Question 1  Both adverse selection and moral hazard will reduce profits.

*Adverse selection:* Owners of expensive bikes are more likely to sign up for insurance than owners of cheap bikes. Thus, the average value of insured bikes will be larger than 200 Dollars.

*Moral hazard:* People whose bike is insured will be less careful, e.g., not lock the bike. Thus, the percentage of insured that are stolen will be higher than 4 percent.

Question 2

(a)  *Yes, at any price* $1,600 \leq p \leq 2,500$

(b)  With insurance, firm $A$’s cost is 1,650. Firm $B$’s cost is 1,750. Thus, any price $P_A$ with $1,650 < P_A < 1,750$ would work.

$$1,650 < P_A < 1,750$$

Question 3

<table>
<thead>
<tr>
<th>Quantity of variable input</th>
<th>total output</th>
<th>marginal product of variable input</th>
<th>average product of variable input</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>1</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>70</td>
<td>50</td>
<td>35</td>
</tr>
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<td>3</td>
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<td>110</td>
<td>60</td>
</tr>
<tr>
<td>4</td>
<td>300</td>
<td>120</td>
<td>75</td>
</tr>
</tbody>
</table>

Question 4  The marginal products are

$$\text{MP}_K(K, L) = \frac{2L}{\sqrt{K}}, \text{ and } \text{MP}_L(K, L) = 4\sqrt{K}.$$ 

Thus, we get
\( MP_K(100, 40) = 8, \) and \( MP_L(100, 40) = 40. \)

The average product of capital and labor are

\[ AP_K(K, L) = \frac{4\sqrt{KL}}{K}, \] and \( MP_L(K, L) = 4\sqrt{K}. \)

Thus,

\[ AP_K(100, 40) = 16, \] and \( AP_L(100, 40) = 40. \)

**Question 5** Variable costs are 500. Thus,

- **Average variable costs are 2.5.**
- **Marginal costs are 14.**
- **Fixed costs are 2,000.**

**Question 6** Marginal costs are \( MC = 40 + 8Q. \) Thus, \( P = 40 + 8Q. \) Therefore,

\[ Q^S(P) = 0.25P - 5. \]

**Question 7** Marginal costs are \( MC = 2Q. \) Thus, \( P = 2Q. \) The firm’s profit is \( PQ - C(Q). \) Thus, \( 0 \leq PQ - C(Q) = 2Q^2 - (64 + Q^2) = Q^2 - 64, \) which implies \( Q \geq 8. \) Thus,

the price \( P \) must be at least 16.

**Question 8** Each firm’s supply function is \( P = 4 + 0.5Q, \) i.e., \( Q = 2P - 8. \) Since there are 100 firms, industry supply is \( Q^S = 200P - 800. \) In equilibrium demand equals supply, i.e., \( 1,000 - 300P = 200P - 800. \) Thus, \( 500P = 1,800, \) i.e., \( P = 3.6. \)

The equilibrium price \( P = 3.60. \)

**Question 9** Recall that \( MC = P(1 + 1/\epsilon). \) Thus, \( 10 = 100(1 + 1/\epsilon), \) which implies \( \epsilon = -10/9. \)
The price elasticity of demand is $-1.11$. Now, $10 = P(1 - 1/1.25)$. Thus,

The price of a copy of Windows XP would be 50 Dollars.

Suppose that annual demand for Windows XP is 100 Million in both cases. Then

Microsoft would lose Dollar 5 Billion.
Suppose the firm charges a price $P$ per unit that maximizes profits. Then

$P = 16$ and the firm’s revenue is 114.

Suppose the firm does two part pricing, i.e., charges a fixed fee and a price per unit $P'$. Then

Then $P' = 12$ and the firm’s revenue is 546.
Question 11 The consumer’s gross benefit in the monopoly case is \( \int_{0}^{750} 200-0.1 Q \, dQ = 200Q - 0.05Q_{750} = 121,875 \). Total payments are \( P \cdot Q = 93,750 \). Thus,

The consumers’ net benefit in the monopoly case is 28,125.

With two airlines, the consumer’s gross benefit is \( \int_{0}^{1,000} 200-0.1 Q \, dQ = 200Q - 0.05Q_{1,000} = 150,000 \). Total payments are \( P \cdot Q = 100,000 \). Thus,

The consumers’ net benefit with two airlines is 50,000.

Firm profits in the monopoly case are 36,250.

The revenue of both firms is 100,000. The cost is 50,000 plus 2 times the fixed costs, because there are two firms. Thus,

Aggregate firm profits with two airlines are 10,000.

From the above you can conclude that in the monopoly case, firm profits are increased by 36,250 - 10,000 = 26,250. The loss of consumer surplus from a monopoly is 21,875. Thus,

consumer + producer surplus is by 4,375 higher than if there are two firms.