Econ 301
Deiter
W In-class #9 (10 pts.)

Name Key

Assume $q = 200L^{1/2}$, where
$q$ = number of bottles of pop sold by a concession stand at an athletic event
$L$ = number of workers hired for the day for the event
$P$ = the price of pop per bottle = \$2.00
$w$ = the daily wage or cost per worker = \$40.00
TFC = total fixed costs = \$100.00

1. Derive the mathematical equations for $MP_L$ and $AP_L$ as functions of L.

$MP = \partial q / \partial L = 1/2(200) L^{1/2-1}$ $(= 100L^{-1/2}$ or $100/L^{1/2}$ or $100/\sqrt{L})$

$AP = q/L = 200L^{1/2}/L$ $= (200/L^{1/2}$ or $200/\sqrt{L})$

2. Use your equations in Q. #1 to provide the missing data in the following table:

| L | TP | MP | AP |
|---|---|---|---|
| **1** | 200 | 100 | 200 |
| **4** | 400 | 50 | 100 |
| **9** | 600 | 33.33 | 66.67 |
| **16** | 800 | 25 | 50 |
| **25** | 1000 | 20 | 40 |
| **36** | 1200 | 11.67 | 33.33 |
| **49** | 1400 | 14.29 | 28.57 |
| **64** | 1600 | 12.5 | 25 |
| **81** | 1800 | 11.1 | 22.2 |
| **100** | 2000 | 10 | 20 |

3. What is the mathematical equation for TRP as a function of L?

$= Pq = (2)(200L^{1/2}) = (400L^{1/2}$ or $400\sqrt{L})$

4. What is the mathematical equation for MRP as a function of L?

$= P \cdot MP = (2)(100L^{-1/2}) = (200L^{-1/2}$ or $200/L^{1/2}$ or $200/\sqrt{L})$

5. What is the value of marginal factor cost (MFC)? Explain in words what this means.

$= w = 40$

= additional cost per additional unit of L

6. What is the optimal (profit-maximizing) number of workers to hire?

$\Rightarrow$ MRP = MFC $\Rightarrow$ $200/\sqrt{L} = 40 \Rightarrow \sqrt{L} = 5 \Rightarrow (L^* = 25)$

7. What is the maximum attainable level of profit (TRP - total labor costs - TFC)?

$\Rightarrow$ at $L^* = 25$, $TRP - TVC - TFC = 400\sqrt{25} - 40(25) - 100$

$= 2000 - 1000 - 100 = \$900$

8. How many dollars of profit are given up (versus maximum attainable) if 16 workers are hired?

$\Rightarrow TRP - TVC - TFC = 400\sqrt{16} - 40(16) - 100$

$= 1600 - 640 - 100 = \$860 \Rightarrow$ give up \$40

9. What is the profit-maximizing number of workers to hire per day if P increases to \$2.40/bottle?

$\Rightarrow MRP = MFC \Rightarrow \frac{240}{\sqrt{L}} = 40 \Rightarrow \sqrt{L} = 6 \Rightarrow L^* = 36$

10. Complete the table below. Then, show graphically below the impact of the pop price increase in Q. #9 in a graph of MRP and MFC curves (label all curves and axes plainly).

| L | Initial MRP | New MRP |
|---|---|---|
| 1 | 200 | 240 |
| 4 | 100 | 120 |
| 9 | 66.67 | 80 |
| 16 | 50 | 60 |
| 25 | 40 | 48 |
| 36 | 33.33 | 40 |
| 49 | 28.57 | 34.30 |
| 64 | 25 | 30 |
| 81 | 22.2 | 26.64 |
| 100 | 20 | 24 |