1. California taxes on cigarettes to fund preschool. Suppose taxes are $15 per carton, paid by consumers. Demand and supply of cigarettes are:

Supply: \( Q_S = 2P + 20 \)
Demand: \( Q_D = 200 - P \)

a) Calculate the market equilibrium price and quantity without the tax. 
\( P = 60, \ Q = 140 \)

b) By how much will this tax increase the price consumers pay? By how much will it increase the price producers receive?

Two ways to do this algebra. Both use the basic facts \( Q_S = Q_D \) and \( P_D = P_S + 15 \)

First, you can set \( Q_S = Q_D \) and plug in the tax equation \( P_D = P_S + 15 \)
That would look like this:
- \( Q_S = Q_D \)
- \( 2P_S + 20 = 200 - P_D \)
- Substitute in \( P_D = P_S + 15 \) for \( P_D \)
- \( 2P_S + 20 = 200 - (P_S + 15) \)
- Collect terms and solve
- \( P_S = 55 \)
- Use the tax equation \( P_D = P_S + 15 = 55 + 15 = 70 \)
- Plug either \( P_D = 70 \) into the demand equation or \( P_S = 55 \) into the supply equation
\( \rightarrow Q_S = Q_D = 130 \)

Or alternatively you could solve for inverse demand and inverse supply and solve for \( Q \)
That would look like this:
- From the Supply eqn: \( P_S = \frac{1}{2} Q_S - 10 = \frac{1}{2} Q - 10 \) (drop the subscript on \( Q_s \) since \( Q_S = Q_D = Q \))
- From the Demand eqn: \( P_D = 200 - Q_D = 200 - Q \)
- Plug these into the tax equation \( P_D = P_S + 15 \)
- \( (200 - Q) = (\frac{1}{2} Q - 10) + 15 \)
- Solve for quantity: \( Q = 130 \)
- Plug \( Q \) into supply equation for \( P_S = \frac{1}{2} (130) - 10 = 55 \)
- Plug \( Q \) into demand equation for \( P_D = 200 - 130 = 70 \)

You should feel comfortable with either algebra, so practice doing this problem using the method you did not use in your homework!

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1 These numbers are made up, although the policy in California is a real one. The actual tax is 50 cents per pack. In 2000, when this was imposed, it resulted in tax revenues of $700 million. Tobacco sales were reduced by 30%.
Note that the consumer price increase is 2/3 of the tax; the $5 decrease in the produce price accounts for the other third. For a good exercise, change the slope of either the supply or the demand curve and see how the division of the tax changes.

c) How much revenue will this tax raise? By how much will it reduce smoking?  
The tax reduces cigarette consumption by 10 (from 140 to 130).  
\[ \text{Tax revenue} = \text{tax} \times Qd = 15 \times 130 = 1950 \]

d) Suppose that consumer groups argue that cigarette taxes are regressive and mostly collect revenue from poorer individuals. They propose that the taxes instead be paid by the wealthy cigarette companies. How will this affect consumers and cigarette companies? What is the new price and quantity traded?

You will get the same answers as above—who bears the burden by paying more (the economic incidence) depends on the elasticities, not on who is legally responsible (the legal incidence).

2. T/F/Explain: Suppliers ability to pass on an excise tax to demanders depends on the strength of demand. If the demand curve is very high, a large percentage of the excise tax will be passed on. If demand is low, suppliers will have to pay more of the tax.

False. The economic incidence depends on the relative elasticities. If the elasticity of demand is large relative to the elasticity of supply, suppliers will pay more of the tax. If the elasticity of supply is larger relative to demand, more of the tax will be passed on to consumers. Another way to think about this is that demand curves tend to be more elastic when a good has closer substitutes. A tax on a product with close substitutes will lead consumers to choose the substitute instead. For example, if the government chose to tax only Coke, consumers would switch to Pepsi if the price of Coke rose by much at all. As a result, Coke suppliers would not be able to pass on much of the tax to consumers. This has nothing to do with whether demand is “high” or not.

3. T/F/Explain: If a tax is mostly borne by demanders in a market, then this is a "sellers" market, and a subsidy will therefore mostly go to the producers. (Be sure you can give a good explanation for the correct answer!)

False. If a tax is mostly borne by demanders, it is because demand is relatively inelastic compared to supply, meaning that quantity demanded responds less to prices that quantity supplies. This means that suppliers will both bear the burden of taxes and receive the benefit of subsidies.

Verify this to yourself by graphing an inelastic demand, an elastic supply, and a tax and subsidy in that market.
Another way to think about this is that there are fewer substitutes for consumers, but suppliers can enter and exit the market easily at about the same cost. For example, suppose we are talking about cigarettes, where the quantity demanded is fairly inelastic but the quantity supplied is fairly elastic (the land to grow tobacco can also be used to grow other crops, crop land is roughly similar in terms of the costs of production). If there is a tax in this market, quantity demanded doesn’t change much. If suppliers bore the burden of the tax, they would shift supply to something else. So the burden is shifted onto consumers who have fewer options.

When there is a subsidy, if suppliers mostly got the subsidy, lots of firms would want to shift into producing tobacco and to produce more of it. But remember, demand is inelastic, so quantity demanded doesn’t change much and there isn’t enough demand for all of those cigarettes. The price would drop, until in the end it is consumers who mostly benefit from the subsidy.

4. Suppose a new law requires students to give a $100 tip to each of their professors to enroll in a course. (Hint—draw the curves!) Assume that students pay the university (and now their professors) by the course and that they are free to take as many or as few courses as they would like. Assume that professors are paid by the course (both by the university and now also the extra $100 from their students) and are free to supply as many courses as they would like.

(a) What happens to the demand curve for college courses? (If the demand curve shifts, by how much and in what direction does it shift?)

*Demand shifts down vertically by $100 (students would only enroll in the same number of courses if the tuition costs were $100 per course less)*

(b) What happens to the supply of college courses? (If supply shifts, by how much and in what direction does it shift?)

*Supply shifts down vertically by $100 (professors would supply the same number of courses for $100 per course less from tuition)*

(c) Are students made better off or worse off as a result of this law? What about professors? Explain

*Both are as well off as they were before. Tuition for courses will fall by $100 per course but students will make a payment of $100 to enroll. The net costs to students is the same. Tuition payments to professors would be $100 less but they would get a payment directly from students. The number of courses taught is exactly the same.*

5. Suppose in problem 4, we replaced the words “student” with “businesses” and the words “professor” with “employee” and the words “$100 tip” with “$100 worth of health insurance.” What do you predict is the effect of requiring businesses to provide a specific dollar amount of health insurance to employees? How will this
affect wages? Employment? Businesses costs? Are there any additional complications in this problem that might be different than in problem 4?

This is roughly the same problem. In the labor market, employees supply their labor to businesses, who demand it. Including health insurance in a job offer makes jobs more attractive, shifting the supply curve to the right. Including health insurance is costly to businesses, decreasing their demand for labor and shifting the demand curve to the left. These two effects cancel each other out if the cost to the business is the same as the value to the employee. As a result, wages would just fall by the full amount of the value of health benefits, leaving firms and employees just as well off as they were before. All that has happened is that the way people are paid has changed.

There are a few complications here however. One major complication is that health insurance may be worth more/less to employees than it costs businesses, which would increase supply by more/less than the decrease in demand. This is probably true in the United States because wages are taxed but health benefits are not, and health plans involve administrative costs that are not valuable to individuals.