



- Name: \_\_\_\_\_
  - Date: \_\_\_\_\_
  - Section: \_\_\_\_\_
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## ECON 300: Intermediate Price Theory

### Problem Set #2

#### INSTRUCTIONS:

- This problem set is not graded.

**Problem 1. The Budget Constraint**

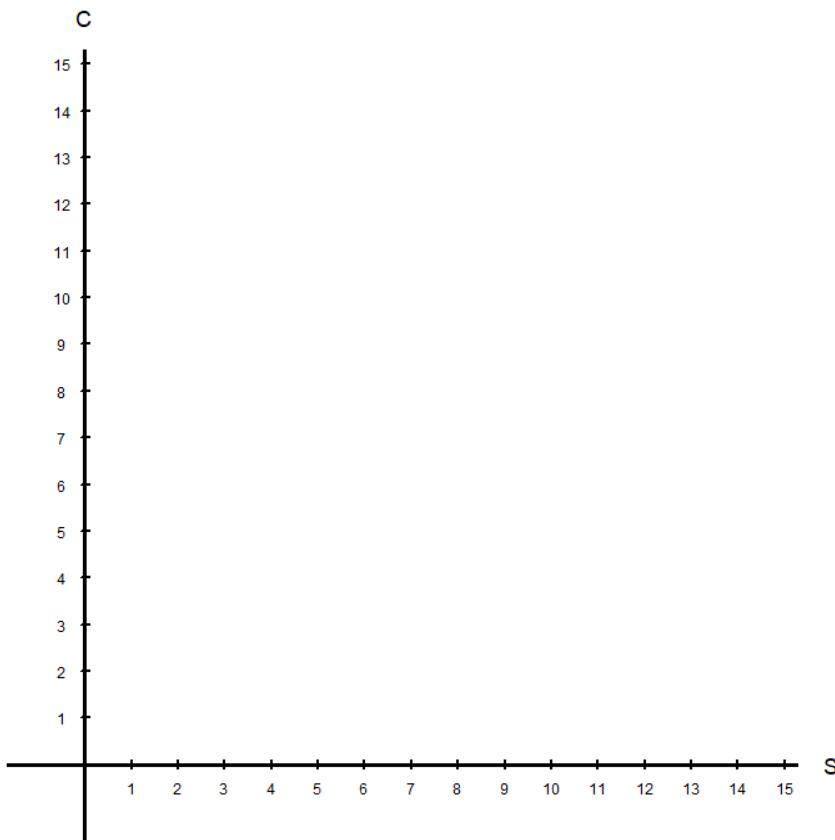
Suppose that you are preparing for a trip abroad with a budget of \$60. You are purchasing and packing toiletries, and the two items you need are shampoo ( $s$ ) and conditioner ( $c$ ). Each ounce of shampoo costs \$5, and each ounce of a conditioner costs \$4. You have no other liquids than the amount of shampoo and conditioner you purchased, but the TSA will allow up to 10 ounces of liquids onboard an aircraft.

1.A. Express the consumer's budget constraint and TSA constraint as two separate equations.

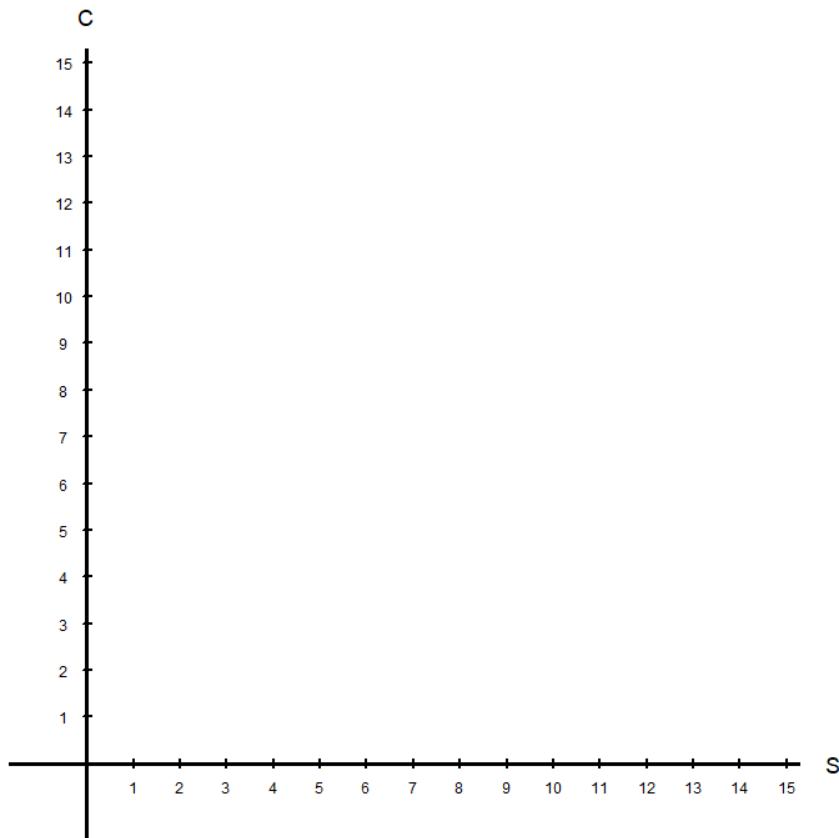
- The Budget Constraint:

