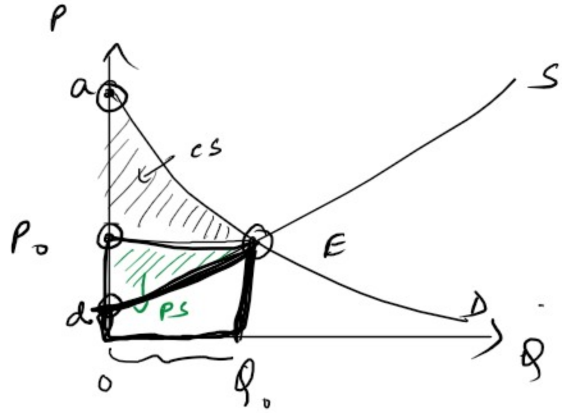
Application in Perfectly competitive market:

Topic 4: Consumer Surplus and Producer Surplus



CS = area aP_0E

$$CS = \int_0^{Q_0} D(Q)\,dQ - (OP_0 \times OQ_0)$$

PS = area dP_0E

$$= (OP_0 \times OQ_0) - \int_0^{Q_0} S(Q)\,dQ$$

Q) Suppose that the market for milk can be represented by the following equations

Demand : $P = 12 - 0.5Q_D$

Supply : $P = 0.1Q_S$

In equilibrium, $Q_D = Q_S = Q$
D = S

$12 - 0.5Q = 0.1Q$

$12 = 0.5Q + 0.1Q$

$Q = 12/0.6 = 20$

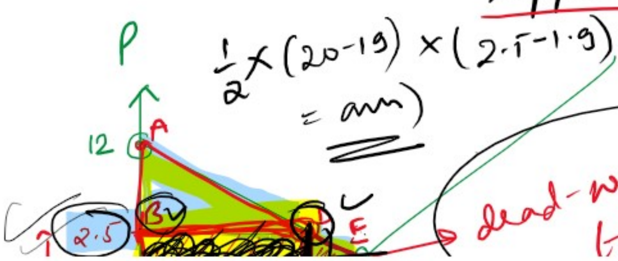
(a) Calculate equilibrium price & quantity. [Q = 20 gallon of milk, P = \$2]

$\therefore P = 0.1Q = 0.1 \times 20 = \$2$

(b) To help the farmers, govt sets a minimum price of \$2.50 per gallon of milk. What is the new quantity of milk sold in the market place?

(c) Calculate how the consumer surplus and producer surplus change after the price supports are enacted.

$\frac{1}{2} \times (20-19) \times (2.5-1.9)$
= ans)



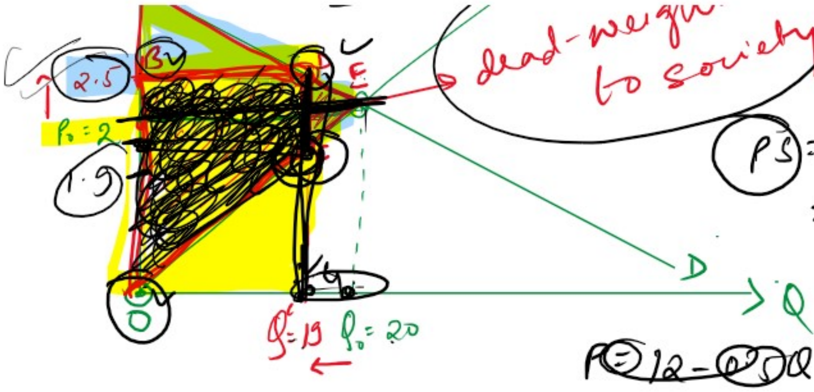
dead-weight loss to society.

area DEF

Demand: $P = 12 - 0.5Q$

$2.5 = 12 - 0.5Q$

$0.5Q = 12 - 2.5$



area DEF

$2.5 = 12 - 0.5Q$

$0.5Q = 12 - 2.5$

$0.5Q = 9.50$

$Q = \frac{9.50}{0.5} = \frac{95}{5} = 19$ gallons

$PS = BOFD$

$= OBEG - OFG$

$P = 12 - 0.5Q$ $\quad P = 0.1Q_S$

$= 0.1 \times 19 = 1.9$

(Before Price support) $CS = $ area ACE

$$= \int_0^{Q} D(Q)\,dQ - (P_0 \times Q_0)$$

$$= \int_0^{20} (12 - 0.5Q)\,dQ - (2 \times 20)$$

$$= 12\,[Q]_0^{20} - 0.5\,\frac{[Q^2]_0^{20}}{2} - 40$$

$$= 12\,[20 - 0] - \frac{0.5}{2}\,[20^2] - 40$$

$$= (12 \times 20) - (0.5 \times 20 \times 10) - 40$$

$$= 240 - 100 - 40$$

$$= 240 - 140$$

$$\boxed{CS = 100}$$

Producer's Surplus, $PS = $ area OCE

$$= P_0 \times Q_0 - \int_0^{Q_0} S(Q)\,dQ$$

$$= (2 \times 20) - \int_0^{20} (0.1Q)\,dQ$$

$$= 40 - 0.1\left[\frac{Q^2}{2}\right]_0^{20}$$

$$= 40 - \frac{0.1}{2}\,[20]^2$$

$$= 40 - 0.1 \times 20 \times 10$$

$$= 40 - 20$$

$$\boxed{PS = 20}$$

$SW = CS + PS = 100 + 20 = 120$ (Before Govt intervention through price support)

CS after price ceiling is $\int_0^{19} D(Q)\,dq - P_0 \times Q_0$

$$= \int_0^{19} (12 - 0.5)\,dQ - (2.5 \times 19)$$

$$= 12[Q]_0^{19} - \frac{0.5}{2}\left[Q^2\right]_0^{19} - 47.5$$

$$= (12 \times 19) - \left(\frac{0.5}{2} \times 19^2\right) - (47.5)$$

$$= 90.25$$

Change in consumer surplus is $-100 + 90.25$

$$\Delta CS = -89.75$$

PS after Price support is $P \times Q - \int_0^{19} S(Q)\,dQ$

$$= 2.5 \times 19 - \int_0^{19} (0.1Q)\,dQ$$

$$= 47.5 - 0.1\left[\frac{Q^2}{2}\right]_0^{19}$$

$$= 47.5 - \frac{0.1}{2} \times 19^2$$

$$= 4.1.5 - \frac{0.1}{2} \times 19^2$$
$$= 29.45$$

change in PS $= 29.45 - 20$

$= 9.45$