**1st Question:**

The hydraulic grade line must not cross the water transmission line and it should be adjusted to a slope, so that it is steep as possible. All the possible peak points of the line are checked:

\[ J_N = \frac{(300 - 282)}{(300 + 250 + 250)} = 0.0225 \]

\[ J_M = \frac{(300 - 277.85)}{(300 + 250 + 250 + 500)} = 0.0170 \]

The HGL should pass over M, so the slope is \( J = J_M = 0.0170 \). If \( \alpha \) is assumed to be 0.04;

\[ J = \frac{f}{D} \frac{V^2}{2g} = 0.04 \times \frac{V^2}{0.15 \times 2 \times 9.81} = 0.0170 \]

\[ V = 1.12 \text{ m/s} \]

\[ Q = V \times A = 1.12 \times 0.15^2 \times \pi / 4 = 0.020 \text{ m}^3/\text{s}. \]

\[ \text{max } Q_{\text{day}} = 150 \times 1.5 \times 10000 / 86400 / 1000 = 0.026 \text{ m}^3/\text{s}. \]

\( Q < \text{max } Q_{\text{day}} \)

The transmission line is not sufficient.
2\textsuperscript{nd} Question:


The maximum allowable pressure on the pipeline is 80 m, so a P. D. R. (pressure decrease room) is necessary. The elevation of the PDR can be found,

\[ H_{PDR} = 230 - 80 = 150 \text{ m}. \]

Then the design discharge for the water transmission line must be found:

\[ Q = 165 \times 9800 / 86400 = 18.7 \text{ lt/s} \]

The maximum allowable velocity through the pipeline is 2 m/s, so the diameter of the pipeline can be at most:

\[ Q = V \times A \quad 0.0187 = 2 \times D^2 \times \pi / 4 \quad D = 109 \text{ mm}. \]

As we cannot tolerate a higher velocity \( D > 109 \text{ mm}. \) Considering the standard pipe diameters, \( D = 125 \text{ mm}. \)

\[ Q = V \times A = V \times 0.125^2 \times \pi / 4 = 0.0187 \text{ m}^3/\text{s} \]

\[ V = 1.52 \text{ m/s}. \]

\[ J = \frac{f \times V^2}{D \times 2g} = 0.04 \times \frac{1.52^2}{0.125 \times 2 \times 9.81} = 0.037 \]

With this information, the H.G.L is drawn on the figure.

The dissipation values will be found accordingly:

\( (P/\gamma)_1 = 230 - 0.037 \times (900+500+200) - 150 = 20.8 \text{ m} \)

\( (P/\gamma)_2 = 150 - 0.037 \times (1000+300) - 95 = 6.9 \text{ m} \)