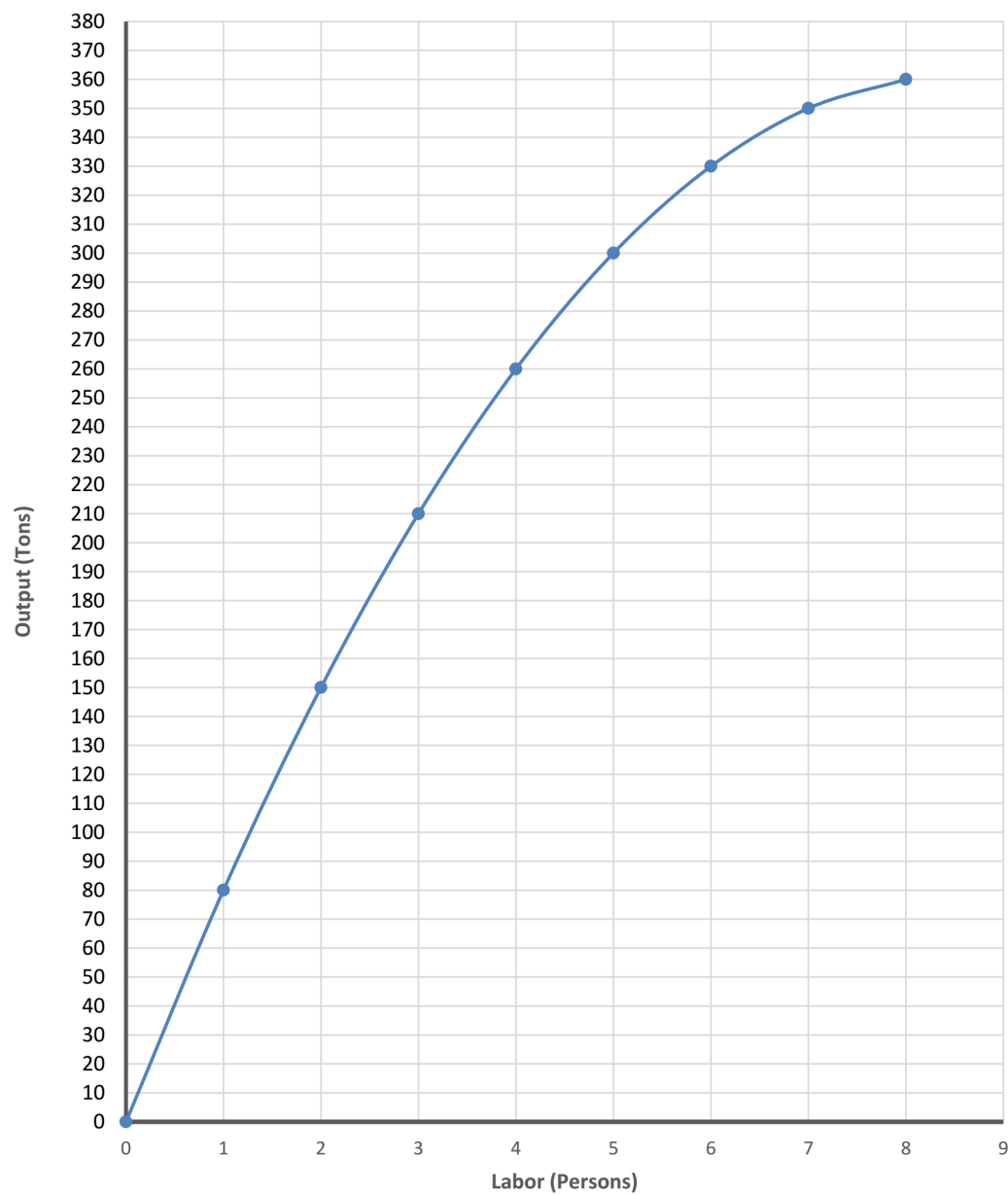


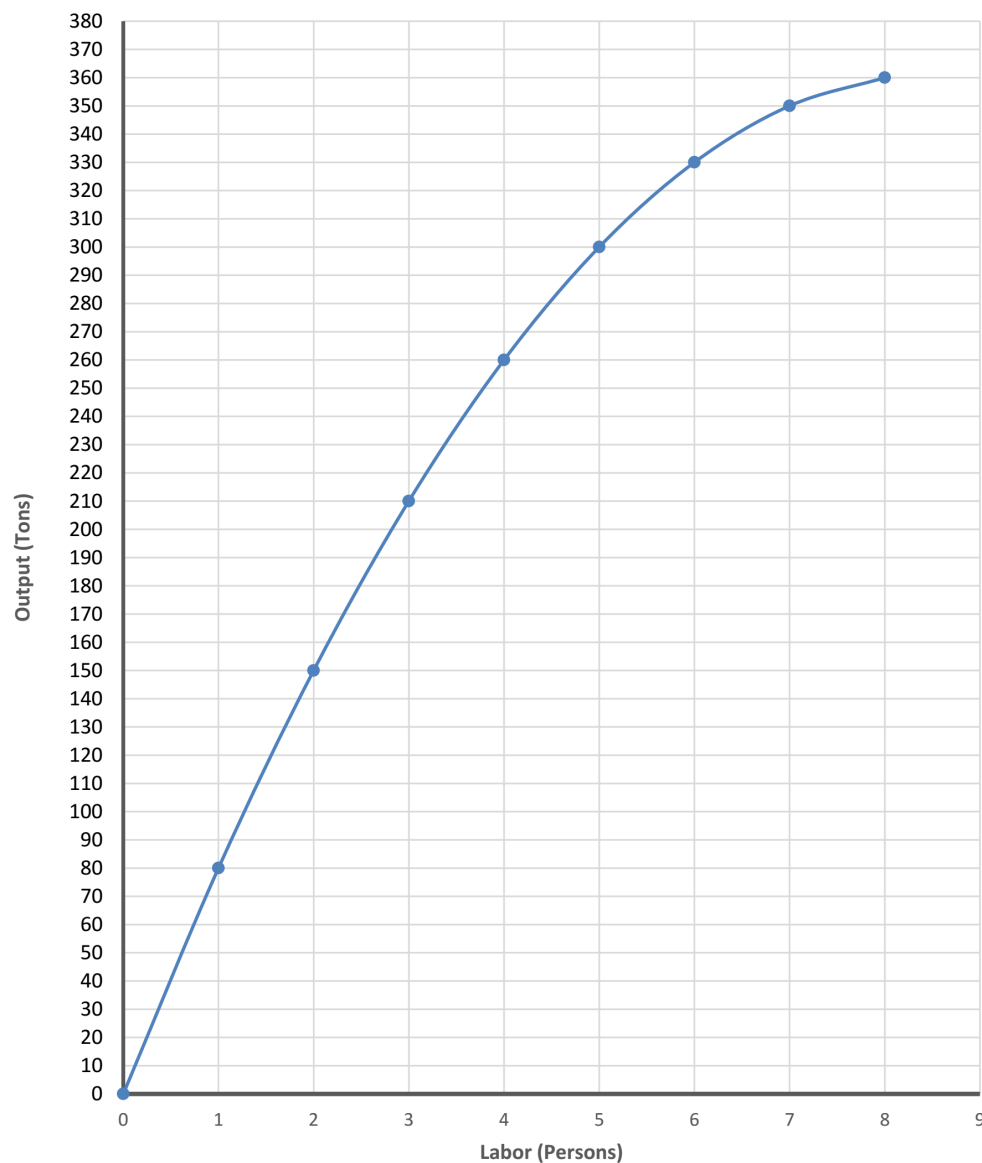
Problem 1.



The marginal product of the sixth worker is how many tons of the product?

Answer 1. The marginal product is how much output increases when you add one more unit of labor. We want to see how much output increases when we go from 5 to 6 workers. According to the graph it goes from 300 to 330, so the marginal product of the sixth worker is $330 - 300 = 30$ units of output.

Problem 2.



If the real wage is 50 units, the firm will want to employ how many workers (using the marginal productivity rule discussed in the class)?

Answer 2. They will want to employ 4 workers. A firm only wants to add another worker if that extra worker increases profits.¹ They will therefore stop hiring workers if hiring an additional worker would reduce profits. This will happen when the cost of an additional worker—their wage W —exceeds their contribution to profit— $P \times MPL$. So to maximize profit, they will hire up to the point where $W = P \times MPL$.