- The TSA Constraint:

1.B. Plot the consumer's budget constraint in the diagram below.



1.C. Plot the consumer's budget constraint and TSA constraint in the diagram below.



1.D. Is either the budget constraint or the TSA constraint redundant? If so, which one is the *binding* constraint?

**Problem 2. The Utility Maximization Problem**

Suppose that you are the consumer from **Problem 1**. Your utility function over shampoo ( $s$ ) and conditioner ( $c$ ) is defined as:

$$u(s, c) = s^2c$$

2.A. Find the formula for the marginal utility of shampoo and the marginal utility of conditioner.

- $MU_s =$

- $MU_c =$

2.B. Find the formula for the marginal rate of substitution and the *price ratio* (slope of the constraint).

- $MRS_{s,c} =$

- “Price” Ratio =

2.C. Find the optimal units of shampoo and conditioner that will maximize this consumer’s utility.

**Problem 3. Deriving the Engel Curve**

Suppose that the consumer is participating in a market consisting of goods  $x$  and  $y$ . The price of good  $x$  is 2, the price of good  $y$  is 1. The consumer's utility function is given as follows:

$$u(x, y) = x + 2y$$

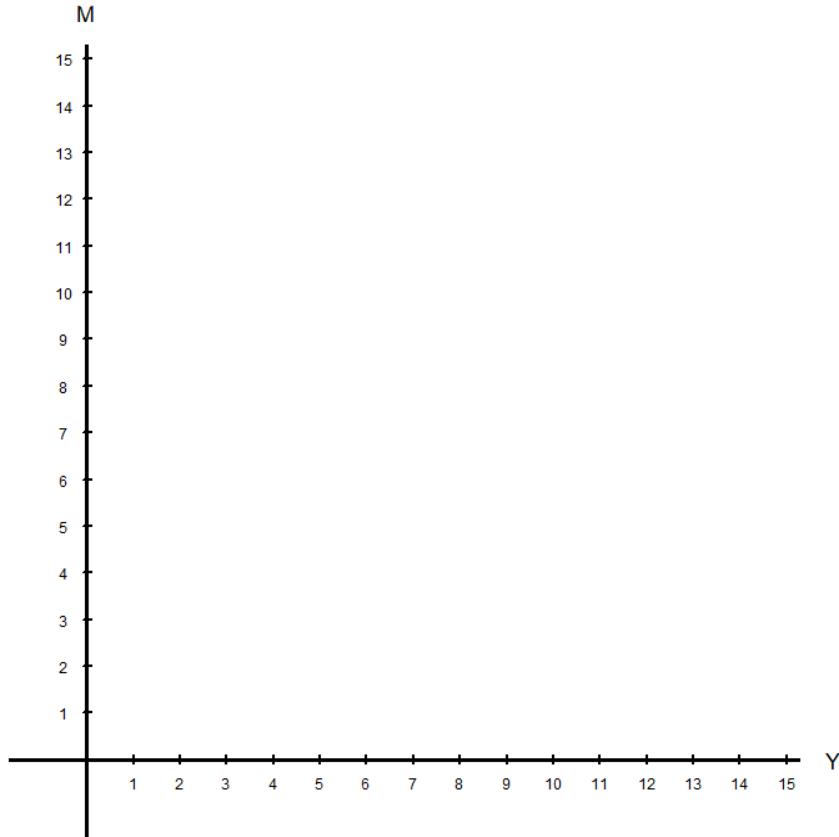
3.A. If the consumer's income is  $M_0 = 2$ , what is the consumer's optimal consumption bundle?

