$$

    (b) In the graph below, plot the marginal social benefit MSB and marginal social cost MSC. Label the curves, as well as all intercepts and kinks' coordinates.
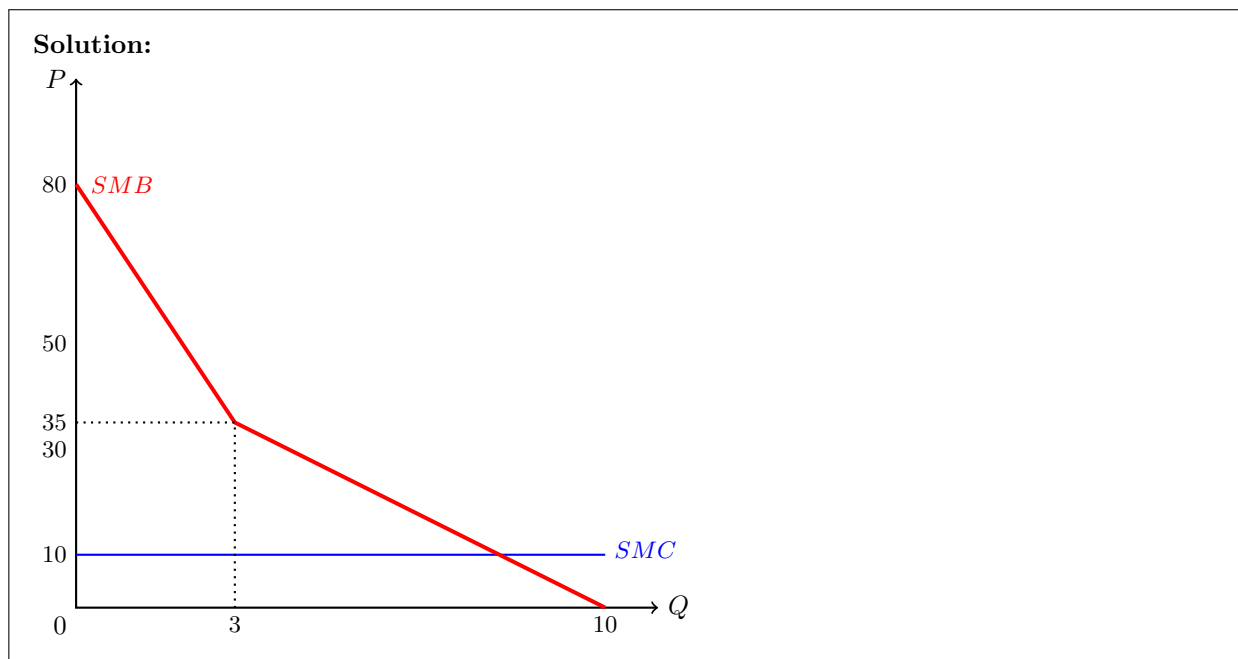
    Solution:

(c) It would be socially efficient to raise the temperature by $Q_E = $ _____**8**_____ degrees.

> **Solution:**
>
> $$SMB = 80 - 15Q \quad \text{if } Q \leq 3$$
> $$SMB = 50 - 5Q \quad \text{if } Q \geq 3$$
>
> At Q_E, $SMB = SMC$. Notice that $SMC = 10 < 35 = SMB(Q = 3)$. Therefore, you should use the equation $SMB = 50 - 5Q$. $50 - 5Q_E = 10 \Rightarrow Q_E = 8$. So, they raise it by 8 degrees.

