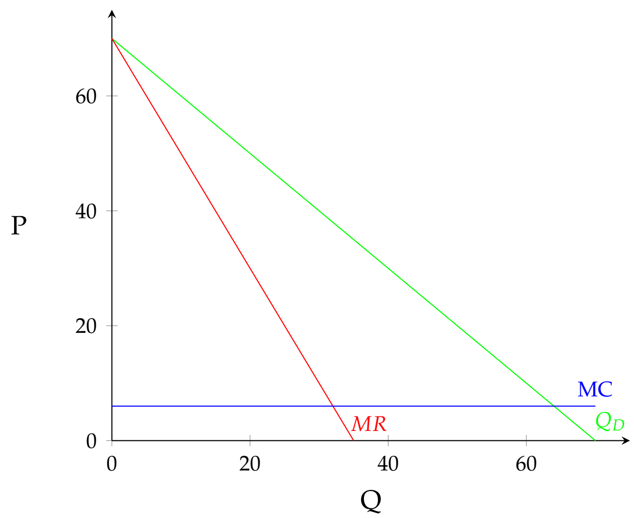
1

Given:

$$Q_D = 70 - P \tag{1}$$
$$AC = MC = 6 \tag{2}$$

1.a

The inverse demand would be $P = 70 - Q_D$. Since we are given that we are analyzing a monopolist and are provided the subsequent demand function, we know the marginal revenue curve is simply twice the slope of the market demand curve: $MR = 70 - 2Q$.



Additionally, to maximize profit, the monopolist will produce when $MR = MC$:

$$MR = MC \tag{1}$$
$$70 - 2Q = 6 \tag{2}$$
$$Q^* = 32 \tag{3}$$

Plugging this quantity back into our demand function, we will obtain the monopolist's price:

$$P^* = 70 - Q^* \tag{1}$$
$$= 70 - 32 \tag{2}$$
$$P^* = 38 \tag{3}$$

Therefore, we can now calculate the total profit the monopolist will receive:

$$\pi = P(Q)Q - MC(Q)Q \tag{1}$$
$$= 38(32) - 6(32) \tag{2}$$
$$\pi = \$1024 \tag{3}$$

1.b

Given that the new total cost function is: $C(Q) = 0.25Q^2 - 5Q + 300$. Marginal cost would then be $MC = 0.5Q - 5$. Again, to maximize profit, we would still need to satisfy the condition $MR = MC$:

$$MR = MC \tag{1}$$
$$70 - 2Q = 0.5Q - 5 \tag{2}$$
$$75 = \frac{5}{2}Q \tag{3}$$
$$Q^* = 30 \tag{4}$$

and the corresponding price would be:

$$P^* = 70 - Q^* \quad (1)$$
$$= 70 - 30 \quad (2)$$
$$P^* = 40 \quad (3)$$

Therefore, the new profits would be:

$$\pi = P(Q)Q - MC(Q)Q \quad (1)$$
$$= 40(30) - 0.25(30^2) - 5(30) + 300 \quad (2)$$
$$\pi = \$825 \quad (3)$$

2

Given:

$$TC = 20Q \quad (1)$$
$$\text{Inverse demand: } P_D = 100 - 2Q \quad (2)$$

2.a

The marginal revenue, again, for a monopolist would be twice the slope of the inverse demand function: $MR = 100 - 4Q$. Marginal cost would be $MC = \frac{dTC(Q)}{dQ} = 20$. Therefore, to find the quantity the monopoly would produce, we set $MR = MC$:

$$MR = MC \quad (1)$$
$$100 - 4Q = 20 \quad (2)$$
$$Q^* = 20 \quad (3)$$

$$P^* = 100 - 2(Q) \quad (1)$$
$$= 100 - 2(20) \quad (2)$$
$$P^* = 60 \quad (3)$$

2.b

$$L = \frac{P - MC}{P} \quad (1)$$
$$= \frac{60 - 20}{60} \quad (2)$$
$$L = \frac{2}{3} \quad (3)$$

2.c

Pareto optimal level would be at perfect competition where $P = MC$, or $P^* = \$20$. Plugging this price back into the market demand, we can obtain the Pareto market quantity:

$$P = 100 - 2q \quad (1)$$
$$q = 50 - \frac{P^*}{2} \quad (2)$$
$$q = 50 - 10 \quad (3)$$
$$q^* = 40 \quad (4)$$

