1. [45 points] In a land far away, families allocate their money between food and the composite good. Assume that there is only one type of “food.” Food costs $3 per pound and a typical family with children earns $30 per day.

i. Draw the budget frontier for a typical family. You may use the graph on the next page. See graph.

ii. A household budget survey shows that most families buy between 1 and 15 pounds of food per day. Draw an indifference curve for a family that buys 5 pounds of food per day. See graph.

The Prime Minister of this land is concerned that many people are not eating enough food. Citing nutritional standards for healthy child development, she calls for a government program to help families with children buy food. The minister asks you to help her think through two options. First, is a “food stamp” program in which every family is given coupons that can be redeemed for 4 pounds of food per day. The other option is a “family bonus” program in which every family with children receives a cash grant in the amount of $9 per day.

iii. Draw the budget curve under the “food stamp” program. Mark it using a squiggly line (~~~~~~~~~~~~). See graph.

iv. How much will the food stamp program cost if there are 100 families? Clearly state any assumptions you make in reaching this figure.

\[ 4 \text{lb} \times \$3/\text{lb} \times 100 \text{families} = \$1200 \]

This answer assumes: zero administration costs, all families take up full benefit, program has no impact on cost of food (i.e. assume perfectly elastic supply of food). Partial credit given for calculations without assumptions.

v. Draw the budget curve under the “family bonus” program. Mark it using a dashed line ( - - - - - - - - ). See graph.

vi. How much will the family bonus program cost if there are 100 families? Clearly state any assumptions you make in reaching this figure.

\[ \$9 \times 100 \text{families} = \$900 \]

This answer assumes: zero administration costs, all families take up full benefit. Partial credit given for calculations only.

vii. From how you drew the indifference curve in part ii, state whether the example family would prefer the family bonus, would prefer food stamps, or has no clear preference. The family should prefer food stamps, but I generally gave partial credit for other answers if the answer matched the way the graph was drawn.

viii. Explain in 2 or 3 sentences why a different family might prefer another option. A different family might have an optimal food consumption of less than 4lbs and a stronger relative preference for non-food goods.

ix. Draw the indifference curve for a family that would prefer another option. Indicate this using a dark line ( ~~~~ ). See graph.
You may use this graph for #1. Note that it is 16 units wide and 20 units high. Read through the problem carefully before deciding on a scale. Be sure to thoroughly label important elements. **NOTE:** This solution graph is not labeled due to impatience with technology. See Jen if you need help interpreting the graph. The dashed line is the family bonus, the dotty line is the food stamp program.
2. [30 points] You are the mayor of a town. Everyone in your town breathes the same air and half the people have three large trees in their yard. These trees drop a lot of leaves in the fall.

There are two ways that homeowners can dispose of their leaves—burn them or bag them for the city compost pile. Burning leaves is free, but it takes some time to rake them up. Bagging leaves requires buying bags and takes a bit more time because you have to rake them and then stuff them into the bag. Leaf burning pollutes the air, whereas bagged and composted leaves are used to beautify the flower beds in the city parks.

At a city council meeting, you argue that the city should do something about the leaf burning. It’s OK if a few people burn leaves, but now too many people are doing it.

Immediately a disgruntled resident speaks up, “Always some new government interference! Why does the government have to be involved in how I get rid of the leaves from my tree?”

i. You know that this fellow used to be a free market economist. Describe in three or four sentences why you think the city should interfere with citizens’ leaf-disposal choices.

Key point: This is an example of a negative externality (partial credit).

Why should government intervene? Market failure due to the fact that private cost is less than true social cost (full credit)

Other good points:
- This is an example where negotiation is not feasible
- There is a public good associated with beautiful flower beds made possible by composted leaves.

Example of partial credit The government should intervene because this is a negative externality problem. People who burn the leaves pollute the air, which negatively affects other people’s health.