This, however is in nominal terms because it is in terms of prices. To express the same thing in real terms, divide both sides by P . Then we have

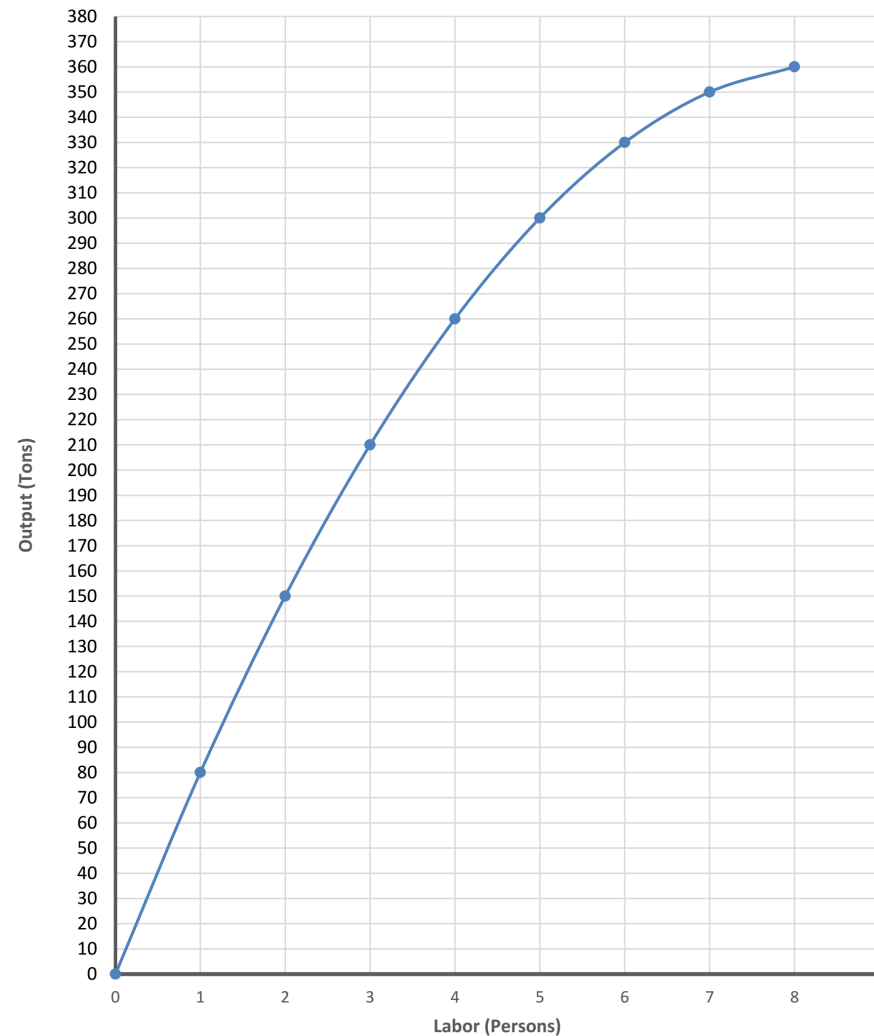
$$\frac{W}{P} = MPL.$$

So firms will stop hiring workers when the real wage equals the marginal product of one additional worker. We are told that $W/P = 50$, so we want to find the number of workers that has an MPL of 50.

That number is 4 workers because going from 3 to 4 workers has an MPL of $260 - 210 = 50$.

¹Always think in terms of *one* extra worker—this is what the word “marginal” means.

Problem 3.



