

**ECON 001**  
**Spring 2022**  
**Midterm 1**  
**February 15, 2021**  
**Time Limit: 60 Minutes**

**Name (Print):** \_\_\_\_\_

**Penn ID number:** \_\_\_\_\_  
**(8 digits)**

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- This exam contains 8 pages (including this cover page) and 9 questions. Check to see if any pages are missing.
  - The exam is scheduled for 1 hour.
  - The total score is 25 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 6 out of 7: 12 points)

1. (2 points) After buying a 1-month gym membership for \$50, Leah is invited on a trip with her friends. If Leah leaves, she will lose the membership. She values the trip at \$70, and it will cost her \$50. The gym is not refundable, but she can transfer it to someone else by paying a fee of \$20. Leah's sister is willing to buy the gym pass from her for \$40. If Leah stays and keeps going to the gym, she will get a benefit of \$30. Which of the following is correct?
- Leah's opportunity cost of staying is \$40 and she should stay.
  - Leah's opportunity cost of staying is \$40 and she should take the trip.**
  - Leah's opportunity cost of staying is \$50 and she should stay.
  - Leah's opportunity cost of staying is \$50 and she should take the trip.
  - Leah's opportunity cost of staying is \$60 and she should stay.
  - Leah's opportunity cost of staying is \$60 and she should take the trip.
2. (2 points) Suppose there is a technological innovation which makes batteries used in electric cars more efficient. Moreover, news about wildfires in California cause consumers to be more environmentally conscious. The market for electric cars is characterized by a downward sloping demand curve and an upward sloping supply curve. Which of the following must be true about the effects of these changes on the market for electric cars?
- I. Both demand and supply of electric cars increase.
  - II. Consumers buy more electric cars in the new equilibrium, compared to the initial one.
  - III. The equilibrium price of electric vehicles is lower in the new equilibrium, compared to the initial one.
- I. only
  - II. only
  - III. only
  - I. and II.**
  - I. and III.
  - II. and III.
  - I., II. and III.
3. (2 points) In the market for cookies, demand and supply are given by  $P = 50 - 0.5Q_D$  and  $P = 0.5Q_S$ . A new cookie-maker machine came out on the market, that makes 3 times more cookies than the old one. Which of the following is a consequence of this change?
- Consumer surplus and seller's total revenue both increase.
  - Consumer surplus increases and seller's total revenue decreases.**
  - Consumer surplus decreases and seller's total revenue increases.
  - Consumer surplus and seller's total revenue both decrease.
4. (2 points) Alex usually buys 2 bagels and 4 coffees at the Walnut street cafe. Today, the cafe offers 20% off bagels, so Alex decides to buy 4 bagels and 4 coffees. Which of the following must be true for Alex?
- I. Bagels is a normal good

- II. Coffee is a normal good
- III. Bagels and coffee are complements
- IV. Alex's demand for coffee is perfectly inelastic

- Only I.
- Only II.**
- I. and II.
- I. and III.
- II. and III.
- I., II. and III.
- I., II. and IV.
- I., II., III., and IV.

5. (2 points) Alice usually purchases toilet paper and wipes at Costco. Suppose that supply chain disruptions limit supply in the market for wipes. As a result, Alice decides to buy less toilet paper. Which of the following is true?

- Alice's income elasticity of demand for toilet paper is positive.**
- Alice's cross-price elasticity of demand between toilet paper and wipes is positive.
- Alice's price elasticity of demand for toilet paper is higher than 1.
- None of the above.

6. (2 points) Consider a firm in a perfectly competitive market with a total cost of  $TC(q) = 4q^2 + 8q + 4$  and marginal cost of  $MC(q) = 8q + 8$ . Suppose the market price for one unit is \$15. Which of the following is true?

- The firm shuts down in the short-run because it makes negative profits.
- The firm operates in the short-run because it makes positive profits.
- The firm operates in the short-run despite making negative profits.**
- The firm operates in the short-run because they will make a positive profit in the long-run.
- None of the above.

7. (2 points) Consider the market for coffee mugs. The market is perfectly competitive and in long-run equilibrium. Each firm currently produces 10 mugs and the market demand is given by  $Q_d = 1000 - 100P$ , where the price is in dollars per cup. If there are 50 identical firms in the market, what is the each firm's total cost of producing 10 mugs?

- \$10
- \$20
- \$50**
- \$100
- Not enough information.

## Short Answer Questions (13 points total)

To get any point you must show your work

8. Matilda and Mrs Phelps are both avid readers of science fiction (SF) and romance novels. The price of these two types of books are  $P_{SF} = \$10$  and  $P_R = \$20$ , respectively.

