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Part 1

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Midterm Exam due Jul 3, 2024 07:30 CST

Completed

Problem E2.1.1

2/2 points (graded)

A bank is trying to decide on how to compensate one of their loan officers (employees who decide what businesses the bank should loan money to). They are considering two different compensation schemes. Scheme A pays the loan officer 10,000 for every loan he gives out. Scheme B pays the loan officer 20,000 for every loan he gives out that does not default and fines him 20,000 for every loan that defaults while he is overseeing it. Suppose that for every loan that does not default the bank gets 40,000 and for every loan that does default the bank loses 40,000. Further, suppose at the end of the year the loan officer is leaving to pursue his passion for music at which point his loans will become another officer's responsibility. Consider the following hypothetical scenario:

The loan officer is approached by a business that has a 75% chance of default within a year.

Under Scheme A, does the bank want its officer to approve the loan? Does the officer approve the loan?

The bank wants the officer to approve the loan, and the officer approves the loan

The bank wants the officer to decline the loan, but the officer approves the loan

The bank wants the officer to approve the loan, but the officer declines the loan

The bank wants the officer to decline the loan, and the officer declines the loan

Explanation

Under Scheme A the bank's expected profits are $(1/4)40000 + (3/4)(-40000) - 10,000 = -30000$ and they don't want him to approve the loan. The officer makes 10000 from approving out the loan so he does anyway.

Under Scheme B, does the bank want its officer to approve the loan? Does the officer approve the loan?

The bank wants the officer to approve the loan, but the officer declines the loan

The bank wants the officer to decline the loan, and the officer declines the loan

The bank wants the officer to approve the loan, and the officer approves the loan

The bank wants the officer to decline the loan, but the officer approves the loan

Explanation

Under Scheme B, the bank's expected profits are $(1/4)(40000 - 20000) + (3/4)(20000 - 40000) = -10000$ so they still don't want him to approve the loan. The officer's expected earnings are $(1/4)(20000) + (3/4)(-20000) = -10000$ so he does what the bank wants and doesn't approve the loan.

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Problem E2.1.2

3/3 points (graded)

Jim is a farmer who produces organic tomatoes and conventional corn. The direct growing costs of organic tomatoes and traditional corn are given by $\alpha_O Q_O^2$ and $\alpha_C Q_C^2$. In order to have his tomatoes certified as organic, the US Department of Agriculture requires that jim plant a "buffer zone" (such as a line of trees or grass) between the organic tomatoes and the corn to ensure no pesticides from the cornfields accidentally contaminate the organic tomatoes. Thus in addition to the direct costs of growing the crops mentioned above, Jim must pay $\alpha_B Q_O Q_C$ in buffer construction costs. ($\alpha_O > 0$, $\alpha_C > 0$, $\alpha_B > 0$.)

Write Jim's total cost function as a function of $Q_O, Q_C, \alpha_C, \alpha_O, \alpha_B$ assuming demand for corn does not change.

$C(Q_O, Q_C) = \alpha(Q_O^2 + Q_C^2 + Q_O Q_C)$

$C(Q_O, Q_C) = \alpha_O \alpha_C \alpha_B Q_O^3 Q_C^3$

$C(Q_O, Q_C) = \alpha_B Q_O Q_C - \alpha_O Q_O^2 - \alpha_C Q_C^2$

$C(Q_O, Q_C) = \alpha_O Q_O^2 + \alpha_C Q_C^2 + \alpha_B Q_O Q_C$

$C(Q_O, Q_C) = \alpha_O Q_O^2 + \alpha_C Q_C^2 - \alpha_B Q_O Q_C$

$C(Q_O, Q_C) = (\alpha_O + \alpha_C + \alpha_B) Q^2$

Explanation

Just add up the costs: $C(Q_O, Q_C) = \alpha_O Q_O^2 + \alpha_C Q_C^2 + \alpha_B Q_O Q_C$.

Does this cost function exhibit economies of scope or diseconomies of scope?

