

EconS 301- Intermediate Microeconomic Theory
Homework #3 - Due date: Thursday October 13th, 2022.

1. Consider a firm with production function $q = 5L + 2K$. If the firm seeks to produce $q = 230$ units, find the isoquant, its vertical and horizontal intercept, and its slope.
2. Consider a firm with production function $q = 5L^{1/3}K^{2/3}$. Find the firm's MRTS. Then, assuming that the firm seeks to produce $q = 220$ units of output, find and depict the isoquant.
3. Sarah is looking into producing her homemade dog treats on a larger scale and is contemplating two different kitchen sizes (K). Her production of dog treats follows $q = 200KL + K^2L^3$. What are the marginal and average product curves for labor when $K = 5$? What happens to the marginal and average product curves when her kitchen doubles to $K = 10$?
4. Is it possible for two firms with different Cobb-Douglas production functions, $q_1 = AL^\alpha K^\beta$ and $q_2 = L^\alpha K^\beta$, to have the same marginal products at particular levels of capital and labor? What about each firm's marginal rate of technical substitution.
5. A firm has the following cost function:

$$TC(q) = 2q^3 - \frac{1}{3}q^2 + \frac{1}{2}q + \frac{9}{10},$$

where q denotes units of output. Intuitively, the first three terms on the right side capture the firm's variable cost, because they depend on the output the firm produces, whereas the last term represents its fixed cost, as it is not a function of output q .

- (a) *Total cost.* For which output q does the total cost curve $TC(q)$ increase or decrease? For which values is it concave or convex in output?
- (b) *Marginal cost.* For which output q does the marginal cost curve $\frac{\partial TC(q)}{\partial q}$ increase or decrease? For which values is it concave or convex in output?
- (c) *Average cost.* For which output q does the average cost curve $AC(q) = \frac{TC(q)}{q}$ increase or decrease? For which values is it concave or convex in output?
- (d) *Average variable cost.* For which output q does the average variable cost curve $AC(q)$ increase or decrease? For which values is it concave or convex in output?
- (e) Find the value of q where the marginal cost curve crosses the total cost curve, where it crosses the average cost curve, and where it crosses the average variable cost curve.