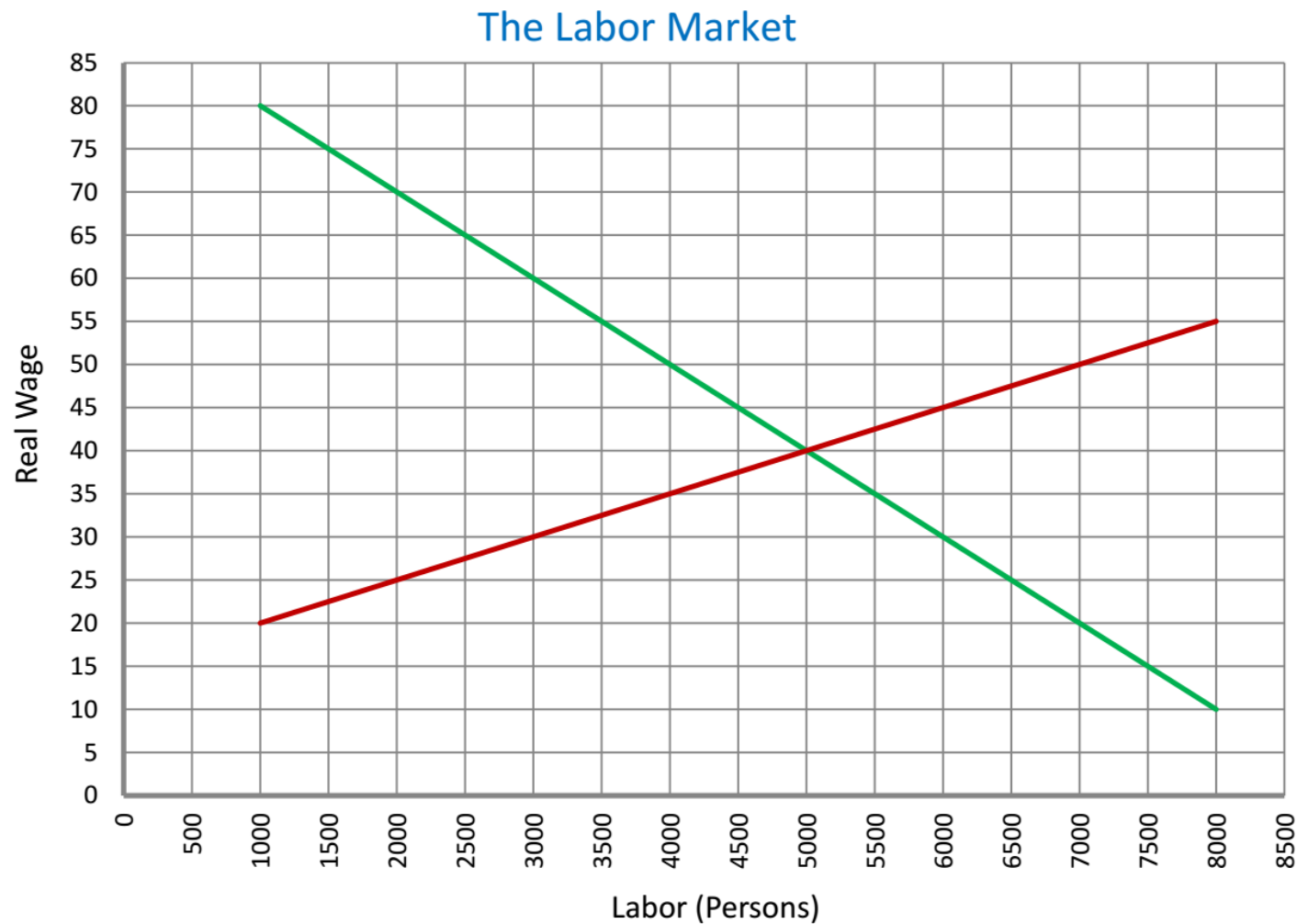
Suppose that due to a technological advance, the productivity of labor increases so that the marginal product of each and every worker increases by 30 units. The real wage is still 50 units. How many workers will the firm now hire to maximize its profit? If the firm employs this many workers, it will be able to produce how many tons of the product?

Answer 3. The MPL of every worker has increased by 30. The real wage is still 50. So now we want to find the worker who previously gave only 20 MPL (because now, after the tech advance, they have an MPL of $20 + 30 = 50$). Going from worker 6 to 7 used to have an MPL of $350 - 330 = 20$, so the firm will hire 7 workers.

Before the tech advance, 7 workers would have produced 350 units of output. But now each one of those seven workers adds 30 more output than they did before, so the total output will be $350 + 7 \times 30 = 560$ units of output.

It might be good practice to draw the new production function. For instance, the first worker would now produce $80 + 30 = 110$. The second worker used to contribute 70 MPL, but now contributes 100 MPL, so the output with two workers would be 210. And so forth.

Problem 4.