3.B. If the consumer's income is  $M_1 = 6$ , what is the consumer's optimal consumption bundle?

3.C. If the consumer's income is  $M_2 = 10$ , what is the consumer's optimal consumption bundle?

3.D. If the consumer's income is  $M_3 = 14$ , what is the consumer's optimal consumption bundle?

3.E. Plot the consumer's Engel curve for good  $y$  in the diagram below.



3.F. Is good  $y$  a Normal good or an Inferior good? Why?

**Problem 4. Deriving the Walrasian Demand Curve**

Suppose that the consumer is participating in a market consisting of goods  $x$  and  $y$ . The price of good  $x$  is  $P_x$ , the price of good  $y$  is  $P_y$ , and the consumer's income is  $M$ . The consumer's utility function is given as follows:

$$u(x, y) = 4xy^3$$

4.A. Find the formula for the marginal utility of  $x$  and the marginal utility of  $y$ .

- $MU_x =$

- $MU_y =$

4.B. Find the optimal ratio of goods  $x$  and  $y$  for this consumer.

4.C. Find the demand function for good  $x$ .

4.D. Find the demand function for good  $y$ .

**Problem 5. The Income and Substitution Effects**

Suppose that the consumer is in a market with coffee ( $c$ ) and bagels ( $b$ ). The price of each cup of coffee is  $P_c = \$4$ , the price of each bagel is  $P_b = \$2$ , and the consumer has \$30 as their income. The consumer's utility function over coffee and bagels is defined as:

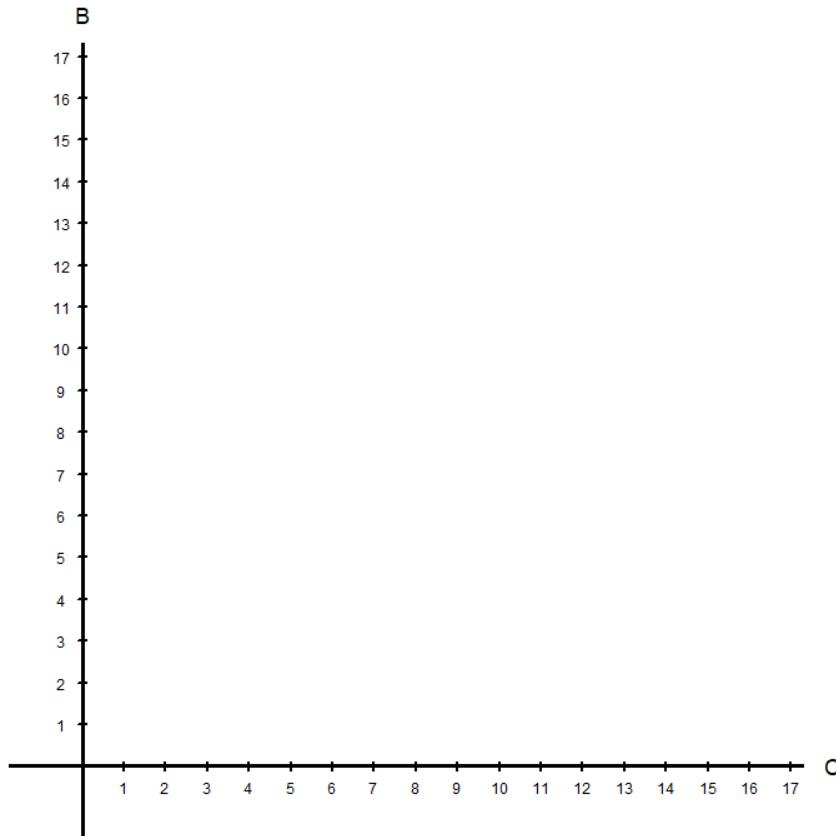
$$u(c, b) = c^3b$$

5.A. Find the bundle of coffee and bagels that will maximize the consumer's utility.

5.B. Suppose that the price of coffee falls to  $P'_c = \$2$ . Find the optimal bundle for the consumer.

5.C. Is coffee an Ordinary good or a Giffen good in this situation? Why?

5.D. Plot this change in the diagram below, showing the income and substitution effect.



5.E. (ADVANCED) Calculate the income and substitution effects of coffee.