Lab 8
Agricultural and Resource Economics
(ARE 012)

Name:_____

Section #:_____

This lab assignment is worth 100 points. Unless instructed differently, you are to complete the lab during the lab period. Late lab assignments will not be accepted without an excused absence. Please let the lab instructor know if you need any help with this lab. Good Luck!

Purpose of Lab:

This assignment will review the mathematics of percents and percent changes, examine the Circular Flow Model of economic activity, show you how to develop an Asset Replacement Fund, and teach you how to use the physical efficiency and the economic efficiency of a factor of production in making business decisions.

Assignments:

I. Reviewing the Mathematics of Percents and Percent Changes. You will often have to calculate percents and percent changes in economics. This exercise will review the mathematics of percents.

- You change a decimal to a percent by multiplying the decimal by 100 and adding a % sign to the product. Multiplying a decimal by 100 is equivalent to moving the decimal point in the number 2 places to the right.

For example, change 2.5 to a percent:

2.5 = 250% (move the decimal point to the right by 2 places and add a % sign)

- You change a percent to a decimal by dividing the percent by 100 and removing the % sign from the quotient. Dividing a decimal by 100 is equivalent to moving the decimal point in the number 2 places to the left.

For example, change 75% to a decimal:

75% = .75 (move the decimal point to the left by 2 places and remove the % sign)

- You calculate the percent change in a variable **from** its value during year *x* **to** its value during year *y* as follows:

$$\text{Percent Change} = \frac{\text{Value during Year } y \text{ - Value during Year } x}{\text{Value during Year } x} \text{ X } 100$$

(add a % sign to the answer)

In using the equation above, you should be careful not to confuse the value of a variable during year *x* with the value of the variable during year *y*. You may want to note that the value of the variable during year *x* typically follows the word "from," and the value of the variable during year *y* typically follows the word "to" in problems associated with this class.

There is a different way to ask you to calculate the percent change in a variable. You may be asked to "Calculate the percent change in a variable between year *x* **and** year *y*." In this case, you should use the formula given above, but note that the value of the variable during year *x* comes before the word "and," and the value of the variable during year *y* comes after the word "and" in the problem.

For example, consider the following data:

Year	**Price of a Good** ($ / unit)	**Quantity Purchased** (units)
1992	$1.00	69.2
1993	$1.07	68.7
1994	$1.25	69.0
1995	$1.22	73.4
1996	$1.29	73.5
1997	$1.33	65.1

a) Calculate the percent change in the price for the good from 1993 to 1997:

$$\text{Percent Change} = \frac{\text{Price during 1997 - Price during 1993}}{\text{Price during 1993}} \text{ X } 100$$

(add a % sign to the answer)

$$= \frac{\$1.33 - \$1.07}{\$1.07} \text{ X } 100 = 24.30\%$$

b) Calculate the percent change in the quantity purchased of the good between 1992 and 1993:

$$\text{Percent Change} = \frac{\text{Quantity during 1993 - Quantity during 1992}}{\text{Quantity during 1992}} \text{ X } 100$$

(add a % sign to the answer)

$$= \frac{68.7 - 69.2}{69.2} \text{ X } 100 = -.72\%$$

Answer the questions below using the following information:

Year[1]	**Price for Gasoline ($ / gallon)**	**Quantity Consumed (billion gallons)**
1980	$1.25	71.9
1981	$1.38	71.0
1982	$1.30	70.1
1983	$1.24	69.9
1984	$1.21	68.7
1985	$1.20	69.3
1986	$.93	71.4
1987	$.95	71.0
1988	$.95	71.0
1989	$1.00	72.7
1990	$1.39	72.4
1991	$1.16	72.8
1992	$1.18	72.5
1993	$1.04	72.7

[1] Source: Statistical Abstract of the United States, 1992.

