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## ANSWERS

### Chapter 1. Technology

1.1 False. There are many counterexamples. Consider the technology generated by a production function  $f(x) = x^2$ . The production set is  $P = \{(x, y) : y \leq x^2\}$  which is certainly not convex, but the input requirement set is  $\bar{Y}(y) = \{x : x \geq \sqrt{y}\}$  which is a convex set.

1.2 It doesn't change.

1.3  $a = 4$  and  $b = 8$ .

1.4 Let  $g(y) = f(x)$ . Then

$$\frac{dy}{dx} = \frac{\sum_{i=1}^n \frac{\partial f(x)}{\partial x_i}}{\sum_{i=1}^n \frac{\partial f(x)}{\partial x_i}}$$

so that

$$\frac{1}{g(y)} \frac{dy}{dx} = \frac{\sum_{i=1}^n \frac{\partial f(x)}{\partial x_i}}{\sum_{i=1}^n \frac{\partial f(x)}{\partial x_i}}$$

1.5 Substitute  $x_i$  for  $i = 1, 2$  to get

$$f(x_1, x_2) = (3x_1)^2 + (6x_2)^2 = 9x_1^2 + 36x_2^2 = 9f(x_1, x_2).$$

This implies that the CES function exhibits constant returns to scale and hence has an elasticity of scale of 1.

1.6 This is false. If  $g'(y) > 0$ , then the function must be strictly increasing for the converse to be true. Consider, for example, the function  $g(y) = y^2$ . This is strictly increasing, but  $g'(y) = 0$ .

1.7 Let  $f(x) = g(h(x))$  and suppose that  $g(h(x)) = g(h(x'))$ . Since  $g$  is increasing, it follows that  $h(x) = h(x')$ . Now  $g(h(x)) = g(h(x))$  and  $g(h(x')) = g(h(x'))$  which gives the required result.

1.8 A homothetic function can be written as  $g(h(x))$  where  $h(x)$  is homogeneous of degree 1. Hence the Cobb-Douglas function has the

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