

The Digital Economist

Intermediate Macroeconomics

Worksheet #4: **Capital Accumulation**

Name: _____

1. Given the following data:

Capital [K]	Output [X]	MP _K	Output Price (P _x)	MRP _K (MP _K x P _x)	Output Price (P _x)	MRP _K '
50	1000	70	\$2.00	\$140	\$4.00	_____
60	1600	60	2.00	120	4.00	_____
70	2100	50	2.00	100	4.00	_____
80	2500	_____	2.00	_____	4.00	_____
90	2800	_____	2.00	_____	4.00	_____
100	3000	_____	2.00	_____	4.00	_____
110	3100	_____	2.00	_____	4.00	_____
120	3150	_____	2.00	_____	4.00	_____

- The Price of a unit of capital (P_k) is \$320
- The [expected] life of a unit of capital is 10 years
- The Optimal level of the capital stock 'K*' is defined where:

$$MRP_K = P_K(r + \delta)$$

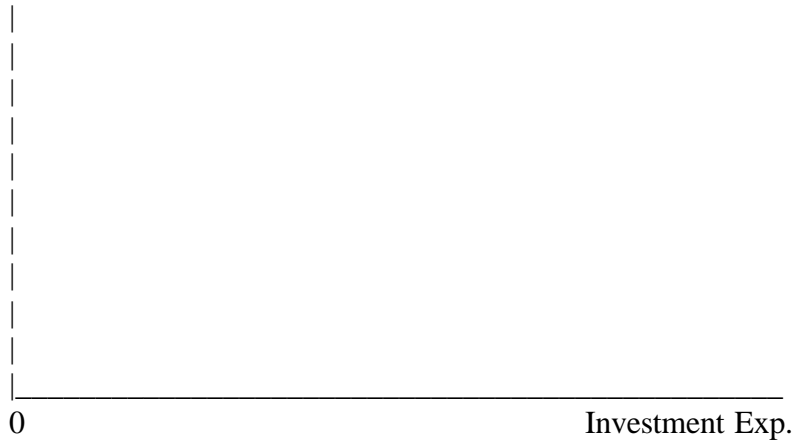
- 'δ' represents the annual rate of depreciation

Complete steps a – d for a market output price 'P_x' of \$2.00

- If the real rate of interest 'r' is 15% (0.15), what is the optimal level of capital stock 'K*'?
- If the real rate of interest falls to 2.5%, what is the new optimal level of capital?
 - Investment is defined as: $I_t = K^*_t - K_{t-1} + \delta K_{t-1}$
- If K_{t-1} is equal to 70 units of capital, what will be the level of *investment expenditure* for r = 15% at the existing rate of depreciation?
- What will be the level of *investment expenditure* for K_{t-1} = 70, r = 15% and a rate of depreciation 'δ' of 0.225?
- Repeat steps 'a-c' for an output price (P_x) of \$4.00.

(Question #1, cont.)

- f. Graphically show the relationship between investment expenditure and the real rate of interest. Specifically, show the level of expenditure for $K_{t-1} = 70$, $\delta = 0.10$, $P_x = \$2.00$, $r_0 = 15\%$, and $r_1 = 8.75\%$.



2. Suppose that production is defined by a Cobb-Douglas production function

$$Y = \mathbf{A}L^{1-\alpha} \mathbf{K}^\alpha \quad \alpha = 0.30, \mathbf{A} = 100$$

- a. Provide an economic interpretation for the parameters ‘ α ’ and ‘ \mathbf{A} ’.
- b. Does this production function exhibit *increasing returns*, *constant returns*, or *decreasing returns* to scale? _____ Explain.

Using the following expression for the *Rental Costs of Capital* (RCC), solve for the optimal level of capital stock ‘ \mathbf{K}^* ’ as a function of the real interest rate ‘ r ’:

$$\text{RCC} = P_k(r + \delta) = \$320(r + 0.10)$$

Remember that K^ is that level of capital where $\text{RCC} = \text{MRP}_K$.*

- c. By how much does the optimal capital stock change when the interest increases from ‘ $r = 10\%$ ’ to ‘ $r = 8\%$ ’?
- d. Using an existing level of capital (K_{t-1}) equal to ‘0’, calculate the changes in investment expenditure for the change in interest rates of part ‘c’.

