Problem 1:

(a) What is a production function?
(b) How does a short-run production function differ from a long-run production function?
(c) Explain the term "Marginal Rate of technical Substitution".
(d) Why are isoquants assumed to be downward sloping?

Problem 2:

You are given production technologies that use labor and capital as inputs. For each of the following technologies, you are to calculate (i) marginal productivity of labor (MP_L), (ii) marginal productivity of capital (MP_K), and (iii) marginal rate of technical substitution ($MRTS_{LK}$):

(a) $Q = 10L^2 + 8K^3 - L^2K$.
(b) $Q = 4L^{0.3}K^{0.5}$.
(c) $Q = 17L + 9K + 0.4L^{0.2}K^{0.4}$.

Problem 3:

Determine the returns to scale implied by each of the following production functions. You must show work to verify your answer.

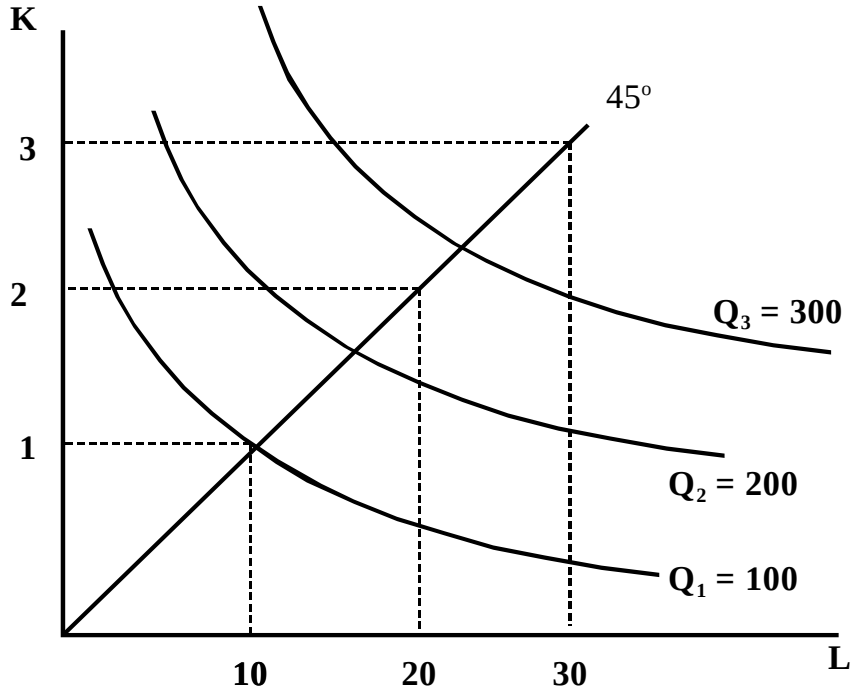
(a) $Q = 0.4A^{1/3} + 0.3A^{1/4}B^{1/3} + 2.0B^{1/2}$
(b) $Q = 0.7L^{3/5}K^{1/5}$
(c) $Q = (2L+2K)^{1/2}$
(d) $Q = 3L + 2K$

Problem 4:
You are given the following table for a production process which has two variable inputs, labor and capital:

	Labor				
Capital ↓	**1**	**2**	**3**	**4**	**5**
1	35	60	70	85	90
2	60	70	85	95	105
3	70	85	95	105	115
4	85	95	105	115	125
5	95	105	115	125	135

(a) Is this a short-run or long-run production function?
(b) If L = 2, what is the MP_K for the K = 4? For K = 5?
(c) If K = 4, what is the MP_L for the L = 2? For L = 3?
(d) Sketch the isoquants corresponding to the following output levels: 70, 85, 95.
(e) What can be said about this production function's $MRTS_{LK}$?
(f) What kind of returns-to-scale does this production function exhibit?

Problem 5:
Use the following graph to answer this question:



(a) Is this a short-run or long-run production function? Explain.
(b) Does this production function exhibit constant-, increasing-, or decreasing-returns-to-scale? Explain.
(c) Is the above production function consistent with *diminishing* MP_L and *diminishing* MP_K? Explain.
(d) Are questions (b) and (c) asking about the same concept, and if not, what are the differences between these two concepts?