Ben Cohen
ECON110-02

OK!

Chapter 5 Problem Set

2. a. The $100,000 depreciation expense would have increased to $205,000 - $100,000 would be added as a result of the accelerated depreciation, and $5,000 would be added as a result of the new yearly capital depreciation ($50,000 over 10 years). Material expenses would have decreased $30,000 to $170,000, and labor would decrease $20,000 to $230,000. Reported profits would drop to $245,000; only $85,750 in taxes would be paid, so after-tax profits would decrease to $159,250; the addition to retained earnings would drop to $59,250. (Attached is a copy of the new income statement.)

b. If the firm were to reclassify $20,000 of labor and materials as a capital expense, reported profits would increase by $18,000 (+$20,000 from the labor/materials loss, -$2,000 from the depreciation expense). In turn, the firm would have to pay a higher corporate tax ($6,300 higher). On the other hand, the higher reported profits would likely increase demand for the company's stock - and thus its price - and improve public perception of the company. Given that this reclassification is illegal, however (re: WorldCom), it would be an unwise move by the company. good

3. $q = K^{1/2}L^{1/2}$ K = capital, L = hours of labor, q = hourly output

a. 1 machine, 16 workers → K = 1, L = 16

output per hour = $\sqrt{1}\sqrt{16} = 4$ $q = K^{1/2}L^{1/2}$

average product of labor = $\frac{q(L)}{L} = \frac{4}{16} = \frac{1}{4}$ $APL = \frac{q(L)}{L} = \frac{L^{1/2}}{L} = \frac{1}{\sqrt{L}}$

marginal product of labor = $\frac{\partial q}{\partial L} = \frac{1}{2\sqrt{16}} = \frac{1}{8}$ $MPL = \frac{\partial q}{\partial L} = \frac{1}{2\sqrt{L}}$

marginal product of capital = $\frac{\partial q}{\partial K} = \frac{1}{2\sqrt{1}} = \frac{1}{2}$ $MPC = \frac{\partial q}{\partial K} = \frac{1}{2\sqrt{K}}$

$= \frac{1}{2\sqrt{1}} \times \sqrt{16} = 2$

b. If the production function is homogeneous of degree 1, $q(pL, pK) = pq(L, K)$. Since L and K are both raised to the same power, the equation is homogeneous of degree 1. For example, if $p = 2$, $\sqrt{2}\cdot\sqrt{32} = \sqrt{2}\sqrt{2}\sqrt{16} = 8 = 2(4)$. If $p = 3$, $\sqrt{3}\cdot\sqrt{48} = \sqrt{3}\sqrt{3}\sqrt{16} = 12 = 3(4)$. (If K and L were raised to different powers - $K^{1/2}L^{1/3}$, for example - the equation would not be homogeneous of degree 1.

c. wage = $10/hr., machine = $20/hr.

$q = 10 = L^{1/2}$ ($K^{1/2} = 1$)

$L = 100$ → the firm would have to hire 100 workers.

total cost = $10(100) + 20 = \$1,020$

$ATC = \frac{\$1,020}{10} = \$102$

$AVC = \frac{\$1000}{10} = \$100$

d. $C(q, \bar{K}) = r\bar{K} + wL^*(q, \bar{K})$

$q = K^{1/2}L^{1/2}$

$L^{1/2} = \frac{q}{K^{1/2}}$

$L = q^2/K$

Since $\bar{K}=1$, $L=q^2$

$C(q, \bar{K}) = r\bar{K} + wq^2$

$r = \$20$, $w = \$10$

$\boxed{C(q) = 20 + 10q^2}$ ✓

e. $C(q) = 20 + 10q^2$ ✓

$\boxed{C'(q) = 20q}$

$\boxed{C'(10) = 20(10) = \$200}$

average cost $= \frac{C(q)}{q} = \frac{20+10q^2}{q}$ $\boxed{= \frac{20}{q} + 10q}$ ✓

$ATC(10) = \frac{20}{10} + 10(10) = 2 + 100$ $\boxed{= \$102}$ ✓

average variable cost $= \frac{C(q)-20}{q} = \frac{10q^2}{q}$ $\boxed{= 10q}$ ✓

$AVC(10) = 10(10)$ $\boxed{= \$100}$ ✓

5. $p(q) = 20 - 2q$, $C(q) = 4q + q^2$

a. $R(q) = q \cdot p(q) = 8(20-2q)$

$\boxed{R(q) = 20q - 2q^2}$ ✓

$\boxed{\frac{dR(q)}{dq} = 20 - 4q}$

b. $\pi = R(q) - C(q)$

When π is maximized, $\frac{dR(q)}{dq} = \frac{dC(q)}{q}$ ✓

$20 - 4q = 4 + 2q$

$16 = 6q$

$\boxed{q = \frac{16}{6} = 8/3}$ ✓

$p(q) = 20 - 2q = 20 - 2(8/3) = \frac{60}{3} - \frac{16}{3} = \frac{44}{3}$ $\boxed{= \$14.67}$

$R(8/3) = 20(8/3) - 2(8/3)^2 = \frac{352}{9}$ $\boxed{= \$39.11}$

$MC = C'(8/3) = 4 + 2(8/3) = \frac{12}{3} + \frac{16}{3} = \frac{28}{3}$ $\boxed{= \$9.33}$

