

## Problem Set 1, due Thursday, February 11<sup>th</sup>, 2016

### Discrete demand

1. Suppose that Ariel's total benefit from coffee drinks per day is given by the table on the left.

coffee drinks	total benefit (willingness to pay)
1	\$12
2	\$17
3	\$20
4	\$21
5	\$21

price range	quantity demanded
> \$ _____	0
\$ _____ - \$ _____	1
\$ _____ - \$ _____	2
\$ _____ - \$ _____	3
\$0 - \$ _____	4

- a) If the price of a coffee drink is \$4.50, how many should Ariel buy? \_\_\_\_\_
- b) What will Ariel's consumer surplus be when the price is \$4.50? \_\_\_\_\_
- c) Fill in the missing spaces in the quantity demanded table (on the right) above.

2. The table below gives Stan's total benefit from gremlins in dollar amounts ( $TB$ ), given the number of gremlins he buys ( $q$ ). The price of a gremlin is \$100.

$q$	$TB$	$MB$
1	350	
2	600	
3	800	
4	950	
5	1,080	
6	1,160	
7	1,200	

$TE$	$CS$

- a) Fill in the  $MB$  column with Stan's marginal benefit from each last gremlin.
- b) Fill in the  $TE$  (total expenditure) and  $CS$  (consumer surplus) column with Stan's total expenditure on gremlins and his consumer surplus. (Note: the  $CS$  column should give his *cumulative* consumer surplus, not just his consumer surplus from buying the last DVD.)

c) On the blank graph above, draw Stan's demand 'curve' (actually more of a staircase shape), and a line representing the price. Shade the area that represents Stan's consumer surplus given the optimal quantity.

d) Using the information above, describe two distinct ways of determining the quantity of gremlins that is optimal (surplus-maximizing) for Stan to purchase, and explain why they are equivalent.

## Continuous Demand

3. Suppose that Kristin's marginal benefit for cinnamon cereal is given by the function  $MB = 10 - 2q$ , where  $q$  is the quantity of cereal she consumes (in pounds).

a) If the price of cereal is \$2 per pound, then Kristin should consume \_\_\_\_\_ pounds of cereal.

b) If she does this, her total consumer surplus will be \_\_\_\_\_.

c) Kristin's demand for cereal as a function of price is  $q_d = \text{---} - \text{---}p$

4. Suppose that Billy's marginal benefit for lentil soup is given by the function  $MB = 30 - 3q$ , where  $q$  is the quantity of soup he consumes (in gallons).

a) If the price of soup is \$6 per pound, Billy should consume \_\_\_\_\_ pounds of cereal.

b) If he does this, his total consumer surplus will be \_\_\_\_\_.

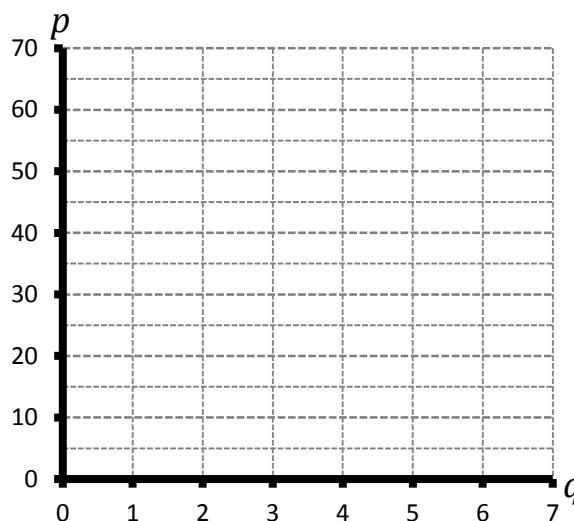
c) Billy's demand for soup as a function of price is  $q_d = \text{---} - \text{---}p$

## Discrete supply

5. The table below gives Jean-Ralphio's total cost of making trinkets ( $TC$ ), given the number of trinkets he makes ( $q$ ). His trinkets sell for \$30 each.

$q$	$TC$	$MC$
1	5	
2	20	
3	45	
4	80	
5	125	
6	180	
7	245	

$TR$	$PS$



a) Fill in the  $MC$  column with Jean-Ralphio's marginal cost of each last trinket.

**b)** Fill in the  $TR$  (total revenue) and  $PS$  (producer surplus) column with Jean-Ralphio's total revenue from trinkets and his producer surplus. (Note: the  $PS$  column should give his *cumulative* producer surplus, not just the added surplus from selling the last trinket.)

**c)** On the blank graph above, draw Jean-Ralphio's supply 'curve' (actually more of a staircase shape), and a line representing the price. Shade the area that represents Jean-Ralphio's producer surplus given the optimal quantity.

**d)** Using the information above, describe two distinct ways of determining the quantity of trinkets that is optimal (surplus-maximizing) for Jean-Ralphio to make, and explain why they are equivalent.

## Continuous supply

**6.** Suppose that Erin is a producer of beer, with a total cost function  $TC = 20Q + \frac{1}{6}Q^2$ , and marginal cost function  $MC = 20 + \frac{1}{3}Q$ , where  $Q$  is her production of beer, in gallons.