2.d

$$CS = \frac{1}{2}(100 - 60)(20) \quad (1)$$
$$= 400 \quad (2)$$

$$PS = (60 - 20)(20) \qquad = 800 \quad (1)$$

$$DWL = \frac{1}{2}(60 - 20)(40 - 20) \quad (1)$$
$$= 400 \quad (2)$$

2.e

$$CS' = \frac{1}{2}(100 - 20)(40) \quad (1)$$
$$= 1600 \quad (2)$$

$$PS' = 0 \quad (1)$$

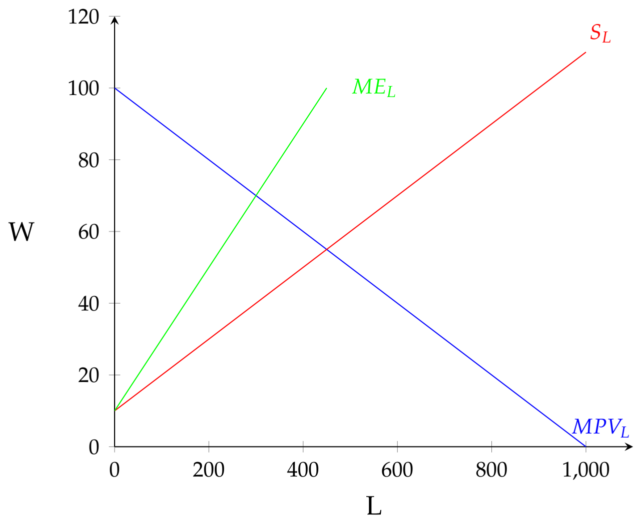
Under monopoly, consumers, therefore, lost 1200 surplus, 800 of which is gained by producers and 400 of which is dead-weight loss.

3

Given:

$$W_D = 100 - \frac{L}{10} \quad (1)$$
$$W_S = 10 + \frac{L}{10} \quad (2)$$

The marginal expenditure would be twice the slope of the labor supply function: $ME_L = 10 + \frac{L}{5}$



3.a

To solve for the monopolistic salary, we would need to solve for labor where the ME_L intersects with W_D:

$$W_D = 100 - \frac{L}{10} = MFC_S = 10 + \frac{L}{5} \quad (1)$$
$$100 - \frac{L}{10} = 10 + \frac{L}{5} \quad (2)$$
$$1000 - L = 100 + 2L \quad (3)$$
$$900 = 3L \quad (4)$$
$$L = 300 \quad (5)$$

We can plug this labor quantity into our W_S to find the wage rate:

$$W_S = 10 + \frac{L}{10} \quad (1)$$
$$= 10 + \frac{300}{10} \quad (2)$$
$$= 40 * 1000 = \$40000 \quad (3)$$

The perfectly competitive salary would simply be where W_S meets W_D:

$$W_D = 100 - \frac{L}{10} = W_S = 10 + \frac{L}{10} \quad (1)$$
$$100 - \frac{L}{10} = 10 + \frac{L}{10} \quad (2)$$
$$1000 - L = 100 + L \quad (3)$$
$$900 = 2L \quad (4)$$
$$L = 450 \quad (5)$$

and the corresponding wage rate would be:

$$W_D = 100 - \frac{L}{10} \quad (1)$$
$$= 100 - \frac{450}{10} \quad (2)$$
$$= 55 * 1000 = \$55000 \quad (3)$$

3.b

The rate of exploitation would be $\frac{70-40}{70} \times 100 = 42.86$.

3.c

Employer surplus (ES) under monopsony would be given as:

$$WS = \frac{1}{2}(100-70)(300) + (70-40)300 \quad (1)$$
$$= 4500 + 9000 \quad (2)$$
$$= 13500 \quad (3)$$

Worker surplus (WS) under monopsony would be given as:

$$ES = \frac{1}{2}(40-10)(300) \quad (1)$$
$$= 4500 \quad (2)$$

Dead-weight loss (DWL) under monopsony would be given as:

$$DWL = \frac{1}{2}(70-40)(450-300) \quad (1)$$
$$= 2250 \quad (2)$$

3.d

$$W_S = 10 + \frac{L}{10} \quad (1)$$
$$45 = 10 + \frac{L}{10} \quad (2)$$
$$L = 350 \quad (3)$$

$$WS' = \frac{1}{2}(100 - 65)(350) + (65 - 45)(350) \quad (1)$$
$$= 6125 + 7000 \quad (2)$$
$$= 13125 \quad (3)$$

$$ES' = \frac{1}{2}(45 - 10)(350) \quad (1)$$
$$= 6125 \quad (2)$$

$$DWL' = \frac{1}{2}(65 - 45)(450 - 350) \quad (1)$$
$$= 1000 \quad (2)$$

3.e

The range would be from any wage above the monopolistic wage up past the competitive wage past the competitive wage until the wage reaches a point where it reaches the employment level of the monopolistic wage. The range would be from $40,000 up until $70,000.

