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Question 1
(a)

$$L = (Q - K_0)^2$$

- Labour is independent from w, r and increases with Q increasing.
(b)

$$SRTC = w(Q - K_0)^2 + rK_0$$

- SRTC increases with Q, or w, or r increase
(c)

$$\min_{L,K} LRTC = wL + rK$$

s.t

$$Q = \sqrt{L} + K$$

Tangency condition:

$$\frac{1}{2\sqrt{L}} = \frac{w}{r}$$

$$L = (\frac{r}{2w})^2$$

$$K = Q - \frac{r}{2w}$$

(d) As Q increases, K increases and L is constant.
- L is not normal input.
- K is a normal input.

Question 3
(a) LRTC minimizing problem

$$\min_{L,K} LRTC = wL + rK$$

s.t.

$$Q = L + K$$

We have:

$$\frac{MP_L}{p_L} = \frac{1}{1}$$

$$\frac{MP_K}{p_K} = \frac{1}{2}$$

$$\Rightarrow \frac{MP_L}{p_L} > \frac{MP_K}{p_K}$$

Therefore, to minimize cost, SFA has to only buy labour with no capital

$$\begin{cases} L &= Q \\ K &= 0 \end{cases}$$

$$LRTC = L = Q$$

(b)

$$\begin{cases} Q < 5 & L = 0 \\ Q \geq 5 & L = Q - 5 \end{cases}$$

$$\begin{cases} Q < 5 & SRTC = 10 \\ Q \geq 5 & SRTC = Q + 5 \end{cases}$$

(c)