KEY

ECO 401-002, 003
Spring 2013
Problem Set #3

Due: Friday, February 15

1. When your income is \$30, P_X = \$1, and P_Y = \$5, you consume 10 units of good X. When your income increases to \$40 and the prices of X and Y stay the same, you consume 6 units of good Y. From this we can conclude:

4 pts.

   a) Y is a normal good.
   b) If P_X were to change, then the total effect of the price change and the substitution effect of the price change would be equal to each other.
   c) The income elasticity of demand for good X is equal to zero.
   d) All of the above.

   [Hint: a complete answer requires you to illustrate with a diagram and evaluate the truth or falsity of (a), (b), and (c) above.]

2. You consume two goods, X and Y. Your income is \$100 per month. Initially P_X = \$10 and P_Y = \$10. Under these conditions you choose to consume 5 units of good X.

5 pts.

   a) How much Y do you consume? Illustrate in a diagram.
   b) P_Y falls to \$5. In response you increase your consumption of X to 6. Illustrate these new conditions and sketch the price-consumption curve for good Y.
   c) Plot two points on the demand curve for good Y.
   d) Plot two points on two separate demand curves for good X (one point on the original demand curve for X, and one point on the new demand curve after demand for X increases in response to the drop in the price of a complement.)
   e) Calculate the cross-price elasticity of demand between X and P_Y.

3. Bart consumes beer and pizza. When his income rises, he consumes both more beer and more pizza too. When his weekly income is \$100, the price of beer is \$4 per six-pack, and the price of a pizza is \$5, Bart consumes 12.5 six packs of beer per week. When the price of pizza rises to \$10, Bart chooses to consume the same amount of beer, but reduces his consumption of pizza. Using a budget constraint-indifference curve diagram, illustrate Bart's initial consumption choice, and then illustrate his consumption choice after the price of pizza rises. Then show how you can separate out the income and substitution effects of this price change. Explain your diagram.

4 pts.

4. Jack consumes two goods, X and Y. Jack's income is \$36. When P_X = \$4 and P_Y = \$6, Jack consumes X=3 and Y =4.

   a) Illustrate Jack's initial consumption choice in a budget constraint-indifference curve diagram.
   b) Now the price of Y increases to P_Y = \$9. Jack's consumption of X increases to X = 4.5. Illustrate Jack's new budget constraint and indifference curve in your diagram.
   c) Draw two points on Jack's demand curve for good Y.
   d) Using the concept of consumer's surplus, give a dollar estimate of how much worse off Jack is when the price of Y rises from \$6 to \$9. Illustrate and briefly explain your answer.
   e) Are X and Y substitutes or complements? Briefly explain your answer.

5 pts.

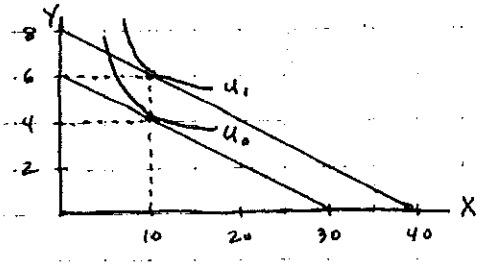
18 pts. total

ECO 401

Problem Set #3 Key

Spring 2013

1.



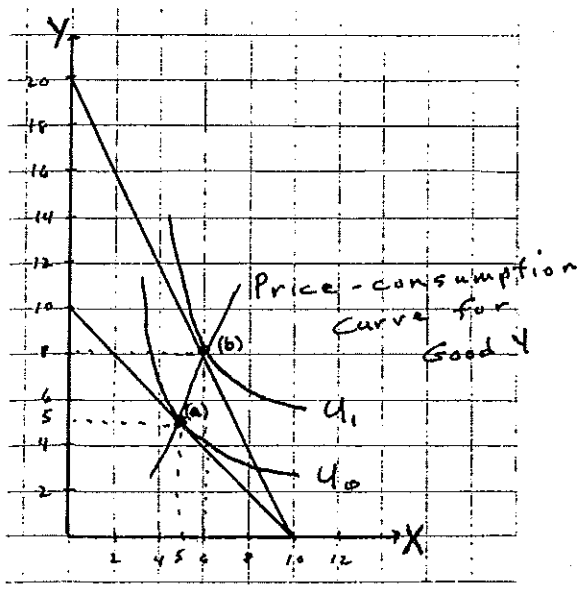
(a) Y is a normal good, since an increase in income causes consumption of Y to increase.

(b) since quantity demanded of X does not change when income changes, the income effect is zero for good X. When P_X changes, the total effect thus is entirely a substitution effect.

(c) as the diagram shows, $\frac{\% \Delta X}{\% \Delta \text{Income}} = 0$

(d) so, all of the above are true.

2.