The cost function exhibits diseconomies of scope

The cost function exhibits economies of scope

The cost function exhibits economies of scope when $\alpha_O > \alpha_C$ and diseconomies of scope when $\alpha_O < \alpha_C$

The cost function exhibits neither economies nor diseconomies of scope

The cost function exhibits economies of scope when $\alpha_O < \alpha_C$ and diseconomies of scope when $\alpha_O > \alpha_C$

Explanation

The cost function exhibits diseconomies of slope. $C(Q_O, 0) + C(0, Q_C) < C(Q_O, Q_C)$ because his buffer zone costs are increasing in the product of the two quantities. That is because his costs of creating buffers depends on the product of the number of organic tomatoes and conventional ears of corn. Diversifying his crops increases his costs.

Suppose that Jim is producing a positive number of both organic tomatoes and conventional ears of corn when the demand for organic tomatoes increases after Oprah talks about how much better organic tomatoes taste than regular tomatoes. How does this affect the quantities of tomatoes and corn jim chooses to produce? (Assume demands for and supplies of both goods are neither perfectly elastic nor perfectly inelastic.)

Assuming demand for corn does not change, Jim will produce...

...more tomatoes and the same amount of corn

...more tomatoes, but the effect on corn production is ambiguous

...more tomatoes and more corn

...more tomatoes and less corn

Explanation

An increase in demand for organic tomatoes causes the price of tomatoes to rise and thus because marginal cost is increasing in quantity of tomatoes produced, jim chooses to produce more tomatoes. Holding demand for corn constant, he will decrease the amount of corn he chooses to produce because the marginal cost of corn is increasing in the quantity of tomatoes due to the need to build buffer zones.

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Part 2

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Problem E2.2.1

2.0/2.0 points

(graded)

Juan has just started a taco restaurant. In order to enter the business he had to pay a sunk cost of **2**, that is, the total value of the time he spent learning tacos recipes. In addition he needs to pay for labor and capital. The wage rate he has to pay is $\frac{1}{4}$, and the rental rate of each unit of capital is **1**. Juan knows that his production function is given by $q = K^{1/3} L^{1/3}$.

In the short run the units of capital that Juan has are fixed and equal to **3**. Find the short run total cost function. (Exclude the sunk costs from this function.) To verify that you have found the correct short-run total cost function, compute the short-run total cost of producing 30 tacos.

$TC(30) =$

2253

✓ Answer: 2253

2253

Explanation

We know that in the short run $K = \overline{K} = 3$. From the production function we have that

$$q = \overline{K}^{1/3} L^{1/3} \implies L = \frac{q^3}{\overline{K}}.$$

The short-run total cost function is given by

$$TC = r\overline{K} + wL = 3 + \frac{1}{4}L = 3 + \frac{1}{4}\frac{q^3}{3} = 3 + \frac{q^3}{12}.$$

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Problem E2.2.2

2.0/2.0 points

(graded)

Now, let's consider a time horizon long enough such that producers like Juan can adjust the level of capital, although they still have to pay the sunk cost of **2** in order to learn the recipes. Assuming that they face the same price for labor ($w = \frac{1}{4}$) and for the rental rate of capital ($r = 1$), find the long run total cost production function in this market. (Exclude the sunk costs in this function.) To verify that you have found the correct long-run total cost function, compute the long-run total cost of producing 30 tacos.

$TC(30) =$

164.3168

✓ Answer: 30^(3/2)

164.3168

Explanation

In this case the problem that they face can be written as

$$\min_{K,L} \frac{1}{4}L + K \text{ subject to } q = L^{\frac{1}{3}} K^{\frac{1}{3}}.$$

From the fact that the factor price ratio has to be equal to the marginal rate of technical substitution in this market we know that

$$\frac{1}{4} = \frac{\frac{1}{3}\left(\frac{K}{L^2}\right)^{\frac{1}{3}}}{\frac{1}{3}\left(\frac{L}{K^2}\right)^{\frac{1}{3}}} = \frac{K}{L}.$$

This implies that in the optimal bundle of labor and capital we should have that $L = 4K$.

Then we have that $q = 4^{\frac{1}{3}} K^{\frac{2}{3}} \implies K = \frac{q^{\frac{3}{2}}}{2}$ and we have that $L = 2q^{\frac{3}{2}}$. So $TC = q^{\frac{3}{2}}$.

