Three randomly selected questions will be graded for credit. All graded questions are worth 10 points. Always show all your work, so that you can receive partial credit. An answer with no explanation will receive zero credit. Use extra pages if necessary, but make sure you clearly indicate where the rest of your answer is.

1. Prove the following to be true or false. In each case, show your calculations of the price elasticities. If you showed your calculations for a point in an earlier part of the question, you don’t have to show it again, just refer back to it.

a. Demand 1 is less elastic at point B than is Demand 2. (True)

Demand 1 : \( P_1 = -2Q_1 + 12 \)

Demand 2 : \( P_2 = -Q_2 + 8 \)

\[ E_{D_1} \text{ at } B = \frac{1}{\text{slope } Q_1} \cdot \frac{P_1}{Q_1} = \frac{1}{-2} \cdot \frac{4}{4} = -\frac{1}{2} \]

\[ E_{D_2} \text{ at } B = \frac{1}{\text{slope } Q_2} \cdot \frac{P_2}{Q_2} = \frac{1}{-1} \cdot \frac{4}{4} = -1 \]

b. Demand 2 has the same elasticity at B that Demand 3 has at point C. (False)

Demand 3 : \( P_3 = -Q_3 + 10 \)

\[ E_{D_3} \text{ at } C = \frac{1}{\text{slope } Q_3} \cdot \frac{P_3}{Q_3} = \frac{1}{-1} \cdot \frac{4}{6} = -\frac{2}{3} \]

c. Demand 1 has the same elasticity at A and at B. (False)

\[ E_{D_1} \text{ at } A = \frac{1}{\text{slope } Q_1} \cdot \frac{P_1}{Q_1} = \frac{1}{-2} \cdot \frac{10}{1} = -5 \]

d. Point A of Demand 1 is definitely less elastic than point C on D3. (False)

More elastic!
e. Point C on Demand 3 is elastic. (False)

Note that the elasticity at C is >-1 (close to zero) or inelastic

f. Without doing any additional calculation, state at which price on each of the curves total revenues are maximized.

D1: \( P_1 = 6 \)  \quad \quad \text{D2: } P_2 = 4 \quad \quad \text{D3: } P_3 = 5

\text{Middle of the demand curve!}

2. (#7 chapter 4) Suppose the demand for crossing the Golden Gate Bridge is given by \( Q = 10000 - 1000P \) (note that this is not written in the usual slope intercept form that we typically use in class).

a. If the toll (P) is $3, how much revenue is collected?

\( \text{When } P = 3, \text{ then } Q = 10000 - 1000*3 = 7000 \)

\( \text{Revenue} = PQ = 3*7000 = $21,000 \)

b. What is the price elasticity of demand at this point?

\[ \text{If you want to use the equation that we usually use, you have to solve for the slope in the form we're used to seeing the demand curve in:} \]

\[ 1000P = 10000 - Q \Rightarrow P = \frac{10000}{1000} - \frac{1}{1000} Q, \text{ so the slope is } 1/1000. \]

\[ \frac{1}{\text{slope}} \frac{P}{Q} = \frac{1}{1000}, \quad \frac{3}{7000} = \frac{-1000}{7000} * \frac{3}{7000} = -\frac{3}{7} \]

\( \text{However, notice that the equation we usually use is} \)

\[ \frac{1}{\text{slope}} \frac{P}{Q} = \frac{1}{\Delta P} \frac{P}{\Delta Q}, \text{ which is just: } \frac{\Delta Q}{P} \frac{P}{\Delta Q} \quad \text{where } \frac{\Delta Q}{\Delta P} \text{ is the just the slope of the demand curve in the form it is written above!! Much easier:} \]

\[ \frac{\Delta Q}{\Delta P} \frac{P}{Q} = -1000 * \frac{3}{7000} = -\frac{3}{7} \]

c. Could the bridge authorities increase their revenues by changing their price? Briefly explain.

\( \text{When demand is inelastic (> -1), the quantity demanded is relatively unresponsive to a change in price. So,} \)

\( \text{raising their price will increase the total revenue because the price will be higher but the quantity demanded will not change much.} \)

d. The Red and White Lines, a ferry service that competes with the Golden Gate Bridge, began operating hovercrafts that made commuting by ferry much more convenient. Intuitively how would this affect the elasticity of demand for trips across the Golden Gate Bridge?