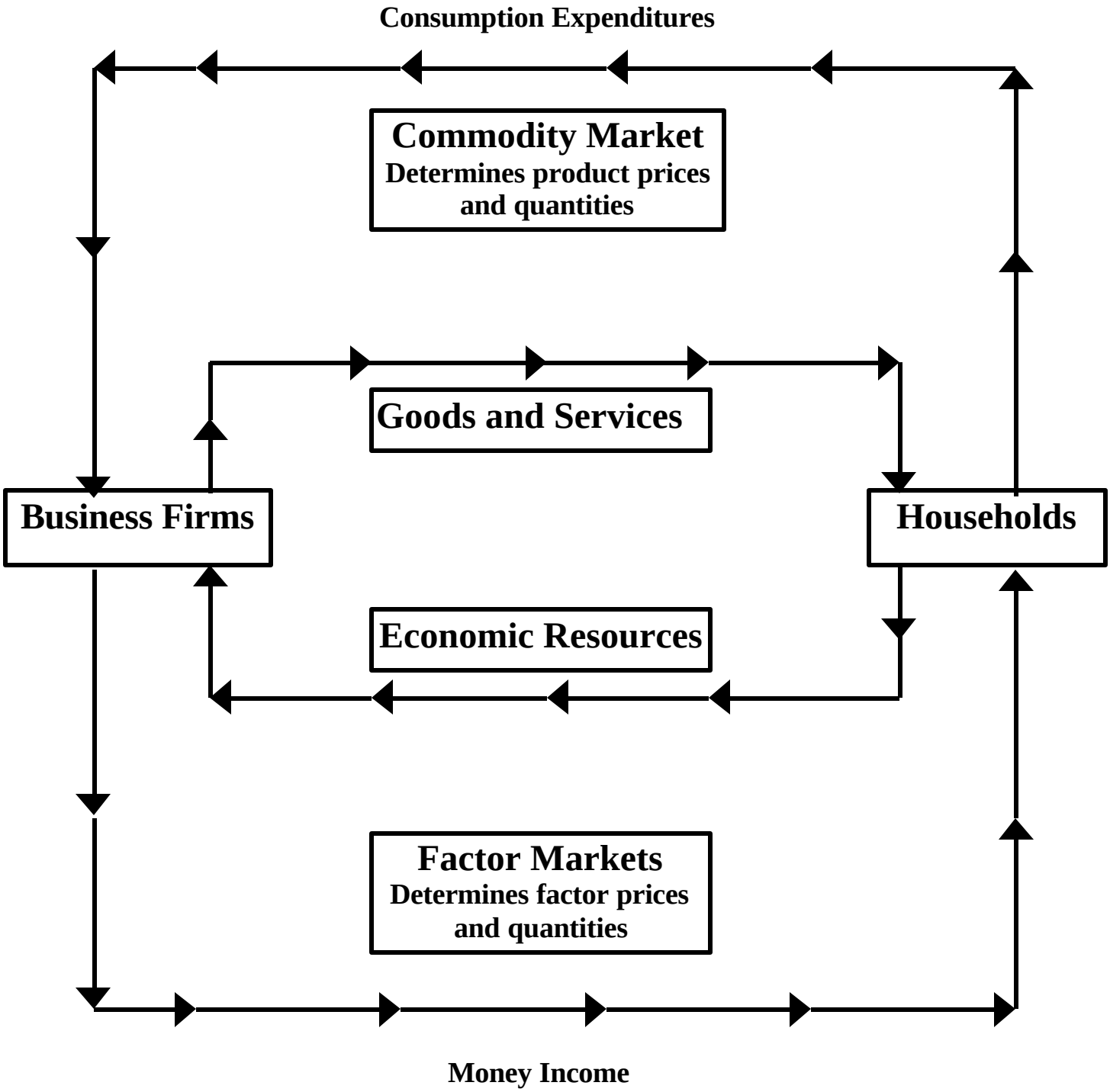
1. What is the percent change in the price for gas from 1981 to 1993?

2. What is the percent change in the quantity of gas consumed between 1981 and 1993?

3. What is the percent change in the price for gas between 1981 and 1987?

4. What is the percent change in the quantity of gas consumed from 1981 to 1987?

II. Examining the Circular Flow Model of Economic Activity. The diagram below demonstrates the circular flow of economic activity in a free market. You should be able to duplicate the diagram and explain the components of the Circular Flow Model on the next exam. Spend a few minutes studying the diagram before proceeding.



Answer the questions below. You should refer to the diagram of the Circular Flow Model. You may want to refer to your notebook and lecture notes.

1. What is the function of the commodity market? Give an example.

2. What is the function of the factor market? Give an example.

3. What are the "factors" in the factor market?

4. Why does money flow from households to businesses?

5. Why does money flow from businesses to households?

6. Explain the Circular Flow Model of economic activity in a free market.

III. Developing an Asset Replacement Fund. *Capital goods* are defined as goods that are used to produce other goods. For example, a router may be used in a workshop to cut dovetails in the making of furniture. Like all capital goods, a router will not last forever. Sooner or later, the router will break and have to be replaced. The term *depreciation* refers to the wear-and-tear that occurs to capital goods over time.

