

Problem Set #7 Solutions
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1)

$$C=2q^3-4q^2+5q$$
$$MC=6q^2-8q+5$$

a)

i) Shutdown Point: The point where $MC=AVC$
since $C=2q^3-4q^2+5q$ has no fixed costs, then

$$AVC = AC = \frac{2q^3 - 4q^2 + 5q}{q} = 2q^2 - 4q + 5$$

which can be solved for:

$$2q^2-4q+5 = 6q^2-8q+5$$
$$-4q^2 + 4q = 0$$
$$4q=4q^2$$
$$q=q^2$$
$$q=1$$

Since, in a perfectly competitive market, $P=MC$

$$P=6(1)^2-8(1)+5$$
$$=6-8+5$$
$$P=3$$

So the shutdown point is where $q=1$ and $p=3$.

ii) The Break Even Point occurs where $AC=MC$. Since there were no fixed costs, $AVC=AC$. So, the break even and shutdown points are the same in this case.

b) The break even and the shutdown point, in this instance, are the same.

c) The firms' supply function is the MC curve, so...

$$P=6q^2-8q+5$$

but, this is true only above the shutdown point. Below that point, $q=0$.

d) Setting market demand equal to market supply, we have:

$$95-4q^2-8q = 6q^2 - 8q + 5$$

a bit of algebra yields that $q=3$

putting $q=3$ back into either function, say $95-4q^2-8q$, yields $p=35$

2)

a)

i) Shutdown: $MC=AVC$

$$150q^2-40q+10=50q^2-20q+10$$

solving yields...

$$100q^2-20q=0$$

$$100q-20=0$$

$$q=1/5$$

The corresponding price is found by putting this quantity back into, say, the MC function, yielding:

$$P=150(1/5)^2-40(1/5)+10$$

$$P=8$$

ii) Breakeven: $MC = AC$

$$150q^2-40q+10=50q^2-20q+10$$

again, $q=1/5$, $p=8$

b) The Breakeven and Shutdown point are again equal because of the absence of fixed costs.

c) The supply function is equal to the Marginal Cost, except below the shutdown point, where q then is equal to 0.

d) $150q^2-40q+10 = 165-5q^2-40q$

algebra yields $q=1$. Then, $P=150(1)^2-40(1)+10$

$$P=120$$

3)

$$C=q^2+1$$

$$MC=2q$$

a) Breakeven: $MC = AC$

$$AC = C/q = q + 1/q$$

so, $MC=AC$ condition is written:

$$2q=q+(1/q)$$

$$q=(1/q) \text{ sp } q=1 \text{ (since } -1 \text{ is nonsensical)}$$

b) Each individual supply function can be expressed as

$$q=p/2 \text{ (from the MC equation)}$$

so the market supply Q can be found (since there are 6 firms) by adding the 6 individual supply functions together...

$$Q=6(P/2)$$

c) To find equilibrium, manipulate market supply, which is $Q=6(P/2)$ to get $P=Q/3$. and set this equal to market demand. This yields $Q/3 = 60 - Q$, which can be solved for $Q=45$. Putting this into the $Q=6(P/2)$ equation and solving yields $P=15$

4)

a) Break Even Point: $MC=AC$

since $C=20q^2+180$, $AC = 20q + 180/q$

so, setting $MC=AC$ yields

$$40q=20q+180/q$$

$$20q=180/q$$

$$q=3$$

the corresponding p is 120.

b) From MC , we can get

$q=p/40$, so the market supply curve is $Q=20(p/40)$

c) Solving the market supply curve for p yields...

$$p=2Q$$

so, set market supply equal to market demand. Doing this yields...

$$2Q=300-3Q$$

$$Q=60$$

substituting into market supply curve yields

$$P=2(60) = 120$$