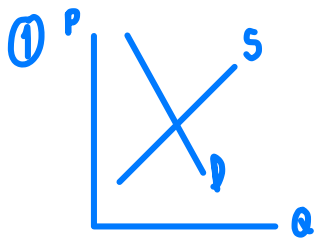


EE320 Placement test

1. Attempt all.
2. Submit your work (in .pdf) on the Moodle. The required format of your filename is **studentID_PT**
3. You will get **TWO** bonus points if you submit this placement test by the deadline.
4. **This placement test is due on Friday 14th, at 11 AM. Late submission will not be accepted.**

1. Suppose that market demand is given by $P = 10 - Q^2$ and the market supply is given by $Q = a + P$, where P is the unit price, Q is the quantity of output, and a is the coefficient in the supply equation.
 - 1.1) Graph the market demand and market supply curve in a P-Q diagram. Set the value of a equal to -14 .
 - 1.2) Solve for the market equilibrium quantity (Q^*) and price (P^*) when $a = -14$. Show your work.
 - 1.3) If " a " increases to -12 , what would happen to the market equilibrium quantity and price? State the qualitative predictions without redoing the algebra.



$$\begin{aligned} D: P &= 10 - Q^2 \\ S: P &= Q - 2 \\ &= Q - 14 \end{aligned}$$

2. Suppose that the revenue function is given by $R(Q) = \ln(Q^2 + 1) + 3\left(\frac{Q}{Q+1}\right)$, $Q \geq 0$. Use the derivative technique and calculate the marginal revenue function. Is the revenue function an increasing or decreasing function?

$$R(Q)' = \left(\ln(Q^2 + 1) + \frac{3Q}{Q+1} \right)$$

$$= \frac{d}{dQ} (\ln(Q^2 + 1)) + \frac{d}{dQ} \left(\frac{3Q}{Q+1} \right)$$

$$= \frac{1}{Q^2 + 1} \times 2Q + \frac{3(Q+1) - 3Q}{(Q+1)^2}$$

$$= \frac{2Q}{Q^2 + 1} + \frac{3}{(Q+1)^2}$$

3. Suppose that the profit function is given by $\pi(Q) = -\frac{1}{3}Q^3 - Q^2 + 8Q - 1$ where Q is the level of output. Use the calculus and solve for the level of profit-maximizing output. Confirm your answer with the second derivative.

$$\pi(Q)' = -Q^2 - 2Q + 8$$

$$\pi(Q)'' = -2Q - 2$$

4. Suppose that $A = \begin{bmatrix} 8 & 9 \\ 10 & 11 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$ and $C = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$, calculate the following object. Show your work.

4.1 $A + B$ $\begin{bmatrix} 8 & 9 \\ 10 & 11 \end{bmatrix} + \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} = \text{undefined}$

4.2 $A * B$ $\begin{bmatrix} 8 & 9 \\ 10 & 11 \end{bmatrix} \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} = \begin{bmatrix} 8+36 & 16+45 & 24+54 \\ 10+44 & 20+55 & 30+66 \end{bmatrix} = \begin{bmatrix} 44 & 61 & 78 \\ 54 & 75 & 96 \end{bmatrix}$

4.3 $\det(A)$

$$\begin{vmatrix} 8 & 9 \\ 10 & 11 \end{vmatrix} = 88 - 90 = -2$$

4.4 $\det(B)$

No answer

4.5 $\det(C)$

$$\begin{vmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{vmatrix}$$

$$\begin{aligned} &= (45 + 84 + 96) - (105 + 48 + 72) \\ &= 225 - 225 \\ &= 0 \end{aligned}$$

5. Suppose that $U(x, y) = x^a y^b + \ln\left(\frac{x}{x+y}\right)$. Use the partial derivative technique, calculate $\frac{\partial U}{\partial x}$ and $\frac{\partial U}{\partial y}$.

$$\begin{aligned} \frac{d\pi(Q)}{dQ} &= -Q^2 - 2Q + 8 = 0 \\ &= -(Q^2 + 2Q - 8) = 0 \\ &= (Q + 4)(Q - 2) = 0 \\ &Q = 2, -4 \end{aligned}$$

$$Q = 2 ; \pi = \frac{25}{3}$$

$$\begin{aligned} \frac{d\pi'(Q)}{dQ} &= 2Q + 2 = 0 \\ &Q = -1 < 0 \end{aligned}$$