(d) At the efficient raise in temperature Q_E:

- Luis' total benefit is $TB_L = $ _____**240**_____

- Jamie's total benefit is $TB_J = $ _____**45**_____

> **Solution:**
>
> $$\text{Luis' total benefit} = 0.5 \times 8 \times (\$50 + \$10) = \$240$$
> $$\text{Jamie's total benefit} = 0.5 \times \$30 \times 3 = \$45$$

(e) Suppose that each pays the same flat fee to finance the efficient raise temperature. How much is that flat fee, and will they both agree to pay? Explain in the box below.
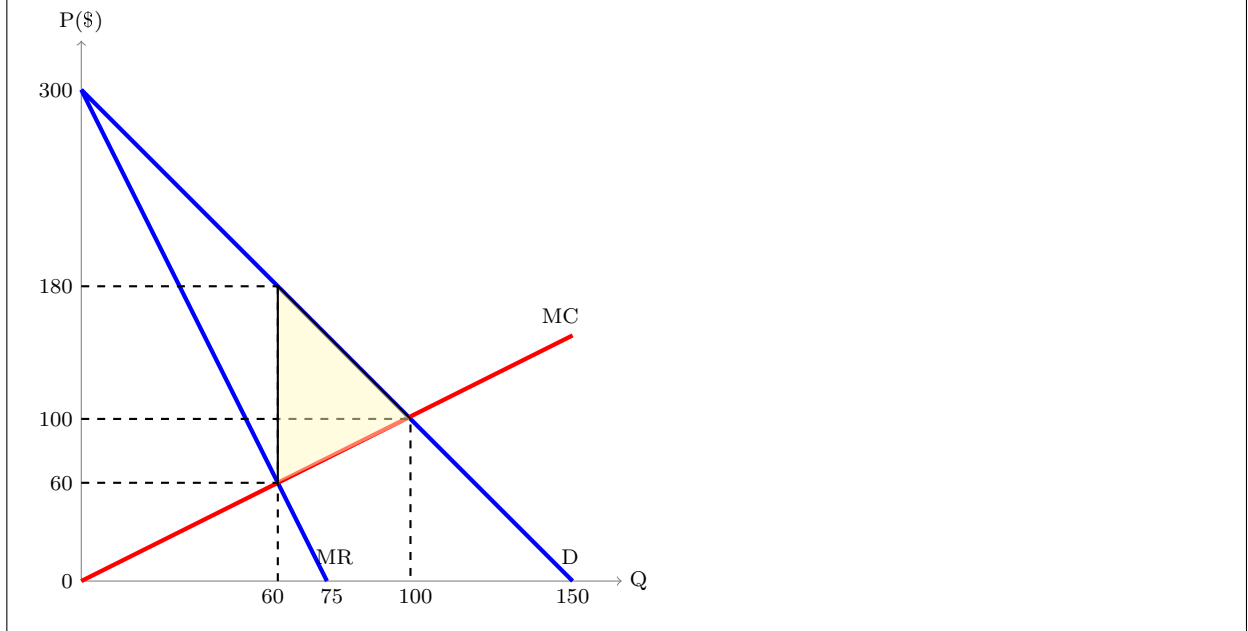
> **Solution:** The flat fee should be $40. Both will agree to pay because it is smaller than their individual total benefit.

15. Pearson books signed a contract with all of the universities to be the only provider of the "Introduction to Biology" textbook. The market demand is given by $P = 300 - 2Q_D$ and the publisher's marginal cost is $MC = Q$.

    (a) In the graph below, show demand, marginal cost and marginal revenue. Make sure to label all of the axes and curves.

P ($)

0 ──────────────────────────────→ Q
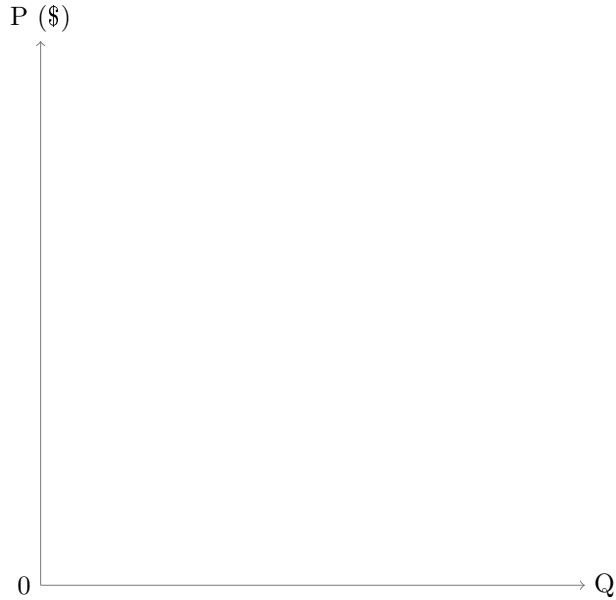
Solution: To find the marginal revenue equation we keep the same y-intercept as market demand and multiply its slope by 2: $MR = 300 - 4Q$. For the equilibrium, we set $MC = MR$ to get $Q_M = 60$; Plug into Demand to get $P_M = 180$.