\( \text{The elasticity of demand will increase. The more substitutes a good has the easier it is for consumers to switch to another product if the price goes up.} \)

   a. What is the elasticity of demand for electricity from the summer of 2000 according to the economists Reiss and White estimate for the summer of 2000? (Hint: use the numbers in the article to calculate elasticity). Be careful with the sign!

   \[ E_d = \frac{\% \Delta Q^d}{\% \Delta P} = \frac{-12}{-130} = 0.0923 \]

   b. Is electricity elastic or inelastic?

   *Very inelastic!*

   c. Does their estimate surprise you? Why or why not?
4. Estimates suggest that the price elasticity of demand for beer is -0.16 (Phelps 1997).

a. If we raised the price of beer (through higher taxes) by 15 percent, how much would we expect the consumption of beer to decrease? Show your work.

\[ E_d = \frac{\%\Delta Q^d}{\%\Delta P} \]

\[-0.16 = \frac{\%\Delta Q^d}{15} \]

\[ \%\Delta Q^d = -0.16 \times 15 = -2.4 \%

b. If the goal was to reduce beer consumption by 10 percent, how much would you have to raise the price of beer? Show your work.

\[ E_d = -0.16 = \frac{-10}{\%\Delta P} \]

\[ \%\Delta P = \frac{-10}{-0.16} = 62.5 \%

c. Do you expect teenagers or adults to be have more elastic price elasticity of demand for beer? Why?

*Smaller share of budget for adults.*

*More substitutes exist for adults?*

*Therefore adults have relatively less elastic demand for beer.*

d. Go back to part a. Suppose the cross price elasticity between beer and cigarettes is 0.1. What effect would the 15 percent increase in the price of beer have on the quantity demanded of cigarettes? Does this number suggest that beer and cigarettes are substitutes or complements?

\[ E_{B/C} = 0.1 = \frac{\%\Delta Q^\text{Cigarette}}{\%\Delta P^\text{Beer}} \]

\[ \%\Delta Q^\text{Cigarette} = 0.1 \times 15 = 1.5 \%

*The cross-price elasticity between beers and cigarettes is positive. This means that two goods are substitutes.*
5. The tiny island of WackiWacki is a large producer and consumer of coconut milk. The graph represents the supply and demand for coconut milk.

Label $P^*$ and $Q^*$ on the graph. Label your axes carefully!

$$P^* = 50$$

$$Q^* = 50$$

The government of WackiWacki decides to raise revenue in order to throw large parties for political donors. They plan to raise revenue by placing a $30/unit tax on the producers of coconut milk.

Following the $30/unit tax...

Graphically illustrate the exact effect of this tax. Label any new curve(s)! Label $P_{\text{after tax}}^*$ and $Q_{\text{after tax}}^*$ on the graph.

What price per unit is paid by the consumers? Label this on the graph. $\_\_\_\_\_\_\_70\_\_\_\_\_\_\_\$

What price per unit do producers receive? Label this on the graph. $\_\_\_\_\_\_\_40\_\_\_\_\_\_\_\$

How much revenue does this tax raise for the government? Show your work! $\_\_\_\_\_\_\_30/\text{unit}*30 = 900\_\_\_\_\_\_\_\$

What is the exact share (this should be a fraction!) of the tax paid by consumers? Producers? Show your work.

Consumers bear most of the burden. Their price increases from $50 to $70 because of the $30 tax, so they bear $2/3 of the tax: $\frac{P_{\text{after tax}} - P_{\text{tax}}}{P_{\text{tax}}} = \frac{70 - 50}{30} = \frac{20}{30} = \frac{2}{3}$. They bear most of the burden because the demand is relatively more inelastic than the supply curve. The producers receive $40/Q when they used to receive $50/Q, so they pay $1/3 of the tax.

What does your answer to the above question tell you about the elasticity of supply and demand? Which is relatively more elastic?