Business owners have to replace capital goods that are worn out. The replacement of capital goods can be very expensive. For example, a farmer may have to spend $60,000 or more to replace a tractor.

An *Asset Replacement Fund* is used by business owners to save money for the replacement of worn out capital goods. Business owners should place a certain amount of money in their Asset Replacement Fund each year. Their goal is to accumulate enough money in their Asset Replacement Fund to be able to buy new capital goods when the old ones wear out. The money that is put in an Asset Replacement Fund comes from the profits of the business.

This exercise will teach you how to develop an Asset Replacement Fund. Answer the questions below using the following information:

Let's suppose that you are a golf course superintendent. We will assume that you have recently purchased a greens mower for $14,000. From past experiences, you know that the *useful life* of a mower of this type is 8 years. You will have to replace your mower at the end of this period.

The value of a capital good at the end of its useful life is referred to as its *salvage value*. We will assume that the salvage value of your mower will be $1,000. This is the amount of money that you would receive if you sold the mower at the end of 8 years. It could also be equivalent to the trade-in value that you would receive toward the purchase of a new mower at the end of the useful life period.

1. In the simplest case, the amount of money that you should put in an Asset Replacement Fund is equal to the annual depreciation of the mower. If this amount of money is placed in the Asset Replacement Fund each year, the money in the fund plus the salvage value of the mower will be sufficient to buy a new mower at the end of 8 years (i.e., assuming that the price of a new mower does not increase.)

The straight-line method for calculating the annual depreciation on a capital good, which you should use in this exercise, is as follows:

$$\text{Annual Depreciation} = \frac{\text{Cost} - \text{Salvage Value}}{\text{Useful Life}}$$

a) Using the simplest case, how much money should you place in the Asset Replacement Fund for your mower?

2. Let's assume that the marginal tax rate for federal and state income tax purposes is 33%. This assumption means that you have to give the government 33 cents in taxes for each dollar of taxable income (e.g., the tax on $100 in taxable income is $33).

The annual depreciation on the mower lowers the taxable income of the golf course. This is because taxable income is calculated by subtracting depreciation and other expenses from gross income. You can think of the tax savings from claiming depreciation for tax purposes as a subsidy for a non-cash expense from the government to businesses.

a) What is the annual tax savings from claiming the depreciation on the mower for tax purposes?

3. Let's assume that you place the annual tax savings derived from the depreciation deduction into the Asset Replacement Fund. Under these circumstances, how much "profit" would you need to allocate to the golf course's budget for the Asset Replacement Fund?

4. We have assumed that the price for a mower will not change over the 8-year period. Of course, this assumption is not realistic because of the forces of inflation.

Let's suppose we expect that the average annual increase in the price for a mower over the next year is 5% of the original cost. How much money should we allocate from "profit" to the golf course's annual budget for the Asset Replacement Fund to account for this inflation?

5. Let's suppose that you place the Asset Replacement Funds in a money market account with your bank yielding an after tax return of 3%. What is the after-tax interest earned on the Asset Replacement Fund at the end of the first year?

6. You can think of the interest that you earn on the Asset Replacement Fund as partial compensation for the effects of inflation on the price for a mower. For example, a dollar in additional interest means that you can subtract a dollar from the amount of money that you need to add to the Asset Replacement Fund to account for the effects of inflation.

Using this reasoning, how much money do you actually need to add to the Asset Replacement Fund to account for the effects of inflation?

7. What function of an economic system is demonstrated in this exercise? Explain your answer.

IV. Using Physical Efficiency and Economic Efficiency in Making Business Decisions. The concept of efficiency is very important in economics. This is because one of the goals of society is to use our scarce resources as efficiently as possible. That is, we want to maximize the profit and utility that we receive from our resources. We will discuss the two types of efficiency in this exercise.

Physical efficiency is calculated by dividing the number of units of output from a production process by the number of units of an input required:

$$\text{Physical Efficiency} = \frac{\text{Units of Output}}{\text{Units of Input}}$$

For example, we may refer to the physical efficiency of labor in mowing grass. If a groundskeeper can mow a 3-acre office complex in 4.5 hours, the physical efficiency of labor is .67 acres mowed per hour:

$$\text{Physical Efficiency} = \frac{\text{Acres Mowed}}{\text{Hours of Labor}} = \frac{3\,\text{Acres}}{4.5\,\text{Hours}} = .67\ \text{Acres Mowed per hour}$$

There are two ways to maximize the physical efficiency of a production process. The first way is to obtain the highest level of output possible from a given level of input. For example, a grounds keeper is said to be physically efficient at mowing grass if he or she mows the maximum number of acres per hour without sacrificing quality.

