1. (1) The effect on the revenues of the monopolist due to a marginal increase in the amount of the input is called the marginal revenue product. The revenues of the monopolist is \( r(y) = p(y) y \), which can be rewritten as a function of the factor employment: \( R(x) = p(f(x)) f(x) \).

We calculate the marginal revenue product, \( MRP_x \), by differentiating this expression with respect to \( x \). Using the chain rule, we have

\[
MRP_x = \frac{dR(x)}{dx} = p(f(x)) f''(x) + p'(f(x)) f'(x) f(x)
\]

\[
= [p(f(x)) + p'(f(x)) f(x)] f'(x)
\]

\[
= [p(y) + p'(y) y] f'(x)
\]

\[
= MR_y \times MP_x,
\]

where \( MR_y \) denotes the marginal revenue and \( MP_x \) denotes the marginal product of the factor. (Note that \( MR_y = dr(y)/dy = p(y) + p'(y) y \).)

(2) For the monopolist, the marginal revenue product is always smaller than the value of the marginal product, \( pMP_x \), due to the fact that the marginal revenue from increasing output is always less than price. In terms of the symbols, we have

\[
MRP_x = p(y) (1 - 1/|\epsilon|) MP_x \leq pMP_x,
\]

where \( \epsilon \) is the price elasticity of demand. As long as the demand function is not perfectly elastic, the \( MRP_x \) is strictly less than \( pMP_x \).

2. (1) Let \( W^* \) and \( L^* \) represent the equilibrium levels for \( W \) and \( L \), respectively. Solving \( -50W^* + 450 = 100W^* \) for \( W^* \), we obtain \( W^* = 3 \).

Next, substituting this equilibrium wage into either the demand function or the supply function, we obtain \( L^* = 300 \).

(2) Let \( s \) denote the subsidy offered to employers for each person hired. Then demand for labor is given by

\[
L = -50(W - s) + 450.
\]

At \( W = 4 \), the quantity demanded of labor is equal to \( -50(4 - s) + 450 \), and the quantity supplied of labor is 400.
Equating these two quantities yields $s^* = 3$,
where $s^*$ denotes the subsidy needed to raise the equilibrium wage to $4$.

The new equilibrium level of employment is 400.
Toal subsidy paid is 1200.

(3) At $W = 4$, the quantity demanded of labor is equal to 250,
and the quantity supplied of labor is 400.
With a minimum wage of $4 per hour, the minimum wage is binding.
Thus the quantity actually bought of labor is 250,
and the unemployment is 150.

3. You can answer this question using panel B of Figure 27.3 on page 511 of the text.