Suppose that Matilda views 1 romance novel as a perfect substitute to 1 science fiction novel, while Mrs Phelps always reads each romance novel together with 1 science fiction novel. Each reader has a monthly budget of \$300.

- (a) Each figure below corresponds to one consumer (Figure 1 for Matilda, Figure 2 for Mrs Phelps). On each figure:
- Draw the reader's budget constraint  $BC$ .
  - Plot the optimal consumption point ( $M$  for Matilda,  $P$  for Mrs Phelps).
  - Draw the indifference curve  $IC$  that is consistent with the optimal choice.

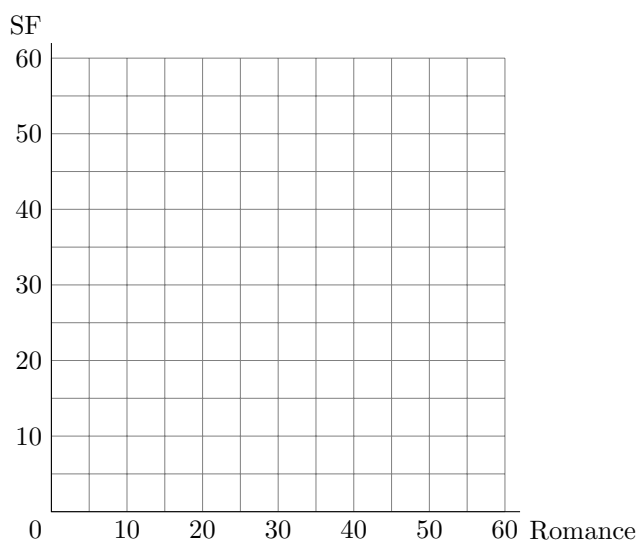


Figure 1: **Matilda (M)**

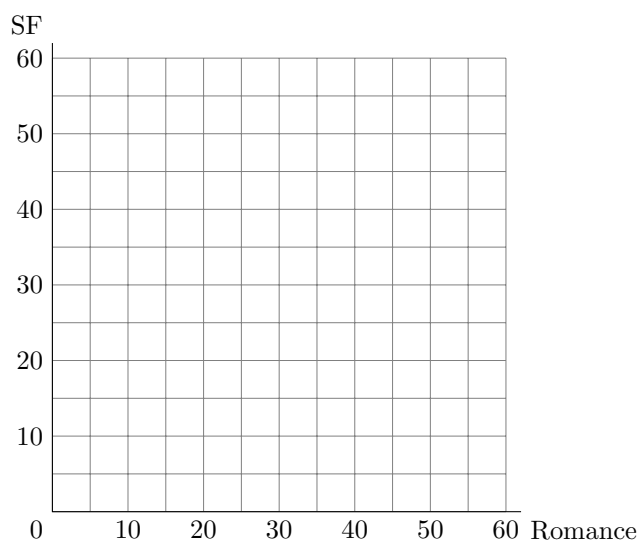
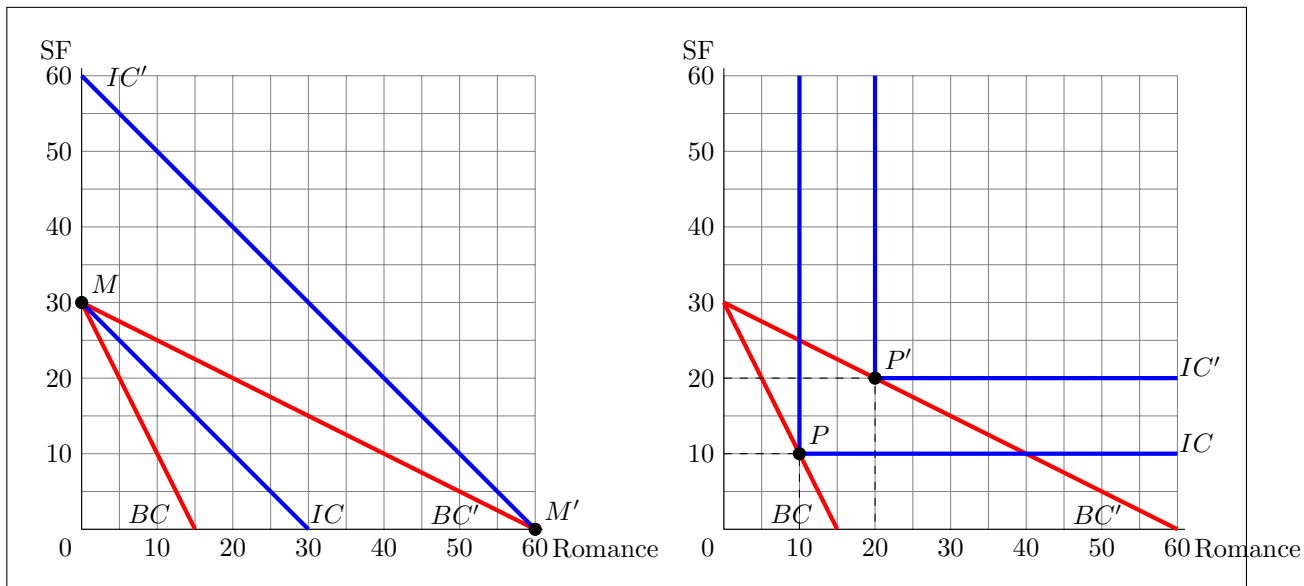