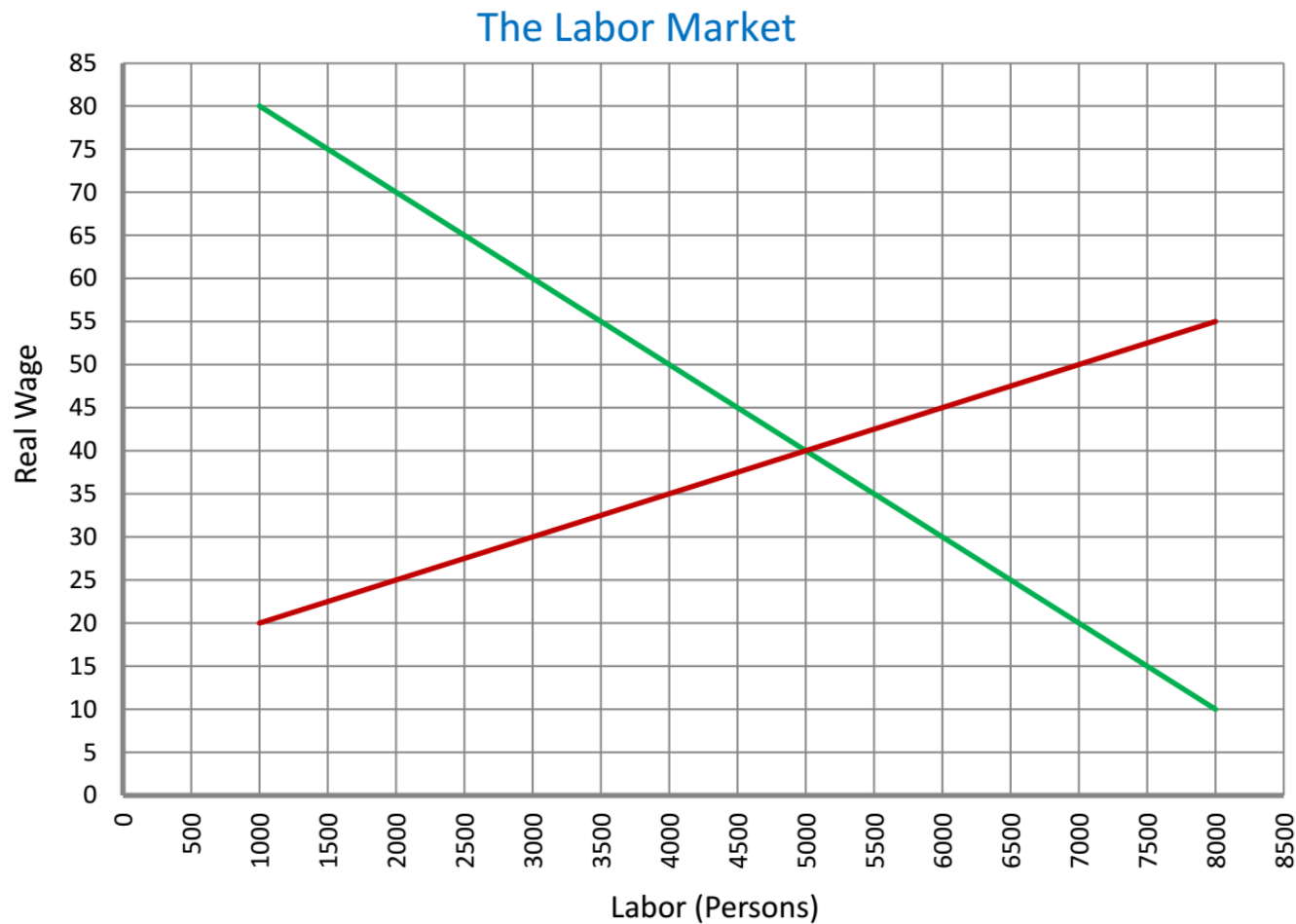


In this country, if the real wage equaled 50 units, there would be how many jobs available?
How many people would be willing and able to work?

Answer 4.