4

Given:

$$TOC = 0.5q^2 + 10q \quad (1)$$
$$N^2 = 0.5w \quad (2)$$
$$TC = 0.5q^2 + 10q + w \quad (3)$$

4.a

Given:

$$Q_D = 1500 - 50P \quad (1)$$

First, we need to find the equilibrium for entrepreneurs:

$$Q_s^e = \sqrt{\frac{1}{2}w} \quad (1)$$
$$Q_d^e = n \quad (2)$$
$$Q_s^e = Q_d^e \quad (3)$$
$$\sqrt{\frac{1}{2}w} = n \quad (4)$$
$$\frac{w}{2} = n^2 \quad (5)$$
$$w = 2n^2 \quad (6)$$

We can now replace w in our total cost function in terms of n number of firms:

$$TC = \frac{1}{2}q^2 + 10q + 2n^2 \quad (1)$$
$$MC = q + 10 \quad (2)$$
$$AC = \frac{1}{2}q + 10 + \frac{2n^2}{q} \quad (3)$$

Setting $MC = AC$, we get:

$$MC = AC \quad (1)$$
$$q + 10 = \frac{1}{2}q + 10 + \frac{2n^2}{q} \quad (2)$$
$$\frac{1}{2}q^2 = 2n^2 \quad (3)$$
$$\frac{1}{4}q^2 = n^2 \quad (4)$$
$$q = 2n \quad (5)$$

The quantity supplied would, therefore, be:

$$Q_s = nq = n(2n) = 2n^2 \quad (1)$$

Additionally, because $P = MC$, we can find the price in terms of number of firms as:

$$P = MC \quad (1)$$
$$P = q + 10 \quad (2)$$
$$q = P - 10 \quad (3)$$
$$Q_s = np = n(P - 10) \quad (4)$$
$$2n^2 = n(P - 10) \quad (5)$$
$$2n = P - 10 \quad (6)$$
$$P = 2n + 10 \quad (7)$$

Plugging this into our given demand function:

$$Q_D = 1500 - 50P \quad (1)$$
$$= 1500 - 50(2n + 10) \quad (2)$$
$$= 1000 - 100n \quad (3)$$

Setting our demand and supply equal to each other:

$$1000 - 100n = 2n^2 \quad (1)$$
$$2n^2 + 100n - 1000 = 0 \quad (2)$$
$$2(n^2 + 50n - 500) = 0 \quad (3)$$
$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad (4)$$
$$\frac{-50 \pm \sqrt{50^2 - 4(1)(-500)}}{2(1)} \quad (5)$$
$$\frac{-50 \pm 67.08}{2} \quad (6)$$
$$n = 8.54 \quad (7)$$

There would be 8.54 number of firms. Price would then be $P = 2n + 10 = 2(8.54) + 10 = \$27.08$. Industry output would be $2n^2 = 2(8.54^2) = 145.86$ units. Individual firm output would be $\frac{Q}{n} = \frac{145.86}{8.54} = 17.08$ units.

4.b

$$\pi = P(q)q - MC(q)q \quad (1)$$
$$= (27.08)(17.08) - (17.08 + 10)(17.08) \quad (2)$$
$$\pi = 0 \quad (3)$$

$$PS = \frac{1}{2}(27.08 - 10)(145.86) \quad (1)$$
$$= 1245.64 \quad (2)$$

$$CS = \frac{1}{2}(30 - 27.08)(145.86) \quad (1)$$
$$= 212.96 \quad (2)$$

Total surplus would be the sum of CS and PS: $1245.64 + 212.96 = 1458.6$.

4.c

Under monopoly, $MR = MC$ and the marginal revenue curve would be the twice the slope of the demand curve which would be:

$$MR = 30 - \frac{Q}{25} = Q + 10 \quad (1)$$
$$750 - Q = 25Q + 250 \quad (2)$$
$$Q = 19.23 \quad (3)$$

Then, since $P = q + 10 = 19.23 + 10 = \$29.23$.

$$CS = \frac{1}{2}(30 - 29.23)(19.23) \quad (1)$$
$$= 7.40 \quad (2)$$

$$PS = \frac{1}{2}(29.23 - 10)(19.23) \quad (1)$$
$$= 184.90 \quad (2)$$

Under monopoly, we see quantity supplied decreases from 145.86 down to 19.23, price increases from \$27.08 to \$29.23, consumer surplus decreases from 212.96 to 7.4, and producer surplus also decreases from 1245.64 down to 184.9.