1 Q1

(a)
- Nominal GDP of 2022 $= (P^A_{2022} \times Q^A_{2022}) + (P^B_{2022} \times Q^B_{2022})$
  $= 10 \times 100 + 5 \times 100 = 1500$

- Real GDP of 2022 $= (P^A_{2022} \times Q^A_{2022}) + (P^B_{2022} \times Q^B_{2022})$
  $= 10 \times 100 + 5 \times 100 = 1500$

- Nominal GDP of 2023 $= (P^A_{2023} \times Q^A_{2023}) + (P^B_{2023} \times Q^B_{2023})$
  $= 15 \times 200 + 10 \times 150 = 4500$

- Real GDP of 2022 $= (P^A_{2022} \times Q^A_{2023}) + (P^B_{2022} \times Q^B_{2023})$
  $= 10 \times 200 + 5 \times 150 = 2750$

(b)
- GDP deflator of 2022 $= \frac{\text{Nominal GDP}_{2022}}{\text{Real GDP}_{2022}} \times 100$
  $= \frac{1500}{1500} \times 100 = 100$

- GDP deflator of 2023 $= \frac{4500}{2750} \times 100 = \frac{1800}{11} \approx 163$

- inflation rate $= \frac{\text{GDP Deflator}_{2023} - \text{GDP Deflator}_{2022}}{\text{GDP Deflator}_{2022}} \times 100\%$
  $= \frac{163-100}{100} \times 100\% = 63\%$

(c) No, the inflation rate will not change (or , if you calculate the inflation rate and get 67%, it is also correct)

(d) GDP deflator measures the price changes of all final goods and services produced in an economy while CPI measures the price changes of a fixed basket of goods and services purchased by consumers. And goods that made by foreign country will not be in GDP therefore not in GDP deflator, but these goods may appear in CPI

2 Q2

(a) The cost of living in 2022 of individual 1 $= 10 \times 3 + 5 \times 1 = 35$ and cost of living in 2023 $= 15 \times 3 + 10 \times 1 = 55$, Therefore, the cost of living increase by $\frac{55-35}{35} \approx 57\%$ (or , if you answer 20 is also correct)

(b) The cost of living of whole economy is the mean cost of living of individual 1 and 2. Therefore, the average consumption of the economy $(Q^A, Q^B) = (2, 2)$. Therefore, the cost of living of 2022 $= 10 \times 2 + 5 \times 2 = 30$ and cost of living in 2023 $= 15 \times 2 + 10 \times 2 = 50$, Therefore, the cost of living increase by $\frac{50-30}{30} \approx 67\%$
(or, if you answer 20 or 40 is also correct)

3 Q3

(a) Slove the equation, we get $(P^*, Q^*) = (5, 110)$

(b) The tax increase shift the supply curve to

$$Q_s = 90 + 4(P - 15)$$

and we slove the new equation , we get$(P^*, Q^*) = (15, 90)$

4 Q4

(a) we have two budget constraints

$$n + l = h$$

and

$$c = wn + \pi - T$$

we combine these two by substitute n by $n = h - l$ and we get the following :

$$c = w(h - l) + \pi - T$$

which is the answer

(b)

$$\max_{c,l} \quad u(c, l) \quad \text{s.t.} \quad c = w(h - l) + \pi - T$$

and the optimal condition

$$\text{MRS}_{c,l} = -\frac{MU_l}{MU_c} = -\frac{\frac{\partial u}{\partial l}}{\frac{\partial u}{\partial c}} = w$$

The intuition is that MU_l is the benefit of increasing one unit of leisure, and wMU_c is the cost of gaining one more unit of leisure. If $MU_l > wMU_c$ the agent should consume more leisure because the benefit is greater than the cost. And if $MU_l < wMU_c$ the agent should work more because the benefit is less than the cost. It is optimal when $MU_l = wMU_c$ because regardless of whether the agent chooses to spend more time on leisure or work, the utility remains the same.

(c) by the optimal condition, we know that

$$\frac{\frac{3}{l}}{\frac{5}{c}} = w$$

then

$$3c = 5lw$$

we slove it with the budget constraint

$$\begin{cases} 3c = 5lw \\ c = w(h-l) + \pi - T \end{cases}$$

and the result is

$$c^* = \frac{5}{8}(hw + \pi - T)$$

$$l^* = \frac{3}{8}(\frac{hw + \pi - T}{w})$$