1 Supply and Demand

Consider the following supply and demand functions for Ramen noodles. The variables are defined in the table below. Constant values are given for the last 2 variables.

Variable	**Meaning**	**Constant value**
Q_D	Quantity demanded of Ramen	
Q_S	Quantity supplied of Ramen	
P_{Ramen}	Price of Ramen	
P_{Kraft}	Price of Kraft Mac and Cheese	\$0.99
Y	Consumer income	\$11,500

$$\begin{gathered} Q_D = 1,141,000 - (2,683,700)\, P_{Ramen} + (100,000)\, P_{Kraft} - (20)\, Y \\ Q_S = -100,021 + (680,000)\, P_{Ramen} \end{gathered} \tag{1}$$

1. Write down the inverse demand function for Ramen noodles.
2. Find the equilibrium price and quantity in this market.
3. Suppose that P_{Kraft} increases to \$1.33. Recalculate the equilibrium price and quantity given this change.
4. Calculate the own-price elasticity of demand. Use the equilibrium price and quantity as your initial price and quantity. Is demand elastic or inelastic at the equilibrium price and quantity?
5. Calculate the cross-price elasticity for a 1% increase in the price of Kraft Macaroni and Cheese. Are Ramen noodles and Kraft Macaroni and Cheese substitutes or complements? Explain how you know whether they are substitutes or complements.
6. Calculate the income elasticity for Ramen noodles. Use the equilibrium price and the constant value for income. Are Ramen noodles a normal good or an inferior good? How do you know? If it is a normal good, is it a necessity or a luxury?

2 Optimization problem

Rob's utility function over goods a, b, and c is given by:

$$U(a,b,c) = 12a^2b^4\sqrt{c}$$

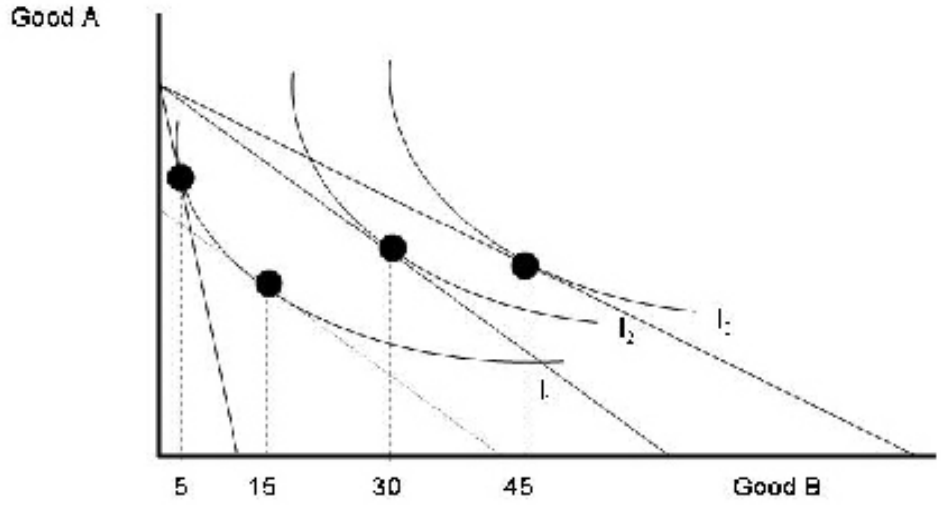
Rob has an income of $Y = 5200$ and the prices of goods a, b, and c are $p_a = 2$, $p_b = 8$, and $p_c = 4$ respectively. Find Rob's optimal bundle of goods a, b, and c.

3 Another optimization problem

Consider the linear utility function $u(x_1,x_2) = \alpha x_1 + \beta x_2$, where α and β are constants and $\alpha > 0$ and $\beta > 0$. The consumer faces budget constraint $y - p_1 x_1 - p_2 x_2 > 0$ with $y > 0$, $p_1 > 0$, and $p_2 > 0$.

1. **a** Calculate the marginal utility for good x_1 and good x_2.
   b. Find the Walrasian demand for goods x_1 and x_2.
   c. Let $\alpha = 2$, $\beta = 6$, $y = 120$, $p_1 = 1$, and $p_2 = 4$. What is the optimal consumption bundle for our consumer for these parameters? What is the utility at this optimal consumption bundle?
   d. Now suppose that $p_2 = 3$ and the other parameters are as in part **c**. Find an optimal consumption bundle for the new set of parameters. What is the utility at the optimal consumption bundle you found?

4 Income and Substitution



The picture above shows a set of indifference curves for a consumer, as well as some budget constraints. We will assume that the price of good A and

the income of the consumer are fixed. Suppose that the budget constraints in the picture correspond to prices of \$5, \$3, and \$2 for good B. Note that the faint budget constraint (or the one that does not pivot at the same point as the others) is to be used in determining income and substitution effects. It is in a sense a "hypothetical" budget constraint.

1. Derive the consumer's demand curve for good B using these 3 prices.
2. Calculate the total effect given a price decrease from \$5 to \$3.
3. Calculate the substitution effect given a price decrease from \$5 to \$3.
4. Calculate the income effect given a price decrease from \$5 to \$3.
5. Is this good a normal good or an inferior good? How do you know?