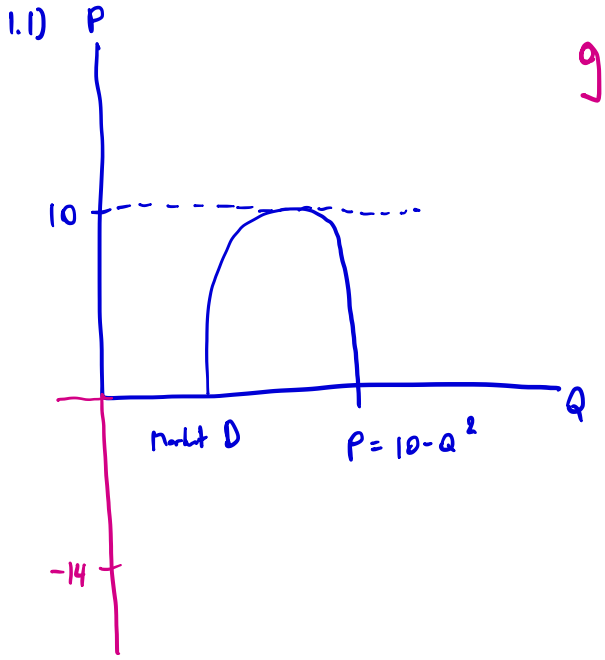
EE320 Placement test

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.

Market D => $P = 10 - Q^2$

Market S => $P = a - Q$ (a = -14)



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?

$\frac{1}{Q^2+1}$

$$R'(Q) = \frac{1}{Q^2+1}(2Q) + 3 \cdot \frac{1}{(Q+1)^2}$$ ใช้กฎผลหาร บน - บน อนุพันธ์ล่าง / (ล่าง)^2

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

Let $Q=0$; $\frac{2(0)}{0^2+1} + \frac{3}{(0+1)^2} = 3$ which $3>0$ $\therefore$ The reverse function is an increasing function.

3. Suppose that the profit function is given by $\pi(Q) = -\frac{1}{3}Q^3 - Q^2 + 8Q - 1$ (= 0) 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.

$\pi'(Q) = -\frac{3}{3}Q^2 - 2Q + 8$

$= -Q^2 - 2Q + 8$

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

lets $\pi'Q = 0$; $0 = -2Q - 2$

$\frac{2}{-2} = Q$

$-1 = Q$ //

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

Cannot

4.2 A*B

$\begin{bmatrix} 44 & 61 & 78 \\ 54 & 75 & 96 \end{bmatrix}$

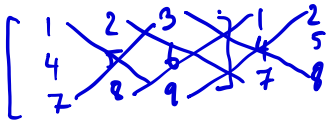
4.3 det(A)

$\begin{bmatrix} 8 & 9 \\ 10 & 11 \end{bmatrix} = 8(11) - 10(9) = -2$

4.4 det(B)

Cannot

4.5 det(C)



$= (45 + 84 + 96) - (105 + 48 + 72) = 0$

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

↳ $\ln(x) - \ln(x+y)$

$$U(x,y) = x^a y^b + \ln(x) - \ln(x+y)$$

$$\frac{\partial U}{\partial x} = a x^{a-1} y^b + \frac{1}{x} - \frac{1}{x+y}$$

$$\frac{\partial U}{\partial y} = b y^{b-1} a^x - \frac{1}{x+y}$$