Figure 2: **Mrs Phelps (P)**

Matilda's optimal consumption is     **0**     romance and     **30**     science fiction novels.

Mrs Phelps' optimal consumption is     **10**     romance and     **10**     science fiction novels.

**Solution:**



- (b) Suppose all romance novels are marked down to \$5 each. On each figure above:
- Draw the new reader's budget constraint  $BC'$ . Label all intercepts.
  - Plot the new optimal consumption point ( $M'$  for Matilda,  $P'$  for Mrs Phelps). Label all coordinates.
  - Draw the new indifference curve  $IC'$  that is consistent with the new optimal choice. Label all intercepts.

Matilda's *new* optimal consumption is 60 romance and 0 science fiction novels.

Mrs Phelps' *new* optimal consumption is 20 romance and 20 science fiction novels.

- (c) Describe the income and substitution effects of the decrease in  $P_R$ :

i. For Matilda:

**Solution:** With the substitution effect, she goes from only buying SF novels to only buying romance novels (from (0,30) to (30,0)). With the income effect, her purchasing power increases and she buys more romance novels (from (30,0) to (60,0)).

ii. For Mrs Phelps:

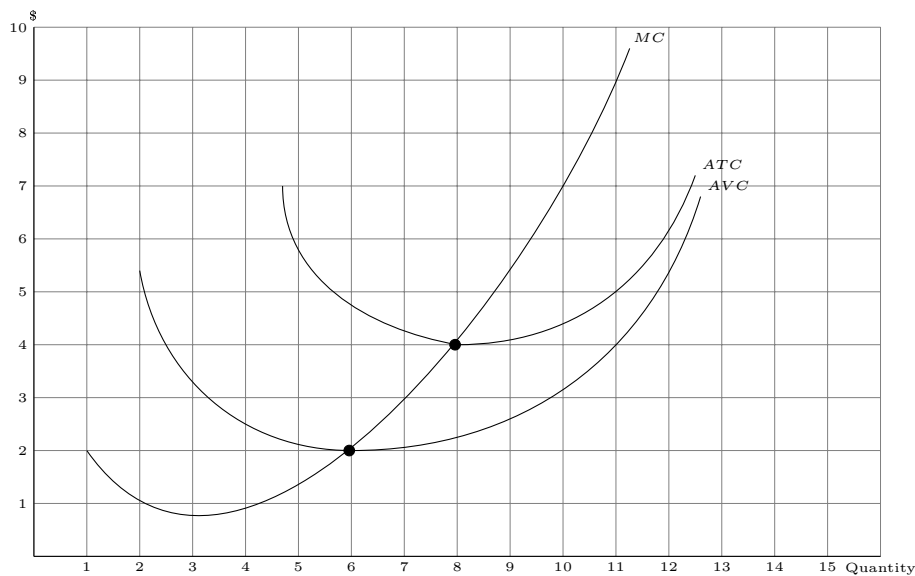
**Solution:** There is no substitution effect, since the goods are perfect complements. With the income effect, her purchasing power increases and she buys more of both types (from (10,10) to (20,20)).

- (d) Let's assume that Matilda and Mrs Phelps are the only consumers in the market for romance novels. Between the two prices, is market demand for romance novels elastic, inelastic, or unit-elastic? *Explain in the box below.*

**Solution:** At a price of \$20, Matilda's demands 0 and Mrs Phelps demands 10, so the market quantity demanded is 10. At a price of \$5, Matilda's demands 60 and Mrs Phelps demands 20, so the market quantity demanded is 80. The price elasticity of demand is  $|\epsilon_D| = \left| \frac{\% \Delta Q}{\% \Delta P} \right| = \left| \frac{(80-10)/45}{(5-20)/12.5} \right| = 35/27 > 1$ . Market demand for romance novels is elastic.

