Microeconomics B01.1303
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Solutions to problem set 4

1. a) The budget constraint is $xp_x + yp_y = I \Leftrightarrow x + 0.1y = 1500 \Leftrightarrow 10x + y = 15000$. At the optimal point A, tangency between the indifference curve and the budget constraint implies

$$p_x/p_y = MU_x/MU_y \Leftrightarrow 1/0.1 = y/x \Leftrightarrow 10x = y.$$

Substituting y into the budget constraint we have

$$10x + y = 15000 \Leftrightarrow 20x = 15000 \Leftrightarrow x^* = 750 \Rightarrow y^* = 7500.$$

Expenditure in x is $x^*p_x = \$750$.

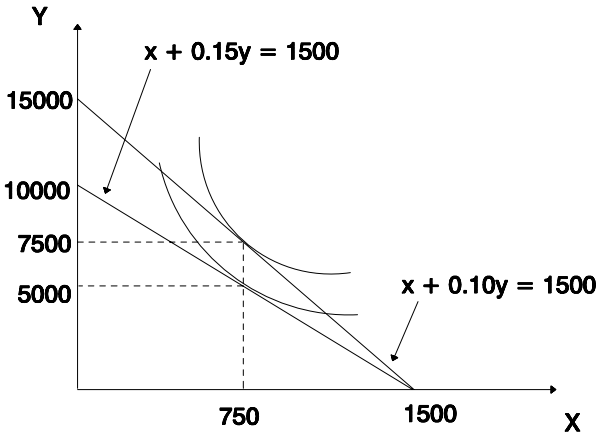
b) The price of electricity after the tax is $p_y' = p_y + t = 0.1 + 0.05 = 0.15$. The new budget constraint is $xp_x + yp_y' = I \Leftrightarrow x + 0.15y = 1500 \Leftrightarrow 100x + 15y = 150000$. At the optimal point B, tangency implies

$$p_x/p_y = MU_x/MU_y \Leftrightarrow 1/0.15 = y/x \Leftrightarrow x = 0.15y.$$

Substituting x into the budget constraint we have

$$100x + 15y = 150000 \Leftrightarrow 30y = 150000 \Leftrightarrow y^* = 5000 \Rightarrow x^* = 750.$$

The revenue of the government is $G = 5000t = \$250$. The net revenue of the electricity company is $y^*p_y = \$500$. Expenditure in x is still $x^*p_x = \$750$.



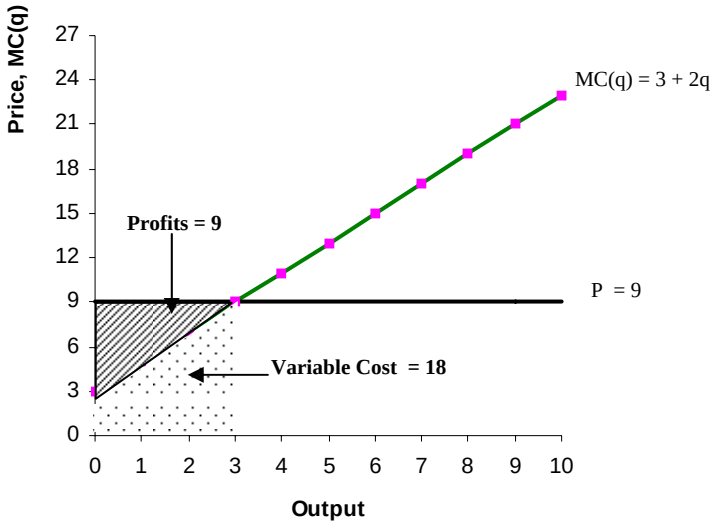
2. a) Maximum profit is realized when P =MC(q). Therefore,

