

Good luck y'all!

1. A firm with cobb-douglas technology is producing the required amount of output, \bar{Q} units with $MP_K/r = 1$ and $MP_L/w = 2$. Is this firm producing at the lowest-possible cost? If not, explain how the firm could shift between inputs and lower costs.
2. Consider the production function $Q(K, L) = 4K + 2L$
 - (a) In the short-run, capital is fixed at $\bar{K} = 4$ units. A firm is going to produce $Q = 40$ units, what is the optimal input of labor L^* used?
 - (b) What is the short-run total cost function to produce Q units in terms of Q , w , and r ?
 - (c) In the long-run, what are the optimal conditional input demands for labor and capital when $w = 4$ and $r = 6$, i.e. $K^*(Q, w, r)$ and $L^*(Q, w, r)$?
3. Consider the long-run total cost function $TC(Q) = 2.5Q^2 + 4Q + 40$.
 - (a) Find the marginal cost function, $MC(Q)$, and the average cost function $ATC(Q)$.
 - (b) What is the marginal cost when $Q = 10$? Interpret this number in words.
 - (c) When is this firm experiencing economies of scale?
4. Consider the production function $Q(K, L) = K^{1/2}L^{1/2}$.
 - (a) What is the marginal product of labor when $K = 5$ and $L = 10$? Interpret this in words.
 - (b) What is the marginal rate of technical substitution $MRTS_{K,L}$ when $K = 5$ and $L = 10$? Interpret this in words.
 - (c) Is this firm a constant, increasing, or decreasing returns to scale function?
5. A firm's cost function is given by $TC(Q) = 8Q + 40$. Show if this firm experiences economy of scale.