**a)** If the price of beer is \$40 per gallon, she should produce \_\_\_\_\_ gallons, to maximize profit.

**b)** Her supply function is  $Q_s = \text{_____} + \text{_____}P$ , where  $P$  is the price of beer per gallon.

**c)** If the price of beer is \$40 per gallon, how much producer surplus can she get? \_\_\_\_\_

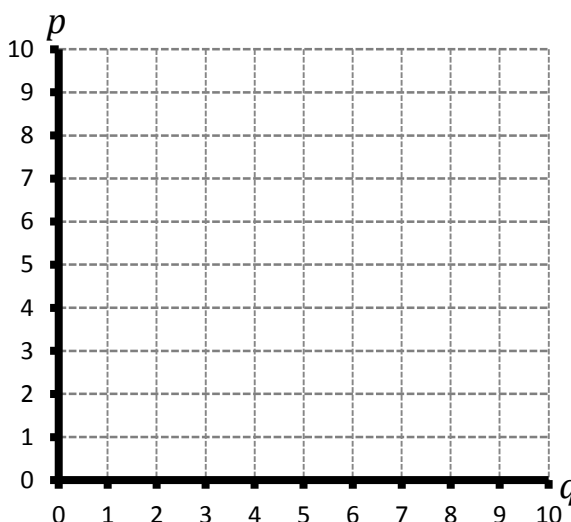
**7.** Larry makes money by growing purple fungus. His total cost of growing fungus is given by the function  $TC = 2q + \frac{1}{4}q^2$ , and his marginal cost is given by  $MC = 2 + \frac{1}{2}q$ , where  $q$  is the quantity of fungus he grows, in bucketfuls.

**a)** Larry's supply function is  $q_s = \text{_____} + \text{_____}p$

For the rest of the problem, suppose that the price of fungus is  $p = 5$ .

**b)** At this price, Larry's optimal quantity is  $q^* = \text{_____}$ , and his resulting producer surplus is  $PS = \text{_____}$ .

**c)** On the blank graph to the right, draw Larry's supply curve, and a line representing the price. Shade in the area that represents Larry's producer surplus given his optimal quantity.



**d)** Explain clearly why the value of  $q^*$  you found maximizes producer surplus. Why would either a lower quantity  $q < q^*$  or a higher quantity  $q > q^*$  clearly lead to less producer surplus?

# Equilibrium

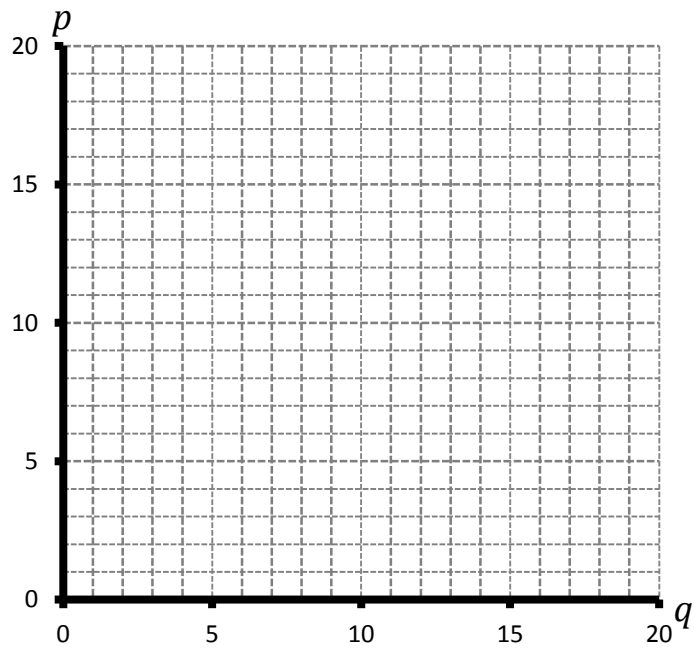
7. The market for blue fuzz is characterized by the marginal benefit function  $MB = 20 - q$ , and the marginal cost function  $MC = 2 + 2q$ , where  $q$  is the quantity of blue fuzz produced and consumed.

a) Assuming that the market is competitive, etc., the equilibrium quantity of blue fuzz is \_\_\_\_\_, and the equilibrium price is \_\_\_\_\_.

b) In the equilibrium, consumer surplus is \_\_\_\_\_, and producer surplus is \_\_\_\_\_.

c) The market demand curve can be represented by the equation  $q_d =$  \_\_\_\_\_, and the market supply curve can be represented by the equation  $q_s =$  \_\_\_\_\_.

d) On the graph to the right, draw the demand curve and the supply curve. Shade the areas that represent consumer surplus and producer surplus.



**8.** The market for purple goo is characterized by the marginal benefit function  $MB = 100 - \frac{1}{5}q$ , and the marginal cost function  $MC = 10 + \frac{1}{10}q$ , where  $q$  is the quantity of purple goo produced and consumed.

**a)** Assuming that the market is competitive, etc., the equilibrium quantity of purple goo is \_\_\_\_\_, and the equilibrium price is \_\_\_\_\_.

**b)** In the equilibrium, consumer surplus is \_\_\_\_\_, and producer surplus is \_\_\_\_\_.

**c)** The market demand curve can be represented by the equation  $q_d =$  \_\_\_\_\_, and the market supply curve can be represented by the equation  $q_s =$  \_\_\_\_\_.

**d)** On the graph to the right, draw the demand curve and the supply curve. Shade the areas that represent consumer surplus and producer surplus.

