Microeconomics for Public Policy I
Fall 2023

Problem Set 7

On what and how to submit

- For this and all future problem sets, questions are from the "Problems" section of the questions at the end of the chapter.
- Due before Lecture 8 to your Box folder
- Name the file "ps07_[lastname].[extension]". For example, my file would be "ps07_brooks.pdf".
- You do not need to type your submission. Any **legible** submission is ok. For example, you can write the problem set with hand-drawn graphs, take a picture, and submit the picture.

1. GLS Chapter 6, Question 4

Answer:

(a) Short run production function

In the short run, capital is fixed, or $K = 9$. Therefore, the short-run production function is

$$Q = 100\sqrt{KL} = 100\sqrt{9L} = 300\sqrt{L}$$

(b) Number of cars Bob can repair each year for $L \in \{1, 2, 3, 4, 5\}$

K	L	Q, or number of cars repaired per year	MP_L	AP_L
9	1	$300\sqrt{L} = 300\sqrt{1} = 300$	.	$\frac{300}{1} = 300$
9	2	$300\sqrt{L} = 300\sqrt{2} \approx 424$	124	$\frac{424}{2} = 212$
9	3	$300\sqrt{L} = 300\sqrt{3} \approx 520$	96	$\frac{520}{3} = 173$
9	4	$300\sqrt{L} = 300\sqrt{4} = 600$	80	$\frac{600}{4} = 150$
9	5	$300\sqrt{L} = 300\sqrt{5} \approx 671$	71	$\frac{671}{5} = 134$

(c) Marginal product of labor

See table above. We calculate marginal product of labor as additional output (Q) from one additional worker, so, for example $Q_{L=3} - Q_{L=2} = 520 - 424 = 124$. Yes – the marginal product of labor is declining as L increases and K is fixed.

(d) Average product of labor

See table above. Average product of labor is $\frac{Q}{L}$. For levels we examine, $AP_L > MP_L$. Because MP_L is decreasing in L, it brings the average down as L increases.

2. GLS Chapter 6, Question 7

Answer:

(a) As L increases, since $MP_L = \frac{2K^{1/3}}{3L^{1/3}}$, MP_L declines. We can see this because L is in the denominator. Thus, as L increases MP_L decreases. Intuitively, when capital is fixed, adding additional units of labor becomes not particularly useful at some point.

(b) As K increases, since $MP_L = \frac{2K^{1/3}}{3L^{1/3}}$, MP_L increases.

(c) The marginal product of labor increases as K increases because workers have more stuff with which to successfully do their jobs. For example, imagine five workers in a coffee shop who get an additional coffee machine. This additional machine may allow them to be produce more output.

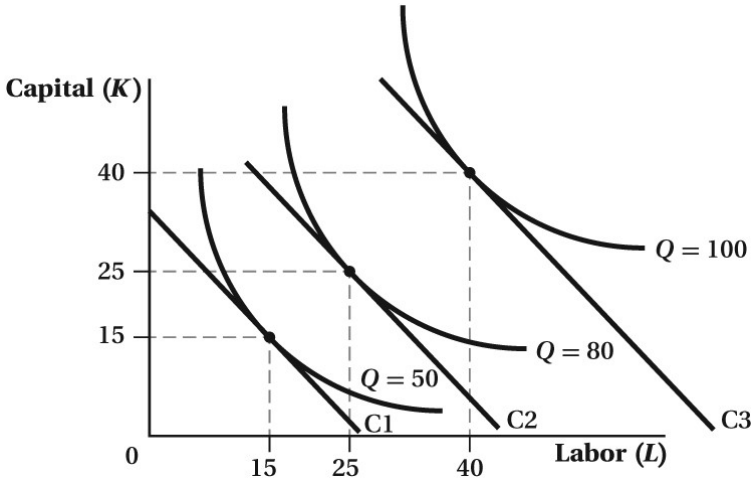
(d) As K increases, the marginal product of capital declines. As L increases, the marginal product of capital increases. Both of these use the same logic and in (b) and (c).

3. GLS Chapter 6, Question 23

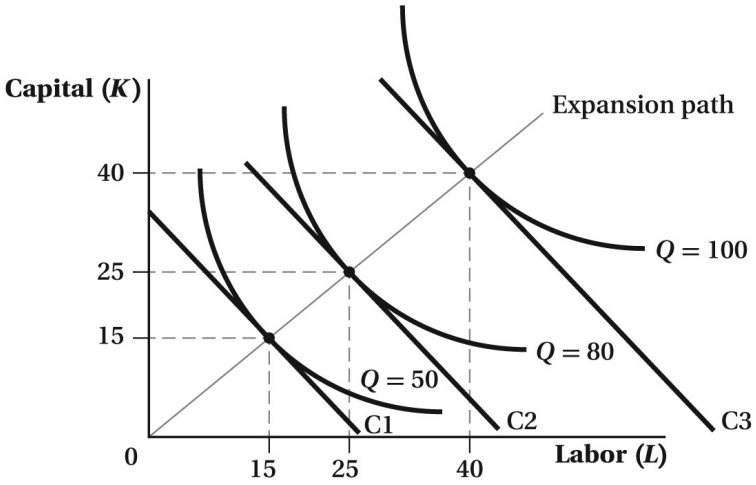
Answer:
From the question, we know that the isocost curve is

$$\begin{aligned} C &= RK + WL \\ &= 10K + 10L \end{aligned}$$

(a) See figure below



(b) See figure below



(c) To find the total cost of production, use the cost curve we wrote above and the amounts of K and L for each level of production.

Q	K	L	Total Cost
50	15	15	$15 * 10 + 15 * 10 = 300$
80	25	25	$25 * 10 + 25 * 10 = 500$
100	40	40	$40 * 10 + 40 * 10 = 800$

(d) Total cost figure: graph Q on the x axis, and total cost on the y axis.