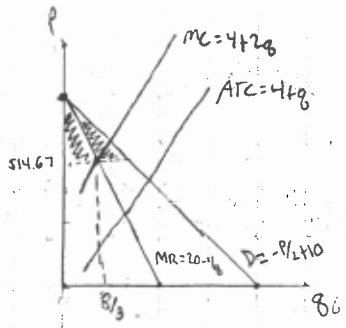
$C(8/3) = 4(8/3) + (8/3)^2$ $\boxed{= \$17.78}$

$ATC = \frac{C(8/3)}{8/3}$ $\boxed{= \$6.67}$ $= AVC$

$\pi(8/3) = R(8/3) - C(8/3)$ $\boxed{= \$21.33}$

per-unit profit $= \frac{\pi(8/3)}{8/3} = \frac{63.99}{8}$ $\boxed{\approx \$8.00}$

c.



$p(q) = 20 - 2q$

$p - 20 = -2q$

$q = -\frac{1}{2}p + 10 = D$

*I forgot that we only had to do 5a and b. Sorry. (The more the merrier, no?)

d. CS = shaded area on graph in (c)

$$= \int_0^{8/3} (20 - 2q - \tfrac{44}{3})\,dq$$

$$= 20q - q^2 - \frac{44}{3}q \Big|_0^{8/3}$$

$$= \frac{16}{3}q - q^2 \Big|_0^{8/3}$$

$$= \frac{16}{3}\left(\frac{8}{3}\right) - \left(\frac{8}{3}\right)^2$$

$$= \frac{128}{3} - \frac{64}{9}$$

$$= \frac{384}{9} - \frac{64}{9} = \frac{320}{9} = \$16.67$$

6. $C(q) = 16 + 4q + q^2$

a. $ATC = \frac{16 + 4q + q^2}{q} = \frac{16}{q} + 4 + q$

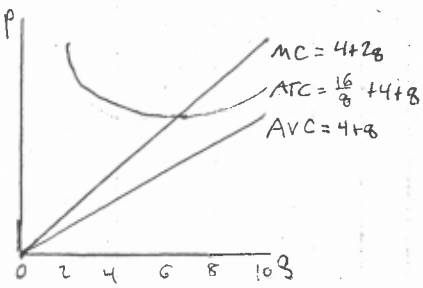
$ATC_{20} = \frac{16}{20} + 4 + 20 = \frac{4}{5} + 24 = \frac{124}{5} = \$24.80$

$AVC = \frac{4q + q^2}{q} = 4 + q$

$AVC_{20} = 4 + 20 = \$24$

$MC = C'(q) = 4 + 2q$

$C'(20) = 4 + 2(20) = \$44$



b. $p = \$20$ in a competitive market

$R'(q) = C'(q)$

In a competitive market, $P = MR = \$20$

$C'(q) = 4 + 2q = 20$

$2q = 16$

$\boxed{q = 8}$ ✓

c. $p = \$10$ in the short term

$R'(q) = p = \$10$

$R'(q) = C'(q) = 10$

$C'(q) = 4 + 2q = 10$

$2q = 6$

$\boxed{q = 3}$ ✓

good work.

Income statement of the Fly-by-Nite Aircraft Company, 2001

Table 5.3, p 196

January 1, 2001 to December 31, 2001 (all figures in $1,000,000)						
Net sales			800			
Less:						
Cost of manufacturing						
Materials	200					
Labor	250					
Depreciation expense	100					
		550				
Less inventory increase		(100)				
Cost of goods sold			(450)			
Gross margin				350		
Less selling cost			30			
Interest expense			20			
				(50)		
Profits					300	
Less corporate profit tax					(105)	
Profits after taxes						195
Less dividends						(100)
Addition to retained earnings						95

Income statement of the Fly-by-Nite Aircraft Company, 2001 (a)

Table 5.3, p 196

January 1, 2001 to December 31, 2001 (all figures in $1,000,000)						
Net sales			800			
Less:						
Cost of manufacturing						
Materials	170					
Labor	230					
Depreciation expense	205					
		605				
Less inventory increase		(100)				
Cost of goods sold			(505)			
Gross margin				295		
Less selling cost			30			
Interest expense			20			
				(50)		
Profits					245	
Less corporate profit tax					(86)	
Profits after taxes						159
Less dividends						(100)
Addition to retained earnings						59

(Note: all figures are rounded to the nearest $1,000)

Income statement of the Fly-by-Nite Aircraft Company, 2001 (b)

Table 5.3, p 196

January 1, 2001 to December 31, 2001 (all figures in $1,000,000)

Net sales			800			
Less:						
Cost of manufacturing						
Materials	190					
Labor	240					
Depreciation expense	102					
		532				
Less inventory increase		(100)				
Cost of goods sold			(432)			
Gross margin				368		
Less selling cost			30			
Interest expense			20			
				(50)		
Profits					318	
Less corporate profit tax					(111)	
Profits after taxes						207
Less dividends						(100)
Addition to retained earnings						107

(Note: all figures are rounded to the nearest $1,000)