Problem Set 6 Solutions

QUESTION 1

Use MC to find AVC

Integral of MC=Variable Cost

Integral of MC/Q=AVC

So since p=Q/5 is linear, the area under the curve is just bh/2

([Q-0] *[(Q/5)-0])/2

$Q^2/10$=VC divide this by Q to find AVC

$Q^2/10*Q$

AVC=Q/10

ATC is minimized when ATC=MC

Fixed cost is 1000

ATC=FC/Q+AVC

ATC=1000/Q+Q/10

Set ATC=MC

1000/Q+Q/10=Q/5 multiply by Q to get it out of denominator
multiply both sides by 10

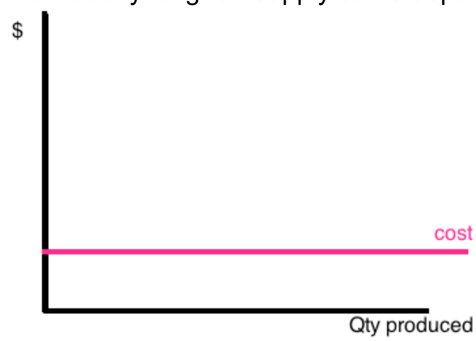
wind up with

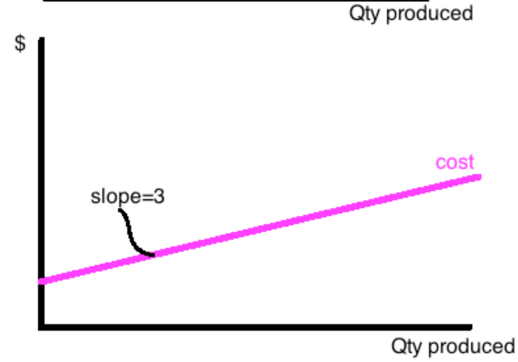
$10{,}000=Q^2$

take the square root of both sides

100=Q

The industry long run supply curve depends on whether the cost increases or is constant.





In a constant cost industry, the long run supply curve of the industry is flat.

Since the industry long-run supply is able to react to shocks, more firms can enter and exit the market until they are each making economic profit of 0..

An increasing cost industry will have a LRAS curve that slopes up.

For this particular industry pick the flat cost curve: Long-run aggregate supply for this perfectly competitive industry is horizontal at a price of $20 per unit.

QUESTION 2

Using the Demand curve to find the Marginal Revenue.

There are a few ways to find this.

One is a rule of thumb that states the MR slope is just 2x the D curve slope.

Another way is:
Use the original Demand function (set equal to P) and multiply it by Q to find Revenue
Then take the derivative or find the change in Revenue for change in q to find the Marginal Revenue (dR/dQ)=MR

Q_D=(100,000/1000)*(20.5-P)
Q_D=100(20.5)-100p
Q_D=2050-100P
Solve for P
100p=2050- Q_D
P=20.5-(0.01*Q_D)

Multiply both sides by Q to find Revenue
Revenue=P*Q=20.5Q-0.01Q^2

Take derivative
dR/dQ=20.5-0.02Q

Whichever way you opt for, the producer will choose to produce at quantity where MC=MR.

MR=MC
20.5-(0.02*Q_D)=Q/5
multiply both sides by 5
102.5-0.1Q=Q isolate Q
102.5=1.1Q divide both sides by 1.1
93.182 Quantity*

Find the PD at Q=93.182?
P=20.5-(0.01*Q_D)
So P=20.5-(0.01*93.182)
P=19.568

Now find the TC at the q=93.182
1000/93.182+(19.182/10)= 20.05
(ATC-PD)*Q=profit
(20.05-19.568)*93.182=-$44.87

profit=-$44.87

She's losing money in this situation because her ATC is above P at the quantity, Q*, where MC=MR

QUESTION 3

Under perfect competition, you have an industry demand curve of Q = (100000)(20.5 - P) and an industry supply curve of P = 20. Thus you have 50000 units produced, 0 producer surplus, and consumer surplus of 50000 x 1/4 = $12,500.
Under monopolistic competition, each of the thousand firms firm is producing 93 at an average cost per unit of $20.053. They are selling them at $19.57 for an average valuation of $20.035. They are destroying $0.018 of value for each unit--so that total consumer plus producer surplus is: -$1674.
You would rather have the competitive industry--unless, of course, you are focused only on the consumers who get lower prices in the short run with the 1000 firms. But in the long run a bunch of these firms will exit--they are, after all, losing money.

QUESTION 4

1000 kitchens, 1000 per kitchen

MC is still q/5

AVC still q/10

ATC=1,000,000/Q+Q/10

Q* will be at MR=MC

However, the following rule applies:

if P>ATC then the firm makes profit in the short-run

if ATC>P>AVC then the firm makes a loss in the short-run but still produces, and the loss is less than the Fixed Costs

if AVC>P then shut down

The first step is find the quantity at which MC=MR

The Demand curve is now QD=100,000(21-P) so we're going to use it to solve for MR

Divide by 1000 to find Demand for each kitchen's output.

