$\pi = -10q + 2000 [\$]$

(1.) (a). max consumption of these consumers;

when π (price) is 0

$$0 = -10q + 2000$$

$$\frac{-2000}{-10} = q$$

$$q = 200$$

(b). price that no consumer is prepared to pay:

; when $q = 0$

$$\pi = -10(0) + 2000 [\$]$$

$$\pi = 2000 \$/\text{widget}$$

(c). max consumers surplus equals;

$\frac{1}{2} \times 2000 \times 200 = 200,000$; $\int -10q + 2000 = \left[-5q^2 + 2000q\right]_0^{200} = 200,000$

consumers won't be able to realize this as ~~consumers~~ producers won't be willing to sell at this zero price.

(d). $\pi = \$1000/\text{unit}$

(i) consumption: $1000 = -10(q) + 2000$

$$-1000 = -10q$$

$$q = 100$$

(ii) consumers gross surplus: $-5(100)^2 + 2000(100)$

$$= 150,000$$

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(d).

(iii) Producers revenue:

$$\pi \times q = 1000 \times 100 = \$100,000$$

(iv) consumer net surplus:

c. gross surplus − prod. revenue

150,000 − 100,000

= \$50,000

(e). π increased 20%

(i) $\pi^* = 1.2p$

new consumption : $q^* = \frac{2000 - \pi^*}{10} = \frac{2000 - 1.2\pi}{10}$

$$q^* = \frac{2000 - 1.2(1000)}{10} = 80$$

(ii)

revenue : $\pi \times q$

$= 1.2(1000) \times q$

$= 1200 \times 80$

$= \$96,000$

(f.) price elasticity of demand;

$\pi = 1000$

$$q = \frac{\pi - 2000}{-10}$$

$$q = \frac{1000-2000}{-10}$$

$$q = 100$$

$$\frac{dq}{d\pi} = \frac{-1}{10}$$

$$\varepsilon = \frac{\pi}{q}\frac{dq}{d\pi}$$

$$= \frac{1000}{100} \cdot \left(-\frac{1}{10}\right)$$

$$= -1$$

(g.) gross consumers surplus; (Demand)

$$= \int_0^q (-10q + 2000)\,dq = -5q^2 + 2000q$$

net consumer surplus:

(gross surplus - expenditure)

$$= (-5q^2 + 2000q) - ((-10q + 2000)q = 5q^2$$

(h.) ~~net~~ gross consumers' surplus. (Price) $q = (\pi - 2000)/-10$

(i) $-5q^2 + 2000q$

$$= -5\left(\frac{2000-\pi}{10}\right)^2 + 2000\left(\frac{2000-\pi}{10}\right)$$

$$= 200{,}000 - 0.05\pi^2$$

(ii) net CS = gross CS $- \pi q$

$$200{,}000 - 0.05\pi^2 - \frac{\pi(2000-\pi)}{10}$$

$$= 0.05(2000-\pi)^2$$

$$= 200{,}000 - 200\pi + 0.05\pi^2$$

(2.3) $q = 0.2\pi - 40$

a) demand, $q_d = \dfrac{2000 - \pi}{10} = 200 - 0.1\pi$

supply, $q_s = 0.2\pi - 40$

At market equilibrium:

$$200 - 0.1\pi = 0.2\pi - 40$$
$$240 = 0.3\pi$$
$$\pi^* = \frac{240}{0.3} = \$800$$

$q^* = 200 - 0.1(800) = 200 - 80 = 120$ units

b). consumers' gross surplus

(i) $-5q^2 + 2000q = -5(120)^2 + 2000(120)$
$= \$168{,}000$

(ii) Consumer's Net Surplus : gross CS $- \pi^* . q^*$

$168{,}000 - (800 \times 120) = \$72{,}000$

(iii) producer's revenue: $\pi^* \times q^* = 800 \times 120 = \$96{,}000$

(iv) producer's profit : Total cost: $\int_0^q (5q + 200)\,dq = \frac{5}{2}q^2 + 200q$

$q = 120$, total cost: $36{,}000 + 24{,}000 = \$60{,}000$

profit = revenue − total cost
$= 96{,}000 - 60{,}000 = \$36{,}000$

total surplus (global welfare): consumers net surplus
+ producers profit

= 72,000 + 36,000 = $108,000

= total surplus.