(a) $P_X \cdot X + P_Y \cdot Y = I$

$I = 100$, $P_X = 10$, $P_Y = 10$

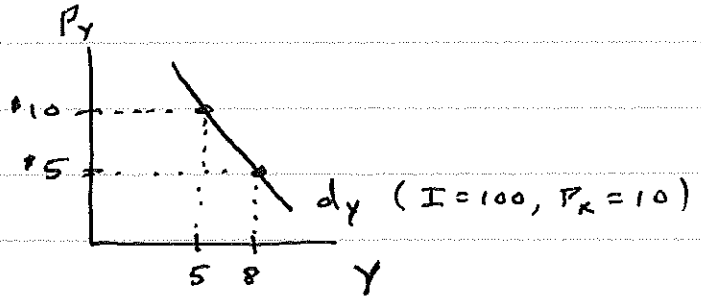
if $X^* = 5$, then $Y^* = 5$

(b) P_Y falls to \$5.

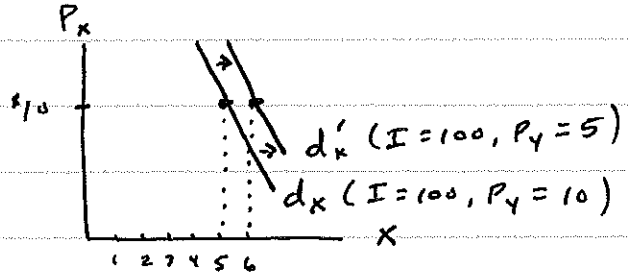
if $X^* = 6$, then $Y^* = 8$

2. (cont)

(c)



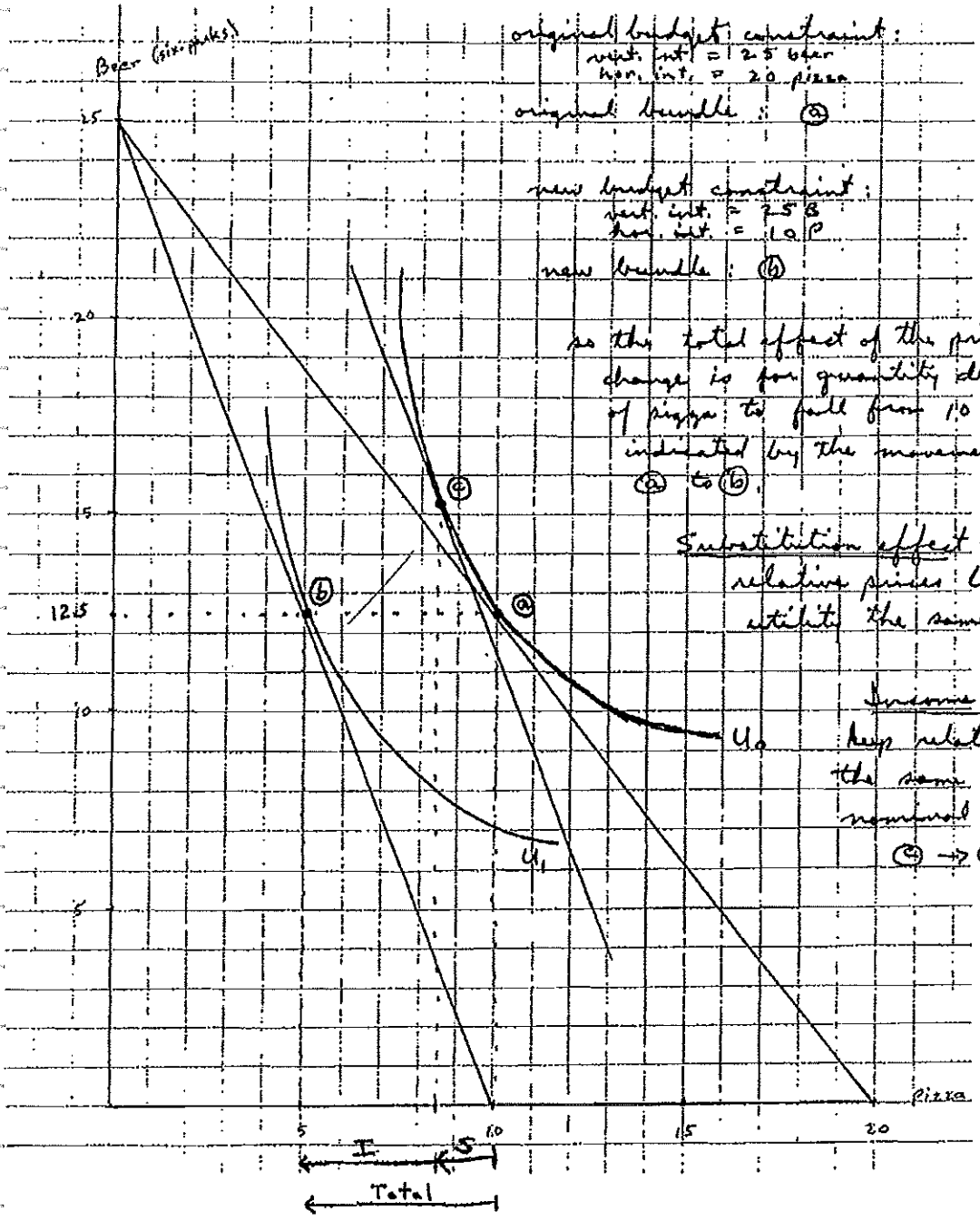
(d)