Suppliers are more elastic – they pay less of the tax because they are more price sensitive.
Senator Sand claims that putting the statutory incidence on consumers rather than producers would increase tax revenue. Is he correct? Show your conclusion on the following graph.

**Nope. In theory, nothing would change in the above calculations, except who actually writes the check to the government. In practice, it might be harder to collect taxes from consumers because there are so many of them, that tax revenue might actually go down!**


In these lean times, cash-poor states and cities across the country have pondered and enacted a host of creative taxes and fees, raising the cost of snowmobiling in Montana, trout fishing in New Mexico and marrying in Massachusetts. But now there is the proposed espresso tax in Seattle.

Seattle is the coffee capital of the nation, the birthplace of Starbucks, a caffeine-crazed city where espresso is available at gas stations, hospitals, roadside stands and drive-through windows. Seattle is so identified with the liquid produced by forcing steam through ground coffee beans that an espresso tax is like a tax on the city’s very soul.

The formal name of the espresso tax, ...on every beverage served in Seattle containing a half-ounce or more of espresso (lattes, mochachinos and countless other frothy concoctions) -- but would not apply to regular drip coffee -- is Initiative 77. ...

If Initiative 77 passes, the annual espresso tax revenue, ..., would be used to pay for day care and pre-kindergarten programs for low-income children, services that have been sharply cut in recent years....Mr. Burbank said the tax was a fairer way to raise money at a time when the economy was weak because it would affect people with higher incomes more than it would affect the poor. "Lower-income people drink less espresso than upper-middle-class people," he said.

He added: "If you don't want to pay it, you can buy drip coffee or tea. But I believe people are more likely to want to consume espresso if their morning purchase doesn't just go to giving them a buzz but goes to children."

...And many coffee drinkers here who support cigarette and alcohol taxes take issue with one on espresso. "Taxing a single product, taxing that way is a slippery slope for other products to be taxed," said Audrey Lincoff, a spokeswoman for Starbucks, which has headquarters in Seattle. "We oppose it because we feel that it really is too important to fund these programs by being dependent on a single product."

Make an argument either way. For full credit, they need to discuss relative elasticity. Particularly, they know which one is relatively more elastic and they can give reasons for why that might be true. That argument must indicate that they know what results in higher or lower elasticity - # of substitute, share of budget, time frame. Fewer substitutes for espresso (cannot make it at home easily, etc).

Give 0 points if they don’t talk about elasticity.

Note, on the two exams, the graphs are switched.

If they may the argument correctly, but then label the graphs wrong based on their argument, take off 0.5 points.
cups of _____________

Prevd by producers

cups of _____________
b. Show the effect of a $1/cup tax paid by producers in the espresso market.

Label the gross price \( (P_g) = $4 \) and the net price \( (P_n) = $3 \).

What is the tax revenue raised by this tax? (Show your work) ___________________________

\[ $1 \times 1500 ; \text{left graph: } $1 \times 1000 \]

c. A rival group has suggested that a $1/cup tax on regular drip coffee would be more effective at raising tax revenue. Based on how you labeled your diagrams, do you agree? Use elasticity in your answer.

*It depends on their elasticity. The one that is least elastic will be the best at raising the most tax.*

Read the following from the same article:

*Ms. Lincoff declined to say whether Starbucks would pass the tax onto its customers if it is approved. But smaller businesses said they would have to charge more for the espresso drinks, and many said the tax would create an accounting quagmire, requiring that charges for espresso drinks be separated from those for other products.*

"I think it is a bad public policy," said Jen Strongin, a co-owner of Victrola Coffee, adding that she would probably raise the price of espresso drinks by [the amount of the tax] if the tax were approved. ...

d. Comment on the ability of the coffee shops to pass the tax onto its customers. Specifically, will the price go up by the amount of the tax if the above diagram represents the espresso market? If yes, explain what leads to this result and whether this is realistic. If no, what conditions would have to hold for this statement to be true?

*In this case, they will because suppliers are perfectly elastic.*

*It is probably not realistic that it is perfectly elastic, that says that coffee suppliers can increase their output at a constant marginal cost of $3. Given the biology of plants, probably the supply curve is more upward sloping.*