$$VC = 15Q^2 + 8Q$$

$$AVC = \frac{VC}{Q} = \frac{15Q^2 + 8Q}{Q}$$

$$= \frac{15Q^2}{Q} + \frac{8Q}{Q} = 15Q + 8$$

$$TC = 15Q^2 + 8Q + 45$$

$$ATC = \frac{TC}{Q} = \frac{15Q^2 + 8Q + 45}{Q}$$

$$= \frac{15Q^2}{Q} + \frac{8Q}{Q} + \frac{45}{Q}$$

$$= \underbrace{15Q + 8}_{AVC} + \underbrace{\frac{45}{Q}}_{AFC}$$

$$TC = 15Q^2 + 8Q + 45$$

$$MC = \frac{dTC(Q)}{dQ} = 2(15)Q^{2-1} + 8 + 0$$

$$MC = 30Q + 8$$

$C = r\bar{K} + wL$ SR

$Q = 4\bar{K}L$ $Q = 200$

$200 = 4(10)L \Rightarrow L = \frac{200}{40}$

$\boxed{L = 5}$

$$C = r\bar{K} + wL$$

$$C = 10(10) + 8(5) = 100 + 40$$

$$C = 140$$

$$MRTS_{LK} = \frac{w}{r}$$ LR

$$f(\cdot) = Q = 4KL$$

$$MP_L = \frac{\partial f(\cdot)}{\partial L} = 4K$$

$$MP_K = \frac{\partial f(\cdot)}{\partial K} = 4L$$

$$MRTS_{LK} = \frac{MP_L}{MP_K} = \frac{4K}{4L} = \frac{K}{L}$$

$$MRTS_{LK} = \frac{w}{r}$$

$$\frac{K}{L} = \frac{8}{10} \Rightarrow K = \frac{4}{5}L$$

$$Q = 4KL \Rightarrow 4\underbrace{\left(\frac{4}{5}L\right)}_{K}L = \underbrace{200}_{Q}$$

$$L^2 = \frac{200(5)}{16} \Rightarrow L^2 = 62.5$$

$$L = \sqrt{62.5} \Rightarrow \boxed{L^* = 7.91}$$

$$K = \frac{4}{5}L \Rightarrow K = \frac{4}{5}(7.91)$$

$$\boxed{K^* = 6.33}$$

$$C = rK + wL$$

$$C = 10(6.33) + 8(7.91)$$

$$C = 126.58$$

$$LTC = 32,000Q - 250Q^2 + Q^3$$

$$LMC = LATC$$

$$LMC = \frac{dLTC}{dQ} = 32,000 - 500Q + 3Q^2$$

$$LATC = 32,000 - 250Q + Q^2$$

$$32,000 - 500Q + 3Q^2 = 32,000 - 250Q + Q^2$$

$$2Q^2 = 250Q \Rightarrow Q^2 = \frac{250}{2}Q$$

$$Q = \frac{250}{2} \Rightarrow \boxed{Q = 125}$$

ES : $Q < 125$

DS : $Q > 125$