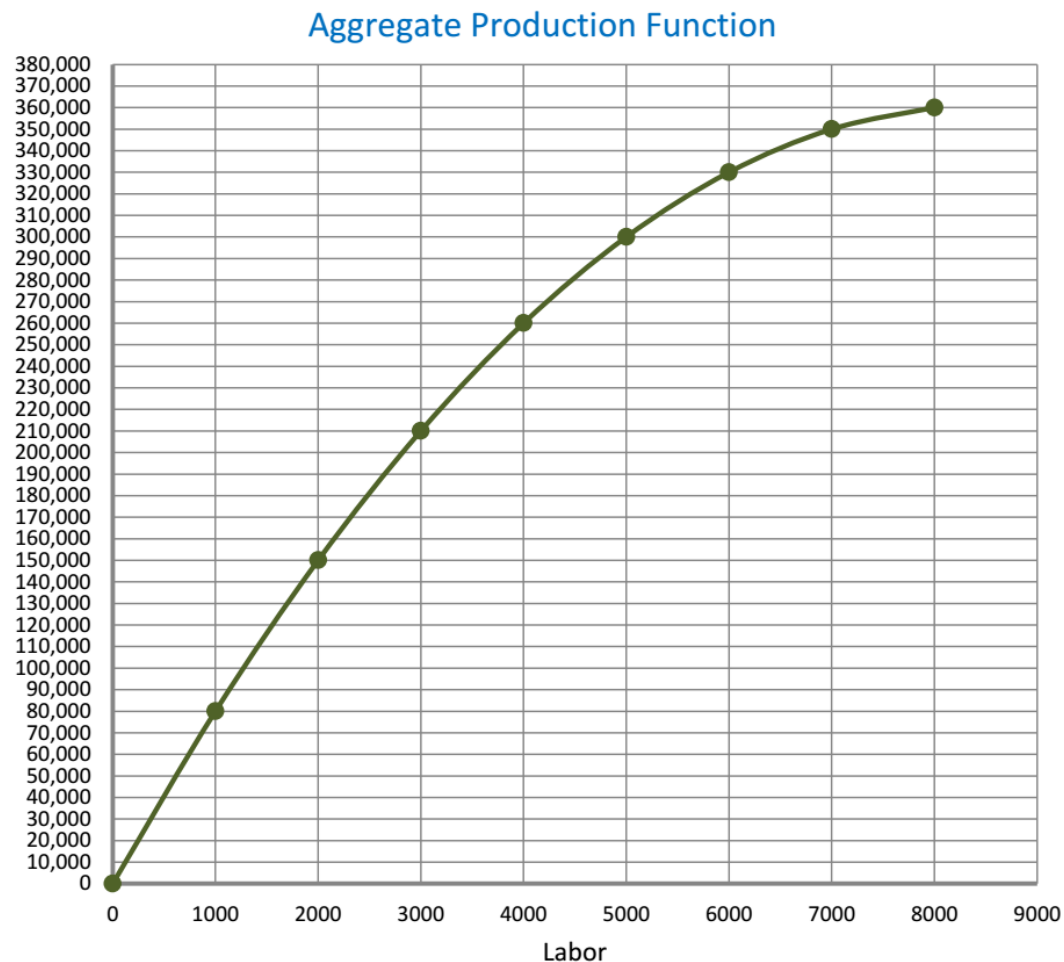
- The number of jobs available is the *demand* for labor, i.e. the downward sloping curve. At a real wage of 50, firms want to hire 4000 workers.
- The number of people who want to work is the *supply* of labor, i.e. the upward sloping curve. At a real wage of 50, 7000 people want to work.
- The number of people who want to work exceeds the number of jobs available—there is a surplus of labor. This suggests that perhaps the real wage of 50 is too high and is causing unemployment for $7000 - 4000 = 3000$ people.

Problem 5.



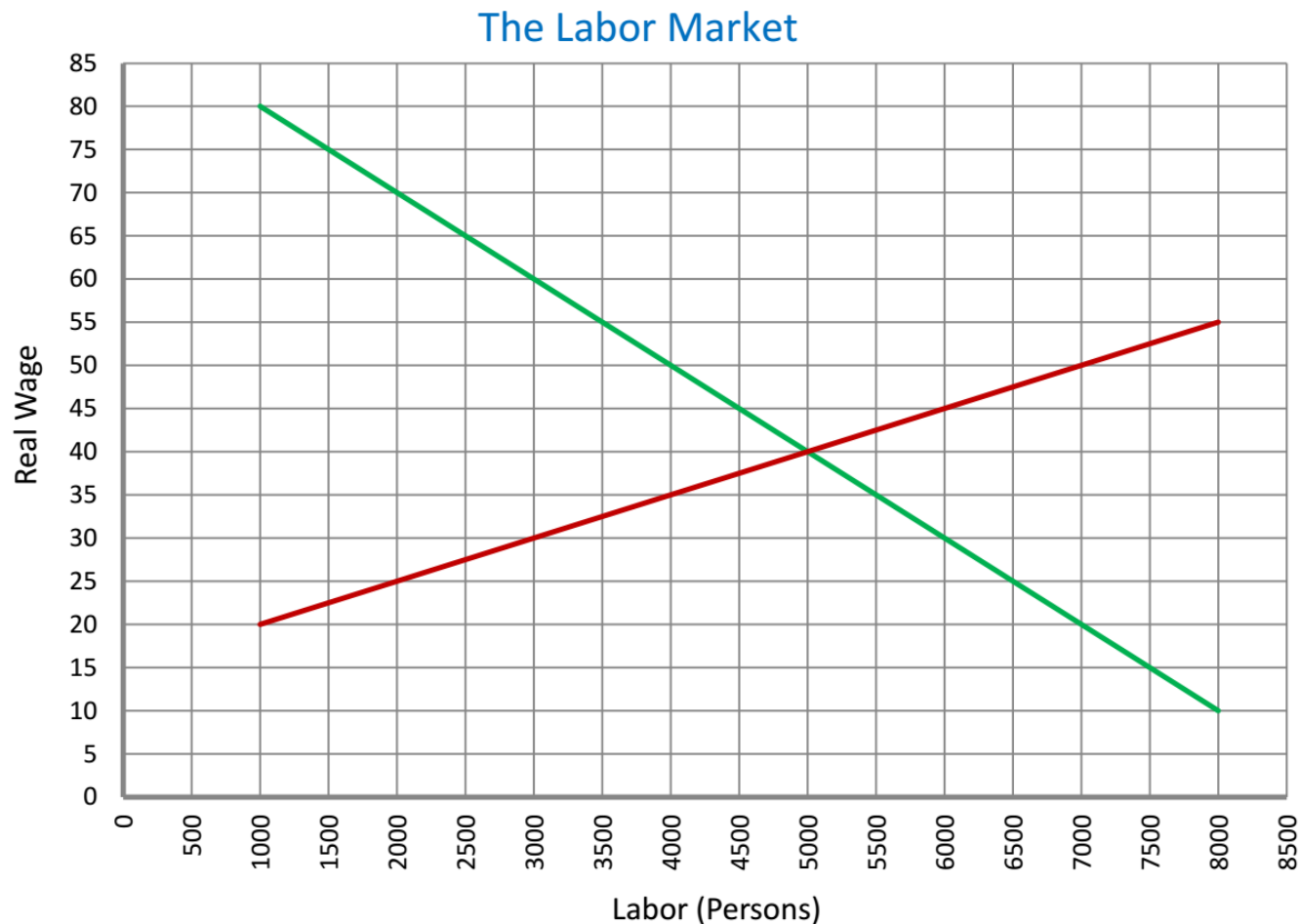
In this country, the real wage to bring about full employment is how many units? At this equilibrium real wage, how many workers will be employed? What will potential GDP be? (There's another chart for the GDP part that I couldn't fit here.)

