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Q4

$Q^d = 100 - 10P$

$Q^s = 10P$

and price ceiling imposed with $P = 3$.

(a.) initial equilibrium,

$Q^d = Q^s$

$\therefore 100 - 10P = 10P$

$\therefore \boxed{P_{e_1} = 100/20 = 5}$

and, $Q_{e_1} = 100 - 10(5)$

$\therefore \boxed{Q_{e_1} = 50}$

now, with price ceiling of $P=3$,

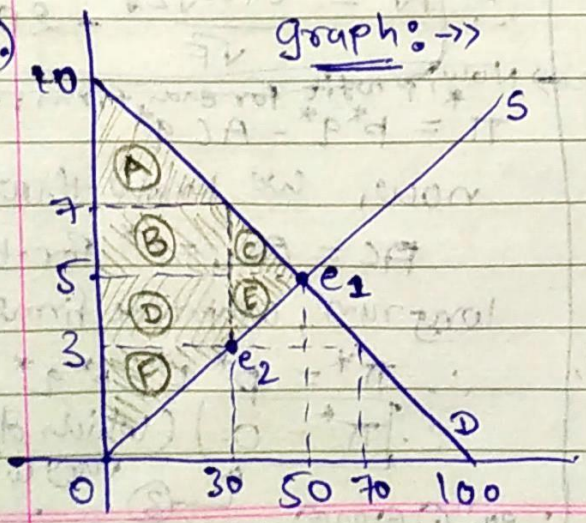
$Q^d = 100 - 10(3) = 70$

and $Q^s = 10(3) = 30$

$\therefore$ Excess demand $= 70 - 30 = 40$ units

$\therefore$ This shows how equilibrium changes with new $\boxed{Q_{e_2} = 30}$ and $\boxed{P_{e_2} = 3}$.

(b.) graph :→



→ so, we have plotted our both equilibriums e1 & e2 in the graph.

→ now, we have to find the effect of this price ceiling on the consumer surplus (CS) producer surplus (PS) and dead-weight loss (DWL), and total surplus (TS).

Previous Equilibrium e1 :

$CS = \text{Area}(A+B+C) = \frac{1}{2} \times 50 \times 5 = 125$

$PS = \text{Area}(D+E+F) = \frac{1}{2} \times 50 \times 5 = 125$

$\therefore TS = CS + PS = 125 + 125 = 250$

& $DWL = 0$.

New equilibrium e2 (after Price ceiling) :

$CS = \text{Area}(A+B+D) = \left(\frac{1}{2} \times 30 \times 3\right) + (4 \times 30)$

$= 45 + 120 = 165$

$PS = \text{Area}(F) = \frac{1}{2} \times 30 \times 3 = 45$

$\therefore TS = CS + PS = 165 + 45 = 210$

& $DWL = \text{Area}(C+E) = \left(\frac{1}{2} \times 20 \times 2\right) + \left(\frac{1}{2} \times 20 \times 2\right)$

$= 20 + 20 = 40$

$\therefore$ changes in surpluses and DWL due to price ceiling :-

$\Delta CS = 165 - 125 = 40$

$\Delta PS = 45 - 125 = (-80)$

$\Delta TS = 210 - 250 = (-40)$

$\Delta DWL = 40 - 0 = 40$

Answer