<div align="center">

Labor Demand and MP$_L$[1]

In-Class Problem[2]

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Let's assume that a labor demand (L$_D$) curve is parameterized by the equation L$_D$ = 350 – 12.5W and that ME$_L$ in a competitive labor market is equal to $16 per hour.   Let's also suppose that the reservation wage for workers in this market is >= $10 and that the price of the good being produced is $2.

  a) **Show the labor demand relation, including the equilibrium price and quantity of labor on a properly labeled labor market model, and accurately specify the labor supply curve (L$_S$) including the equation, it's slope and its placement in the model (you can assume L$_S$ is linear).**

Labor Demand: in competition
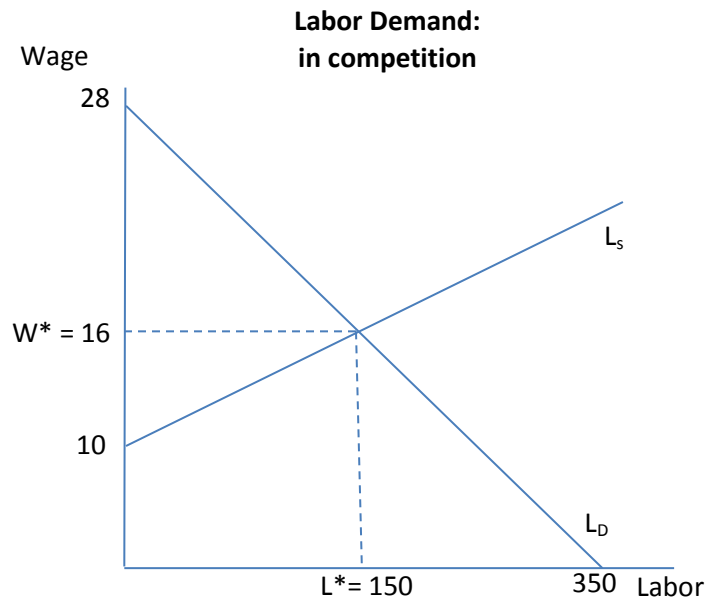
To get this we need to recall one of the profit maximizing conditions for labor in a competitive labor market: ME$_L$ = W. So, if ME$_L$ = $16, then W = $16 and since this is presented in a competitive market it also means that W* = 16. To find L* we simply substitute W* for W into the labor demand equation and solve for L$_D$

L$_D$ = 350 – 12.5W   (1)

L$_D$ = 350 – 12.5(16) = 150 = L*   (2)

Since we're told that the reservation wage is >= $10, this tells us that at or below $10, workers aren't willing to work. Since these workers are the supply of labor this gives us a hint as to where the labor supply curve intersects the Wage axis, at 10.

We know that the slope of $L_S = \frac{\text{rise}}{\text{run}}$ and we can see from the graph we completed with the given data, that L_S rises from 10 to 16 as labor changes from 0 to 150, which equates to a $\frac{\text{rise}}{\text{run}}$ as follows:

$$\frac{W_2 - W_1}{L_2 - L_1} = \frac{16 - 10}{150 - 0} = \frac{6}{150} \qquad (3)$$

So the slope of labor supply is $\frac{1}{25}$.

If we've determined the intercept on the Wage axis is 10 and the slope is $\frac{1}{25}$, then we know that this yields an in labor supply equation of

$$W = 10 + \frac{1}{25}L_S \qquad (4)$$

Which can be rearranged as:

$$L_S = 25W - 250 \qquad (5)$$

We can check this by seeing if it yields the same equilibrium levels of wage and labor that we got earlier

$$L_S = L_D \qquad (6)$$

$$25W - 250 = 350 - 12.5W$$

$$37.5W = 600$$

W= 16 ; which is exactly what we expected!

   b) **Now, what is the marginal product of labor (MPL) at equilibrium in this market?**

If $ME_L = \$16$ in a competitive market then it also means that $ME_L = MRP_L$, which is the profit maximizing condition for labor in a competitive market. So we can work backwards from this to find MP_L given that we know $MRP_L = MP_L \times P$, and price was given as $2.

$$ME_L = MRP_L = (MP_L)(P) \qquad (7)$$

$$16 = (MP_L)(2)$$

$$MP_L = 8$$

c) What might this look like on a Total Product of Labor graph?

We don't know much about this particular Total Product of Labor model with the information given, but what we do know is that we want to hire the number of workers at which $MRP_L = ME_L$ (general condition) or $MRP_L = W$ (competitive market condition since $ME_L = W$ in a competitive market). In this case, if MPL = 8 at W = 8 and L = 150, we can suppose that MPL < 0 when we hire the next worker, which simply means that MPL has change from positive to negative as we go from 150 workers to 151 workers.

Generally, the Marginal Labor Productivity model will look like this:

Marginal Labor Productivity
(holding capital fixed)

Marginal
Product
of Labor

$MP_L = 8$
0

Increasing
Returns to Scale

L= 150

L= 151 Decreasing   Labor
Returns to Scale

Total Labor Productivity
(holding capital fixed)

Total
Product
of Labor

Slope = 0

$MP_L = 8$

Increasing
Returns to Scale

L= 150

L= 151   Decreasing   Labor
Returns to Scale

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