9. Because of your excellent economics background, you have been hired as a consultant by the Almond Board of California, an industry group that works to enhance productivity and profitability in the almond industry. You estimate market demand to be given by  $Q_D = 200 - 10P$ , or  $P = 20 - 0.1Q_D$ .

After running a survey, you obtain the following information on the typical firm's cost structure, where  $MC$  is the marginal cost,  $ATC$  is the average total cost, and  $AVC$  is the average variable cost. The quantity is in pounds of almonds per day.



- (a) Initially, the market for almonds is in the short-run equilibrium and the market price is  $P = \$9$  per pound. In the short-run ( $SR$ ) equilibrium: (*Show your work in the box on the next page*)

- The market quantity is  $Q_{SR} = \underline{\quad 110 \quad}$  pounds per day.
- Each firm produces a quantity  $q_{SR} = \underline{\quad 11 \quad}$  pounds per day.
- There are  $N_{SR} = \underline{\quad 10 \quad}$  firms in the market.
- Each firm's profit is  $\pi_{SR} = \underline{\quad 44 \quad}$  dollars per day.
- Each firm's producer surplus is  $ps_{SR} = \underline{\quad 55 \quad}$  dollars per day.
- Total Producer Surplus in the market is  $PS_{SR} = \underline{\quad 550 \quad}$  dollars per day.

**Solution:** From the market demand equation, when the price is \$9, market quantity is  $Q = 200 - 10 \times 9 = 110$ . The profit maximizing quantity is such that  $P = MC(q)$ . From the graph, the intersection of  $P = \$9$  and  $MC(q)$  is at  $q = 11$ . The number of firms is such that  $Q = Nq$ , so  $N = 10$ . Each firm's profit is  $\pi = q(P - ATC) = 11(\$9 - \$5) = \$44$ . Each firm's producer surplus is equal to  $ps = \pi + FC$ . Moreover,  $FC = AFC \times q$  and is the same at any quantity. At  $q = 11$ ,  $ATC = 5$  and  $AVC = 4$ , so  $AFC = 1$ . Therefore,  $FC = 1 \times 11 = 11$ . So each firm's producer surplus is equal to  $\pi + FC = 44 + 11 = 55$

(b) Suppose the market for almonds is now in the long-run equilibrium, after firms have been able to enter or exit. In the long-run (SR) equilibrium: (*Show your work in the box below*):

- The market price is  $P_{LR} = \underline{\quad 4 \quad}$  dollars per pound.
- Each firm produces  $q_{LR} = \underline{\quad 8 \quad}$  pounds per day.
- The market quantity is  $Q_{LR} = \underline{\quad 160 \quad}$  pounds per day.
- There are  $N_{LR} = \underline{\quad 20 \quad}$  firms in the market.
- Each firm's profit is  $\pi_{LR} = \underline{\quad 0 \quad}$  dollars per day.
- Each firm's producer surplus is  $ps_{LR} = \underline{\quad 11 \quad}$  dollars per day.
- Total Producer Surplus in the market is  $PS_{LR} = \underline{\quad 220 \quad}$  dollars per day.

**Solution:** The long-run equilibrium price is the break-even price, equal to the minimum of the  $ATC$ , which is at the intersection between  $ATC$  and  $MC$ ;  $P_{LR} = 4$ . The corresponding quantity is  $q_{LR} = 8$ . Plugging the price  $P_{LR} = 4$  into market demand yields  $Q_{LR} = 160$ . Since  $Q = Nq$  and  $q_{LR} = 8$ , there must be  $N = 20$  firms operating in the market. Since the long-run price is equal to the break-even price, each firm makes 0 profit in the long-run equilibrium, so each firm's producer surplus is equal to the fixed cost of 11. There are 10 firms so total producer surplus is  $PS_{LR} = 220$ .

(c) Suppose there is an economy-wide recession. Given your knowledge of the demand for almonds, you expect a price drop.

i. What assumptions are you making about the demand for almonds? (*Please explain in the box below*):

**Solution:** The price of almonds has dropped, so the demand for almonds must have decreased. A recession decreases consumers' income. A lower income leads to a lower demand if the good is normal. We are assuming that almonds are a normal good.

ii. As you predicted the price of almonds drops, to \$3. Seeing that firms are still operating in the short-run, one of your interns thinks that the \$3 new price is here to stay in the long-run. Do you agree, and why? *Please explain in the box below:*

**Solution:** The price of \$3 is above the shut-down price but below the break-even price, so firms are operating at a loss. In the long-run, some firms will exit so market supply will decrease (pivoting counter clockwise), which will bring the market price back up to the break-even price of \$4. Firms stop exiting when they are back to zero profits.