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Part 3

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Problem E2.3.1

4/4 points (graded)

You make very tasty hot dogs. You can do hot dog business in two potential monopoly markets: one inside Fenway Park, Boston's baseball stadium, and one inside TD Garden, the home arena for Boston's ice hockey team, the Bruins, and basketball team, the Celtics. The demand for hot dogs in each game in Fenway Park is $Q_{\text{Fenway}} = 100 - 5p$ and the demand for hot dogs per game in TD Garden is $Q_{\text{TD}} = 50 - 5p$. You need to pay 100 dollars per game for renting the space in each market. The cost of making a hot dog is 2 dollars. Assume that you can sell fractions of hot dogs.

What will the price of hot dogs in each market be if you enter both markets?

$p_{\text{Fenway}} =$

11

Answer: 11

11

Explanation

Revenue at Fenway Park is $q(20 - \frac{1}{5}q)$, so $MR_{\text{Fenway}} = 20 - \frac{2}{5}q$. Since $MC = 2$, $q_{\text{Fenway}} = 45$ and $p_{\text{Fenway}} = 11$.

$p_{\text{TD}} =$

6

Answer: 6

6

Explanation

$MR_{\text{TD}} = 10 - \frac{2}{5}q$ and so $q_{\text{TD}} = 20$ and $p_{\text{TD}} = 6$.

You are choosing which market(s) to enter. What will your decision be?

☐ Enter the TD Garden market

☐ Enter neither market

☐ Enter either market, but not both

☐ Enter both markets

☒ Enter the Fenway Park market

✓

Explanation

Your total revenue is $45 \cdot 11 = 495$ at Fenway Park and your total cost is $100 + 2 \cdot 45 = 190 < 495$, so you will enter the Fenway Park market. In TD Garden, your total revenue is 120 but your total cost is 140, so you won't enter.

Calculate consumer surplus in the market(s) you enter.

$CS =$

202.5

Answer: 202.5

202.5

Explanation

$CS_{\text{Fenway}} = \frac{1}{2}(20 - 11) 45 = 202.5$.

Show answer

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You have used 1 of 1 attempt

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Problem E2.3.2

8/8 points (graded)

Now suppose that Fenway Park has space for another potential hot dog seller, who can make the same hot dogs with the same marginal cost as you and has to pay the same amount of rent. Customers will always buy from the cheaper seller, but when the price is the same, they are indifferent and buy randomly (that is, each seller gets half of the customers). In the questions that are part of this problem, assume hot dog sellers are competing over price (not quantity).

If you and the other hot dog seller agreed to charge the same price that maximizes each's profit, what would this price be?

$p =$

11

Answer: 11

11

Explanation

The price will be the monopoly price found above, because this gives you and the other supplier the largest total profit possible in this market and therefore splitting this maximum profit equally gives you the largest possible profit when sharing half of the market with someone else.

What would your (alone, not combined) profit be?

$\pi =$

(Express loss as a negative profit.)

102.5

Answer: 102.5

102.5

Explanation

Your profit is $\frac{1}{2}(100 - 5 \cdot 11) 11 - 100 - 2 \cdot 22.5 = 102.5$.

Given that the other seller agrees to charge the price you solved above, do you in fact keep your promise?

☒ No, you will deviate

☐ Yes, you will keep your promise

✓

Explanation

You will deviate to a price that is arbitrarily close to 11 but smaller than it so that you can take over the entire market and earn almost the monopoly profit, which is 305.

How much will you charge?

(Assume that you can set the price down to cents (hundredths of a dollar).)

10.99

Answer: 10.99

10.99

Explanation

In reality, you will charge 10.99 because the smallest price reduction is a cent.

What will your profit be?

(Round to the nearest cent.)

305.00

Answer: 305.00

305.00

Explanation

This gives you $45.05(10.99 - 2) - 100 = 304.9995$.

And what will the profit of the other seller be?

(Round to the nearest cent.)

-100

Answer: -100

-100

Explanation

The other seller will have no customer and incur a loss, which is the value of the rent.

Suppose both of you are operating in the market. Find the price of hot dogs such that if you and the other seller have no agreement on what price to charge, both of you acting in your own best interest charge the same price.