(e) $$\varepsilon_{x,P_Y} = \frac{\%\,\Delta X}{\%\,\Delta P_Y} = \frac{\frac{\Delta X}{\frac{1}{2}(X_0 + X_1)}}{\frac{\Delta P_Y}{\frac{1}{2}(P_Y^0 + P_Y^1)}} = \frac{\frac{1}{\frac{1}{2}(5+6)}}{\frac{-5}{\frac{1}{2}(10+5)}}$$

$$\varepsilon_{x,P_Y} = \frac{\frac{1}{11}}{-\frac{5}{15}} = -\frac{3}{11} = -.27$$

3.



original budget constraint:
vert. int. = 25 beer
hor. int. = 20 pizza

original bundle: (a)

new budget constraint:
vert. int. = 25 B
hor. int. = 10 P

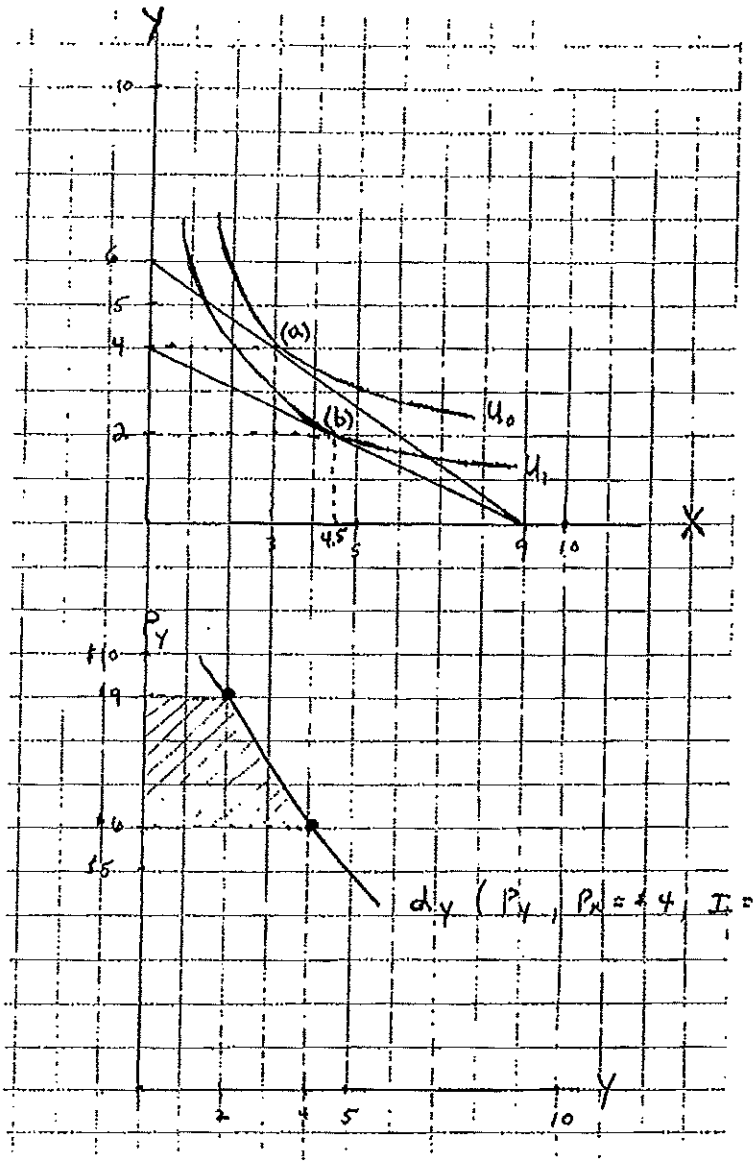
new bundle: (b)

so the total effect of the price change is for quantity demanded of pizza to fall from 10 to 5, indicated by the movement from (a) to (b).

Substitution effect - change relative prices but keep utility the same: (a) → (c)

Income effect - keep relative prices the same but change nominal income: (c) → (b).

4.



(a) $\frac{I}{P_Y} = 6$ $\frac{I}{P_X} = 9$, U_0

(b) $\frac{I}{P_Y'} = 4$ $X = 4.5$

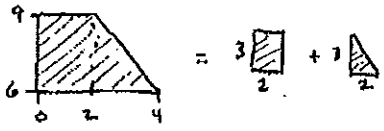
$P_Y \cdot Y = I - P_X \cdot X = \$18$

$Y = 2$, U_1

(c) $P_Y = \$6$, $Y^* = 4$

$P_Y = \$9$, $Y^* = 2$

(d) change in consumer's surplus when P_Y rises from \$6 to \$9:



(e) when P_Y increases from \$6 to \$9, quantity demanded of X increases from 3 to 4.5. $\varepsilon_{X,P_Y} > 0$, as X and Y are substitutes.