P($)

300

180 ┄┄┄┄┄┄┄┄┄┄

                                    MC

100 ┄┄┄┄┄┄┄┄┄┄┄┄┄┄

60 ┄┄┄┄┄┄┄

                MR   D
0 ──────┬────┬──────┬──────────┬──────→ Q
        60   75   100   150

(b) At the monopoly equilibrium:

- The quantity is $Q_M = $ _____**60**_____

- The price is $P_M = $ _____**180**_____

(c) The deadweight loss generated by the monopoly is $DWL = $ _____**2,400**_____

(d) Suppose Pearson sends representatives to all of the schools to talk to the university officials to find out each student's willingness to pay for the Biology textbook.

- The new equilibrium quantity is $Q'_M = $ _____**100**_____

- The new deadweight loss is $DWL' = $ _____**0**_____

(e) Bart, a first year student at Penn, objects to Pearson's new pricing practice, stating that the market for textbooks would be more efficient and more equitable if it was perfectly competitive. Do you agree with Bart, and why? Explain in the box below.

(f) A second student, Lisa, comments that taking biology (which implies reading the textbook), contributes to society at large, as these students will understand scientific thinking and will make better decisions as citizens. She estimates this external benefit at $MEB = \$30$.

   i. The efficient quantity is $Q_E = $ _____**110**_____

  ii. Suppose the firm charges a single price, as in part b. In order to achieve efficiency, should the government use a per-unit tax or per-unit subsidy, and of how much? Show your work below.

 iii. Suppose the firm practices perfect price discrimination, as in part d. In order to achieve efficiency, should the government use a per-unit tax or per-unit subsidy, and of how much? Show your work below.

16. Medonomics, a hospital, is the sole employer of nurses in Econville. The supply of nurses is given by $w = 10 + L_S$, where w is their hourly wage. Their marginal product of labor is given by $MP_L = 10{-}0.1L_D$ and nursing care costs each patient $10 per hour. Suppose that the market for nursing care is perfectly competitive.

(a) Write the equation of the Marginal Revenue Product of Labor: $MRP_L =$ _____ $100 - L$ _____.