$p =$

2.00

Answer: 2.00 or 2.01

2.00

Explanation

The market price will be 2 dollars for each hot dog because if one seller sells at a price higher than this, the other seller can undercut it and capture the whole market. Given that the other seller charges 2 dollars, selling your hot dogs for over 2 dollars gives you no sale, which is strictly dominated by selling them for 2 dollars. Also selling below your marginal cost does not make any sense since you lose money by doing this. Therefore, your best response is to match the other seller's price when he sells it for 2 dollars.

What will the profit for each of you be?

$\pi =$

-100

Answer: -100

-100

Explanation

The profit will be -100 for both of you.

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Answers are displayed within the problem

Problem E2.3.3

1/1 point (graded)

Given the scenario described above, will a seller enter if you are already in the market?

(Assume that you are presently the only one in the market.)

☒ No, the other seller will not enter the market

☐ Yes, the other seller will enter the market

✓

Explanation

If the other seller enters then he knows that you will not credibly collude with him because your profit when you do not collude is greater (which you solved above) than your profit when you do collude (which you also solved above). So if he enters, the market will end up in the situation where both of you lose money (which you also solved above).

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Part 4

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Problem E2.4.1

5/5 points (graded)

Consider the market for fixies in Somerville. (A fixed-gear bicycle (or fixed-wheel bicycle) is a bicycle that has no freewheel, meaning it cannot coast, because the pedals are always moving when the bicycle is in motion. They are popular among hipsters in Cambridge.) The supply side of the market is perfectly competitive and is composed of five producers, who each have a long run cost curve $C(q) = 2q + 5q^2$. The demand side of the market comprises all the hipsters who live in Somerville (since they do not have fixies yet, their travel costs are really high so they only buy their fixies in Somerville). Market demand is $Q^D = 8.5 - 2p$. Afraid that all commercial real estate in Somerville is going to be taken over by fixies producers, the mayor of Somerville caps the maximum number of firms to 25.

What is the long run equilibrium price in the market for fixies? Assume the market structure is still perfectly competitive.

$p =$

3

✔ Answer: 3

3

Explanation

The marginal cost curve is $MC(q) = 2 + 10q$ and the average cost curve is $AC(q) = 2 + 5q$. The average cost is minimized when $q = 0$, which implies that the supply curve is $q = (p - 2)/10$ if $p \geq 2$ and 0 otherwise (from $p = MC = 2 + 10q$). Since the number of firms in the market is fixed, the total quantity supplied is $Q^S = Nq = 25(p - 2)/10$. Setting this equal to demand gives $p = 3$.

What is the total quantity demanded?

$Q^D =$

2.5

✔ Answer: 2.5

2.5

Explanation

$Q^D = 2.5$.

What is the total quantity supplied?

$Q^S =$

2.5

✔ Answer: 2.5

2.5

Explanation

$Q^S = 2.5$.

What is the quantity produced by each firm? (Assume, contrary to fact, that you can produce fractions of fixies in Somerville.)

$q =$

0.1

✔ Answer: 0.1

0.1

Explanation

Each firm produces $q = Q/N = 2.5/25 = 1/10$.

What is the profit earned by each firm?

$\pi =$

0.05

✔ Answer: 0.05

0.05

Explanation

Each firm makes profits $\pi = TR - TC = pq - C(q) = 3 \cdot 0.10 - C(0.1) = 0.05$.

Show answer

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You have used 1 of 1 attempt

Answers are displayed within the problem

Problem E2.4.2

5/5 points (graded)

Elections in Somerville are coming up. The mayor decides to try and win some votes from hipsters. After hearing their complaints about how the price of fixies is too high, he introduces a price ceiling equal to 2.5 (but he keeps the maximum number of licenses set at 25).

What is the quantity produced by each firm?

$q^{PC} =$

0.05

✔ Answer: 0.05

0.05

Explanation

At $p^{PC} = 2.5$, each firm produces $q^{PC} = 1/20$.

What is the profit that each firm earns?

