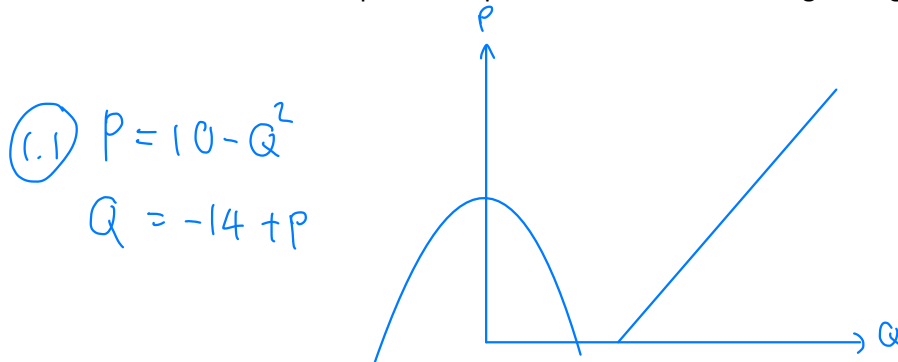


EE320 Placement test

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.



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?

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.

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

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

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

4.1 $A + B$

4.2 $A \cdot B$

$$\begin{bmatrix} (8 \cdot 1) + (9 \cdot 4) & (8 \cdot 2) + (9 \cdot 5) & (8 \cdot 3) + (9 \cdot 6) \\ (10 \cdot 1) + (11 \cdot 4) & (10 \cdot 2) + (11 \cdot 5) & (10 \cdot 3) + (11 \cdot 6) \end{bmatrix} = \begin{bmatrix} 44 & 61 & 78 \\ 54 & 75 & 96 \end{bmatrix}$$

4.3 $\det(A)$

$$(8 \cdot 11) - (10 \cdot 9) = -2$$

4.4 $\det(B)$

$$(5 + 12) - (8 + 15) = -6$$

4.5 $\det(C)$

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

$$(45 + 84 + 96) - (105 + 48 + 72)$$

$$= 225 - 225$$

$$= 0$$

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 $\frac{\partial U}{\partial y}$.