$$3 + 2*q = 9$$
$$\Rightarrow \quad q = 3$$

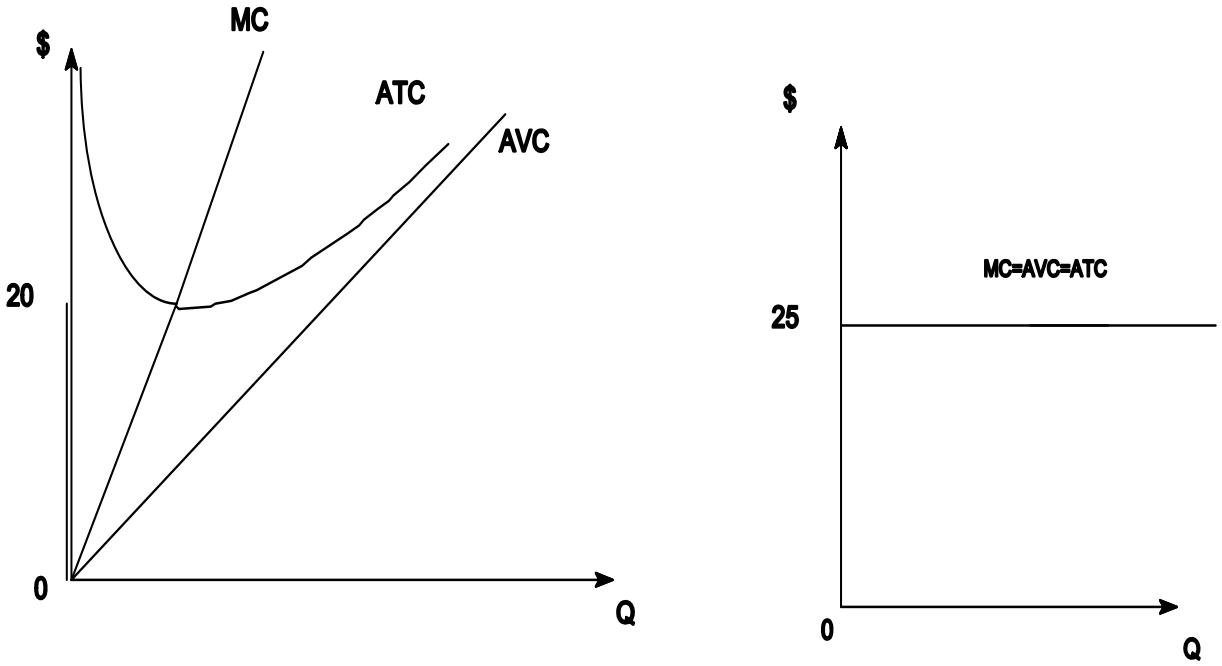
b) Profits = Revenue – Total Cost
= output*price – VC - FC
= 9*3 - 18 – F = 9 - F

Variable cost is area under MC up to q = 3: VC(3) = 3*3 + (3*6)/2 = 18.

We don't have enough information on how large is the fixed cost, so we assume it is F.



3.



a) $TC = Q^2 + 100$, $MC = 2Q$, $AVC = Q$, $ATC = Q + 100/Q$.

b) Short run supply curve is equal to MC for all prices because MC is greater than AVC for all prices. Long run supply curve is equal to MC for all prices above $20. This is the price at which MC>ATC. See graph. For all prices below $20, the long run supply curve will be along the Y-axis (no wheat will be supplied).

c) $P = MR = MC$

$25 = 2Q \quad \Rightarrow \quad Q = 12.5$

$Profit = P*Q - TC = 25*12.5 - 12.5^2 - 100 = 56.25$

d) $TC = 25Q$, $MC = 25$, $AVC = 25$, $ATC = 25$

For prices < $25, the farmer will not supply anything to the market because he will lose money in the short and long run.

For prices > $25, he will supply as much as he possibly can because he makes a profit on each unit he supplies.

e) He will use the new technology for all prices above $25. For all prices above $25, he can make an "infinite" profit under the new technology. For prices below $20 he would choose not to supply any wheat. For prices between $20 and $25, he would lose money with the new technology and make money with the old; therefore for these prices he will use the old technology.