$\pi^{PC} =$

0.0125

✔ Answer: 0.0125

0.0125

Explanation

Profits are $\pi^{PC} = 0.05(2.5 - 2 - 5 \cdot 0.05) = 0.0125$.

What is the total quantity demanded?

$Q_D^{PC} =$

3.5

✔ Answer: 3.5

3.5

Explanation

The total quantity demanded is $Q_D^{PC} = 3.5$.

What is the total quantity supplied?

$Q_S^{PC} =$

1.25

✔ Answer: 1.25

1.25

Explanation

The total quantity supplied is $Q_S^{PC} = 1.25$.

What is the equilibrium quantity transacted?

$Q^{PC} =$

1.25

✔ Answer: 1.25

1.25

Explanation

In disequilibrium the constrained side determines the market outcome, which means that the actual quantity traded on the market is $Q^{PC} = Q_S^{PC} = 1.25$.

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Problem E2.4.3

3/3 points (graded)

Under a price ceiling equal to 2.5, what is consumer surplus?

$CS =$

1.797

✔ Answer: 1.796875

1.797

Explanation

Consumer surplus is $CS = 1.25(1.75 + 1.125)0.5 = 1.797$.

What is producer surplus?

$PS =$

0.3125

✔ Answer: 0.3125

0.3125

Explanation

Producer surplus is $PS = 25 \cdot 0.0125 = 1/2 \cdot (1.25 \cdot 0.5) = 0.3125$.

Show this in a graph.

(The graph is not graded. It is for your understanding.)

Explanation

What happens to total welfare?

☐ The effect on total welfare is ambiguous

☒ Total welfare is lower than before

☐ Total welfare is unchanged

☐ Total welfare is higher than before

✔

Explanation

Total welfare is $W = CS + PS = 1.797 + 0.3125 = 2.1095$. Total welfare is lower than before; introducing a price cap moves the market further away from the perfectly competitive benchmark, which implies that total welfare is going to be lower.

Show answer

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Problem E2.4.4

4/4 points (graded)

Suppose instead implementing of a price ceiling, the mayor decides to increase the number of licenses for fixie producers to 70.

What is the quantity produced by each firm?

$q^{LR} =$

0.05

✔ Answer: 0.05

0.05

Explanation

The total quantity supplied is $Q^S = Nq = 70(p - 2)/10$. Setting this equal to demand, $70(p - 2)/10 = 8.5 - 2p$, which gives $p^{LR} = 2.5$. At $p^{PC} = 2.5$, each firm produces $q^{LR} = 0.05$.

What is the profit that each firm earns?

$\pi^{LR} =$

0.0125

✔ Answer: 0.0125

0.0125

Explanation

Profits are $\pi^{LR} = 0.05(2.5 - 2 - 5 \cdot 0.05) = 0.0125$.

What is the total quantity demanded?

$Q_D^{LR} =$

3.5

✔ Answer: 3.5

3.5

Explanation

The total quantity demanded is $Q_D^{LR} = 3.5$.

What is the total quantity supplied?

$Q_S^{LR} =$

3.5

✔ Answer: 3.5

3.5

Explanation

The total quantity supplied is $Q_S^{LR} = 3.5$.

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Problem E2.4.5

3/3 points (graded)

What is consumer surplus under the new number of licenses for fixie producers?

$CS =$

3.0625

✔ Answer: 3.0625

3.0625

Explanation

Consumer surplus is $CS = 3.5 \cdot 1.75 \cdot 0.5 = 3.0625$.

What is producer surplus?

$PS =$

0.875

✔ Answer: 0.875

0.875

Explanation

Producer surplus is $PS = 70 \cdot 0.0125 = 1/2 \cdot (3.5 \cdot 0.5) = 0.875$.

Show this in a graph.

(The graph is not graded. It is for your understanding.)

Explanation

Is total welfare higher or lower than in the case where the number of firms is capped at 25 and there is no price cap?

☐ The effect on total welfare is ambiguous

☐ Total welfare is lower than before

☐ Total welfare is unchanged

☒ Total welfare is higher than before

✔

Explanation

Total welfare is $W = CS + PS = 3.0625 + 0.875 = 3.9375$. Total welfare is higher in this case since we are moving closer to the perfectly competitive benchmark.

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