Answer 5. Full employment occurs where supply of labor intersects demand for labor. In this case, that is a real wage of 40 and 5000 hired persons.



We can see here that 5000 hired persons implies 300,000 units of output—that is potential (real) GDP.

Problem 6.



Assume that the market is in equilibrium (we have full employment). Assume also that currently the price level is $P = 200$. If the price level increases by 15%, the equilibrium nominal wage will increase from what to what?

Answer 6. The original real wage in equilibrium is

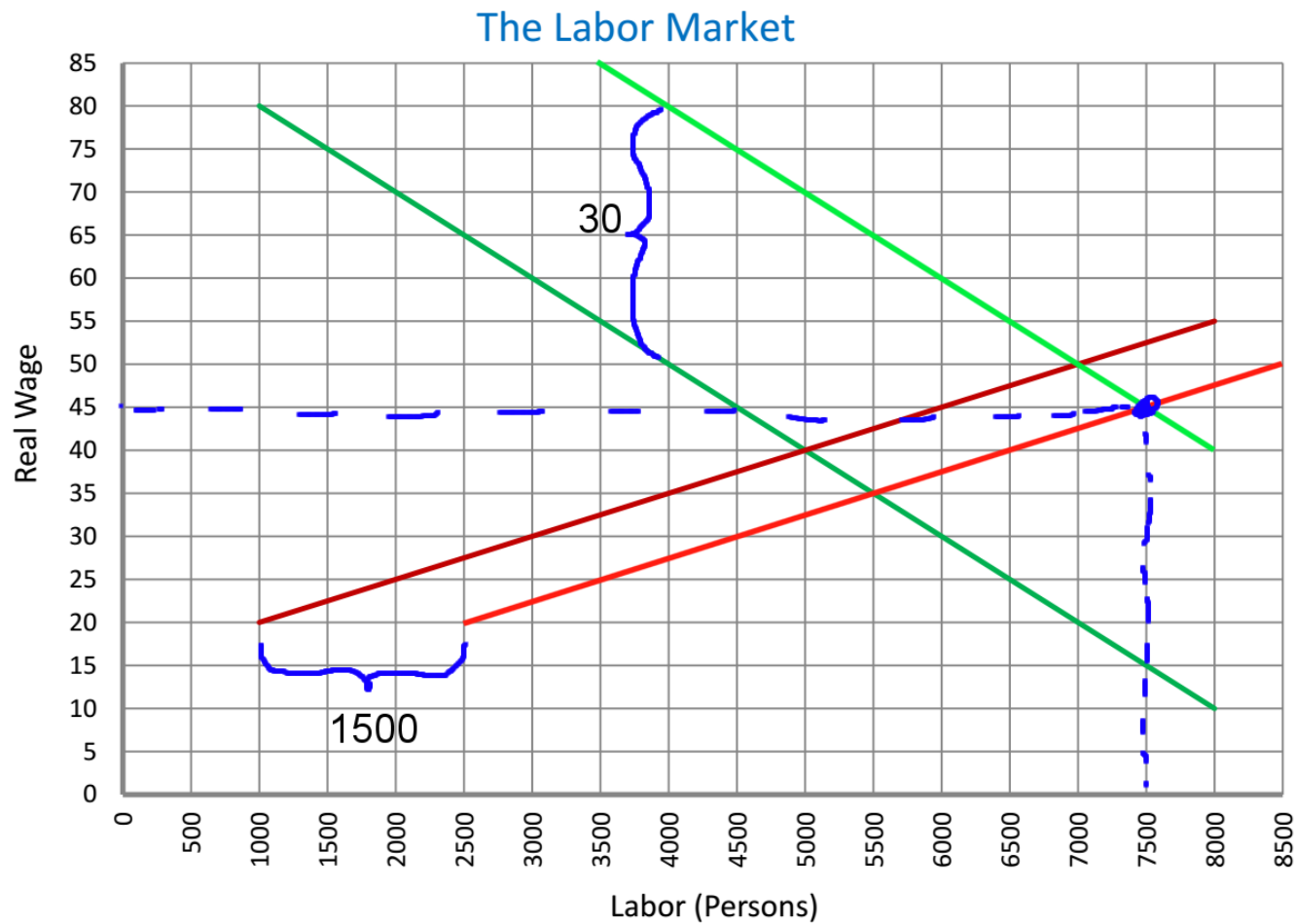
$$\frac{W}{200} = 40 \implies W = 8000.$$