(b) In the graph below, draw the marginal revenue product of labor MRP_L, labor supply L_S, and marginal cost of labor MC_L. Label all curves and intercepts. *For full credit, be sure to label all curves and intercepts.*
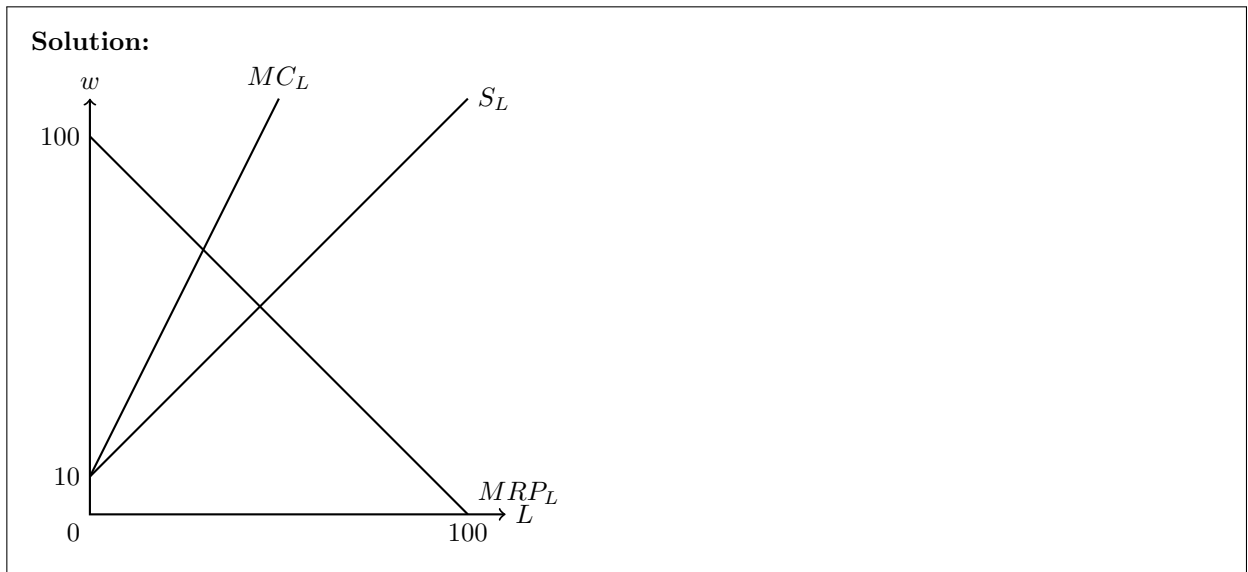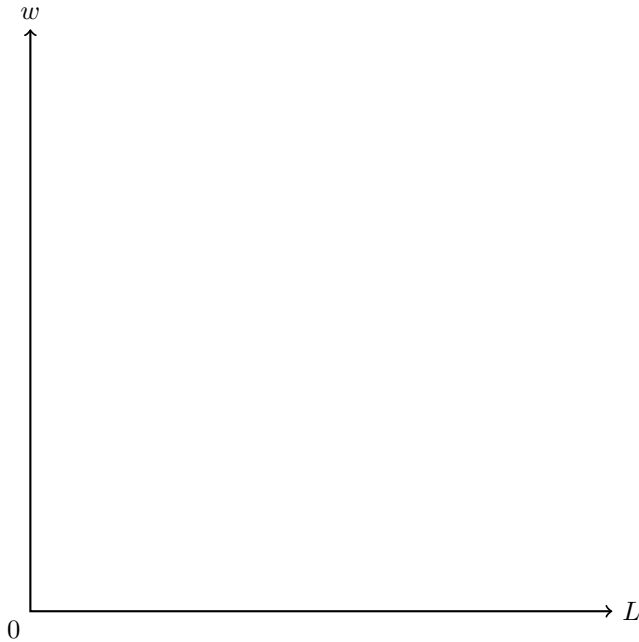
Solution:

(c) At the monopsony equilibrium:

- The monopsony level of employment is $L_M =$_____**30**_____

- The monopsonly wage is $w_M =$_____**40**_____.

> **Solution:** We set $MRP_L = MC_L$ so $100 - L = 10 + 2L$, which yields $L_M = 30$. To find the corresponding wage we plug L_M into the supply equation: $w_M = 10 + L_M = 40$.

(d) Is the monopsony level of employment efficient? Explain in the box below, and calculate the deadweight loss, if any.

> **Solution:** This is inefficient because at L_M, the marginal benefit to society is higher than the marginal cost to society. Another way to explain this is to say the efficient level of employment is such that labor demand intersects $MRP =_L$, i.e. $L_E = 45$. The deadweight loss is given by $DWL = \frac{(45-30)(70-40)}{2} = 225$

(e) In light of the recent pandemic, the mayor of Econville is looking to improve the working conditions of essential workers.

   i. Would a minimum wage increase employment? Would it increase unemployment? Explain in the box below.

   > **Solution:** A minimum wage could increase employment if it is between 40 and 70. However, if the minimum wage is higher than the perfectly competitive wage (55), it will also generate unemployment.

   ii. The minimum wage that maximizes total surplus is $w_N =$_____**55**_____

   iii. At this minimum wage, the level of employment is $L_N =$_____**45**_____

   iv. Given this minimum wage, is there unemployment, and why?

   > **Solution:** There is no unemployment since at $w_N = 55$, the quantity of labor supplied is equal to the quantity of labor demanded: $L_S = L_D$.