First, we'll solve Demand for P

Q_D= 2100-100P

P=21-Q_D/100

Multiply by Q to get revenue

Revenue=P*Q=21Q-Q^2/100

MR=21-2Q/100

MR=21-Q/50

Set MR=MC to find optimal Q

Q/5=21-Q/50

50Q/5=21*50-Q

10Q+Q

11Q=21*50

Wind up with

Q=95.45/kitchen

Find total number of products: 1000*95.45=95,454.5

Find the P_D when Q=95454.5

P_D=21-95,454.5/100000

So P_D= 21-0.9545

P_D=20.045

Find ATC when the Q=95,454.5

ATC=(1,000,000/95,454.5)+(95,454.5/10)

10.47619546+9545.45=

ATC=9555.926

(P-ATC)*Q= Total Profit (in this case a negative number)

(20.045-9555.926)*95,454.5=-910,242,752.9

Total Profit=loss of $910,242,752.90

QUESTION 5

Brie's ATC is minimized when ATC=MR

so Q=100 at ATC=20/unit

Q = 100,000(21-P) is demand
Q = 50,000(21-P) is marginal revenue
Q=50000 is optimal production --> want only 50 kitchens.
At 50000 you can charge a price of 50000 = 100000(21-P)
1/2 = 21-P
P = 20.5
Revenue = 50000 x 20.5 = 1025000
Costs = 1000000
Profit = 25000

QUESTION 6
Channing T
VC=0 → MC=0
FC=1000

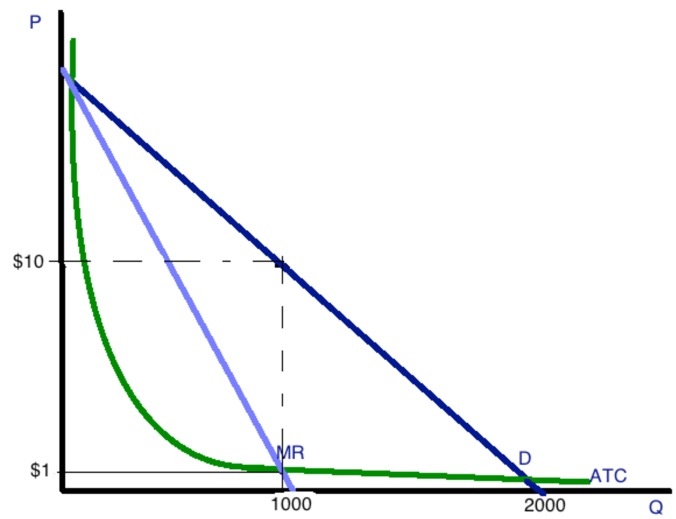
Determine the marginal revenue curve Channing faces:
Either say the slope of the MR is twice that of D curve or solve for MR. If the Demand equation is $P=0.01Q_D-20$, then MR=0.02Q-20

OR solve for MR:
$Q_D=100(20-P)$
$Q_D=2000-100P$
Solve for P
$100P=2000-Q_D$
$P=20-0.01Q_D$
Find Revenue
$Revenue=Q*P=20Q-0.01Q_D^2$
dR/dQ=20-0.02Q

Channing should operate at the quantity, Q*, where his Marginal Revenue= Marginal Cost
MR=MC
Since MC=0
20-0.02Q=0
-0.02Q=-20
1,000=Q*

Plug in Q* to find out what Price is demanded at that quantity
Demand: P=20-0.01Q
20-(0.01*1000)=10
P=$10

To find out total profit (or loss): Find ATC for when Q*=1000
ATC=[Fixed Cost/Q]+AVC
ATC=1000/Q+0
ATC=1000/1000
ATC=1
$(P_D-ATC)*Q=Profit$
(10-1)*1000=Profit
Profit= $9,000



QUESTION 7

The book suggests that in a monopoly, government regulation can enforce a socially optiimal price by requiring the monopolist to charge the price where AC intersects Demand.

However as Channing's MC is 0, he can produce where P=0
First let's find the QD when P=0
D: P=20-0.01Q
20=0.01Q
2000=Q
The Total Revenue is the MR at Q=2000, that is, 0
The ATC at Q=2000

Recall that ATC is the fixed cost, divided by the quantity produced

ATC=1000/Q
ATC=1000/2000 multiply both sides by Q to get it out of the denominator
ATC=0.5
Profit=(Price-ATC)*Q
P_D=0
0-.5(2000)
=-1000

Profit = -1000

QUESTION 8

The social optimum is not sustainable by a market – the producer loses money and goes out of business.

QUESTION 9

The water company holds a monopoly over water supply. It is concerning because if my water rates increase I have no other vendor to turn to – I either have to pay more or adjust my habits to consume less water next month. As mentioned earlier, in the case of water, government regulation seeks to set the price of water at ATC=D for water.