Example of a full credit The city council should interfere with citizens’ leaf-disposal choices because that type of disposal has negative externalities. In this instance, burning leaves costs citizens less in time, but the pollution and health problems created by polluting the air are more costly to the society as a whole and the citizens of the city. So the city council has an obligation to intervene...

Next you hear from a city council member. She agrees that something needs to be done, but knows that in the next town over, they offered free leaf bags and too many people continued to burn leaves. This policy didn’t work, she says.

ii. In one or two sentences, describe one other possible policy that your city could use. This may involve free leaf bags, but it must involve something else as well.

Accepted: selling or auctioning permits, fining those who burn, creating collection mechanism that does not involve bagging, paying people who chose to bag

iii. Could this policy represent a Pareto improvement? If so, explain how; if not, explain why not. This should be a one-paragraph (4-6 sentence) explanation. You may need to make assumptions or assign dollar values to how much people dislike bagging leaves. That’s fine—just be sure you state any assumptions.

A Pareto-improving policy makes some better off without making anyone worse off (partial credit). Specifics will depend on the type of policy and must be explained for full credit. A fine will make the leaf-burners worse off, so solutions that involve a fine or having to buy a permit cannot be Pareto improvements (although they may solve the problem). Paying baggers or altering collection mechanisms (the leaf-sucking truck) may be Pareto improvements IF the value to those who will pay for the program will be outweighed by the gain in air quality.

Note: multi-part policies (fine plus incentives plus free bags) make answering this problem harder, but fine or cost increase rules out a Pareto improvement.
3. [45 points] Imagine a small country in which there are just two goods and two types of economic actors. The goods are vitamins and orange juice. The economic actors are producers (who produce vitamins or juice and then sell what they produce) and consumers (who buy vitamins and juice). The producers operate under normal production technology, meaning that the supply curves for both vitamins and juice look like this:

i. Draw two versions of this supply curve. Call one “Graph O” and the other “Graph V.” Label the parts of the graphs. Must label axes (price, quantity) and curve (supply). NOTE: In visiting this country, you notice that when the price of orange juice goes up a little, people buy a lot less. However, all the consumers take a vitamin every morning no matter how low or high the price of vitamins.

ii. Based on your observations, add a demand curve for orange juice to Graph O and add a demand curve for vitamins to Graph V. NOTE: Graphs not labeled due to impatience with technology

![Graph O](image1.png) ![Graph V](image2.png)

iii. How are the two demand curves different? Explain in 2-4 sentences using economic terms.

Key point here is elasticity – amount that demand will change with a change in price. Demand for orange juice is elastic, demand for vitamins is inelastic (or less elastic).

Now, the legislature approves a business tax. Producers now have to pay a tax based on the value of the goods that they sell. From the consumer’s perspective, this tax acts like a shift of the supply curve up.

iv. Add the (supply + tax) curve to the graph. What happens to the equilibrium in each market? Describe these changes in equilibrium from the perspective of the consumers and the perspective of the producers.

Change in OJ market: price is higher and quantity demanded is lower. For the consumer, this means paying more per unit but not buying as many units. For the producer, this means selling less and taking in less total money (because part of price goes to government in the form of a tax).

Change in vitamin market: price is higher and quantity demanded is the same. For the consumer, this means paying more per unit of vitamin, but no change in amount bought. For the producer, this means selling the same amount and taking in the same amount (although the government is also collecting a tax).

v. Policy debates over tax systems sometimes focus on incidence. Incidence refers to the allocation of the true burden of the tax between buyer and seller. This problem is meant to illustrate a general principle about tax incidence, that demand determines incidence. Explain this concept in a paragraph (3-5 sentences).

Sample response: If demand for a good is inelastic, then the cost of any tax placed on the product can be shifted from the producer to the consumer because the consumer will be willing to pay more for the product. If demand for a good is elastic, then raising the price of the product (through a tax or other means) will cause the consumer to buy a lot less. Hence the producer will be more likely to share the cost of the tax or bear it totally when demand is elastic.

4. Record your finish time