After the price level rises by 15%, it is $P' = 230$. So now the real wage in equilibrium is

$$\frac{W}{230} = 40 \implies W = 9200.$$

Problem 7. Suppose that due to an increase in labor productivity, MPL increases by 30 units for every worker. At the same time, supply of labor increases by 1,500 workers due to an increase in labor force participation rate. As a result of these labor-market developments, the equilibrium real wage will equal how many units, and the equilibrium employment will equal how many workers?

Answer 7. To increase of the supply of labor by 1500 workers will shift the supply curve to the right by 1500 units. The increase in the MPL by 30 means that demand curve will shift to the right by 30 units. At their new intersection, there are 7500 workers hired and the real wage is 45.



Problem 8. Assume that between 1950 and 2015 the employment level of low-skilled workers has decreased. How can you figure out whether this reduction is predominantly due to a reduction in demand or supply?

True or False. The answer is, if during the same time period the real wage had also decreased, then the reduction in employment must have been mainly due to a reduction in supply. Otherwise, it must have been predominantly due to a reduction in demand.

Answer 8. False. If there is a reduction in supply, then the supply curve shifts to the left and the wage is higher. On the other hand, if the demand for labor falls, then the demand curve shifts to the left and there is a lower wage.

Problem 9. Suppose that in a country (not necessarily the United States) both employment and real wage have increased over the past many decades. What can you claim has happened in the labor market *for sure* over this period?

- (a) Demand for labor has increased but supply has remained unchanged.
- (b) Demand for labor has increased but supply has decreased, but the reduction in supply has been smaller than the increase in demand.
- (c) Demand for labor has increased so has the supply, but the increase in supply has been smaller than the increase in demand.
- (d) Demand for labor has increased. Supply may have increased or decreased, but the change in supply (whether increase or decrease) has been smaller than the increase in demand.

Answer 9: (d). Option (d) is basically “all of the above might be true.” If you increase the demand curve, you’ll have a higher wage and higher employment. But we can’t be sure that the supply remains *completely* unchanged. Indeed, it is possible that the supply curve shifts a little bit in either direction, as long as the increase in demand is sufficiently large to make sure that the real wage and employment ultimately do increase.

To see this, just draw all three with a large change in demand and a relatively small change in supply.

Problem 10. *True or False.* According to the report by the President Obama's Council of Economic Advisors, the increase in the real wage inequality between unskilled and skilled workers over the last sixty years has been mainly the result of automation and globalization.

Answer 10. True. Automation has replaced the need for many unskilled workers, and globalization has allowed unskilled labor to be outsourced to other countries for lower cost. High skilled workers however cannot be easily automated away and are more difficult to find elsewhere for relatively low wages.