The second way to maximize the physical efficiency of a production process is to minimize the level of input in a production process for a given level of output. For example, a grounds keeper is said to be physically efficient at mowing grass if he or she mows an acre of grass in the fastest time possible without sacrificing quality. You should make sure that you understand the difference between the two examples of physical efficiency before proceeding.

Economic efficiency is calculated by dividing the **value of the output** from a production process by the **value of the input** required:

$$(1)\ \text{Economic Efficiency} = \frac{\text{Value of Output}}{\text{Value of Input}}$$

As shown below, there are two other ways to calculate the economic efficiency of production. Both of these methods can be derived from the definition of economic efficiency that is given by equation 1. The equation that you should use to calculate the economic efficiency of production will depend on the information that you are given in a problem.

$$(2)\ \text{Economic Efficiency} = \frac{\text{Price of Output} \times \text{Units of Output}}{\text{Price of Input} \times \text{Units of Input}}$$

$$(3)\ \text{Economic Efficiency} = \frac{\text{Price of Output}}{\text{Price of Input}} \times \text{Physical Efficiency of Production}$$

For example, we may refer to the economic efficiency of a hog farm. If a hog farmer can produce $12,000 worth of hogs with $10,000 worth of inputs, the economic efficiency of production is 1.20:

$$\text{Economic Efficiency} = \frac{\text{Value of Hogs}}{\text{Value of Input}} = \frac{\$12{,}000}{\$10{,}000} = 1.20$$

If we assume that producers have no control over input and output prices, which is realistic in most markets, there is only one way to maximize the economic efficiency of production. Under these circumstances, a producer maximizes the economic efficiency of production by maximizing the physical efficiency of his operation. This conclusion should be evident from equation 3 above.

Answer the questions below. You may want to refer to your notebook and lecture notes.

1. It takes 6 hours of labor to mow 3 lawns. What is the physical efficiency of labor?

2. It takes 4 hours of labor to build 20 oak clocks. What is the physical efficiency of labor?

3. In reference to question 2, what could a clock maker do to improve the physical efficiency of labor in building clocks? Do you think that a clock maker would be interested in increasing the physical efficiency of his operation? Explain your answers.

4. If the labor rate is $5.00 per hour and oak clocks sell for $30.00 each, what is the economic efficiency of labor in building clocks? Work this problem in two different ways (i.e., use equation 2 and equation 3). You will need to refer to question 2.

5. If the physical efficiency of labor in washing and waxing cars is 2.9 cars per hour, how many cars can be washed and waxed in 8 hours?

6. If the physical efficiency of labor in preparing tax returns is .70 tax returns per hour, how many hours would it take to prepare 8 tax returns?

7. Blue shell crabs sell for $7.50 per dozen. It takes 2.5 hours to catch three dozen crabs. A crabber is paid $7.00 per hour. What is the economic efficiency of labor in crabbing? Work this problem in two different ways (i.e., use equation 2 and equation 3). What do you think would happen if the economic efficiency of labor in crabbing fell below 1?

8. If the physical efficiency of labor in grading exams is 6 exams per hour, how many exams can be graded in 2.5 hours?

9. If the physical efficiency of labor in preparing a blue-plate lunch special is 24 plates per hour, the economic efficiency is 18, and the labor rate is $6.00, what is the price of the blue-plate lunch special?

10. If the physical efficiency of labor in potting one-gallon azaleas is 20 pots per hour, the economic efficiency is 7.78, and the price of one-gallon azaleas is $3.50, what is the wage rate being paid?

11. Let's assume that you have to choose between two production plans. Plan A has a physical efficiency of 20 units produced per hour of labor. Plan B requires 4 hours of labor. How many units of output are required from production plan B for this plan to be more efficient than plan A?

12. Can you develop a rule-of-thumb relating to the economic efficiency of production that can be used in making production decisions? That is, I would like for you to be able to say to a business owner, "You should not produce the good in question if the economic efficiency of production is less than _____ ." You need to fill in the blank. Explain you answer.

13. Fill in the blanks in the table below:

Units of Input	**Units of Output**	**Physical Efficiency** (units of output / units of input)	**Output Price**	**Input Price**	**Economic Efficiency**
6	14		$21.00	$7.00	
	30	6		$2.00	19
9		.5	$7.00		.7
2			$14.00	$5.00	30
5		10		$1.00	4

14. What do you think would be a good question on the next exam to test your knowledge of economic efficiency?