**Economics 101**
**Spring 2005**
**Elizabeth Kelly**
**Homework #3 Answers**
**Due: Wednesday, 9th in lecture.**

1. (a) Sammy considers these to be perfect substitutes, hence their indifference curves are straight lines. We also know that Sammy considers every two pencils to be a perfect substitute for one mechanical pencil. Hence, wooden pencils are perfect substitutes for mechnical pencils, but only in proportions of 2:1. These are shown in the following figure.
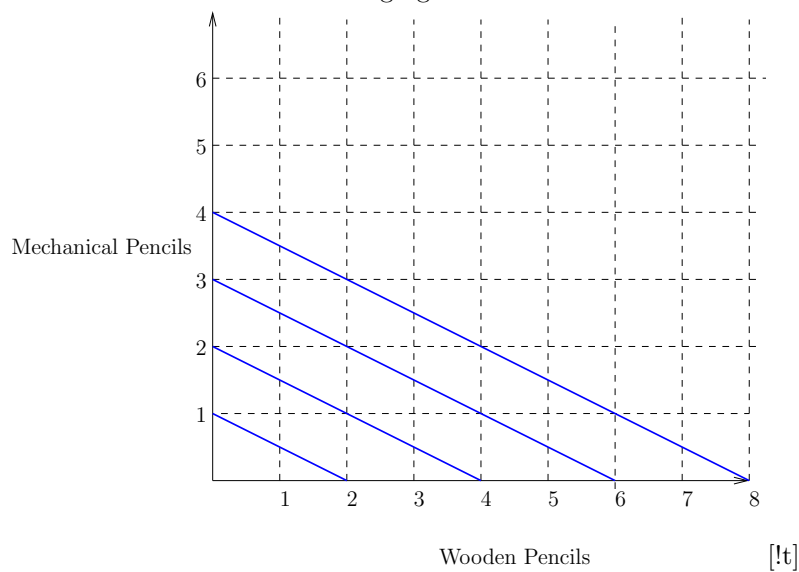


Wooden Pencils                                          [!t]

(b) Sammy has income eqal to $12 and the price of wooden pencils is $2 and the price of mechanical pencils is $3. Let $x$ be wooden pencils and $y$ be mechanical pencils. Then the equation of his budget line is $12 = 2x + 3y$ and is shown in the following figure.
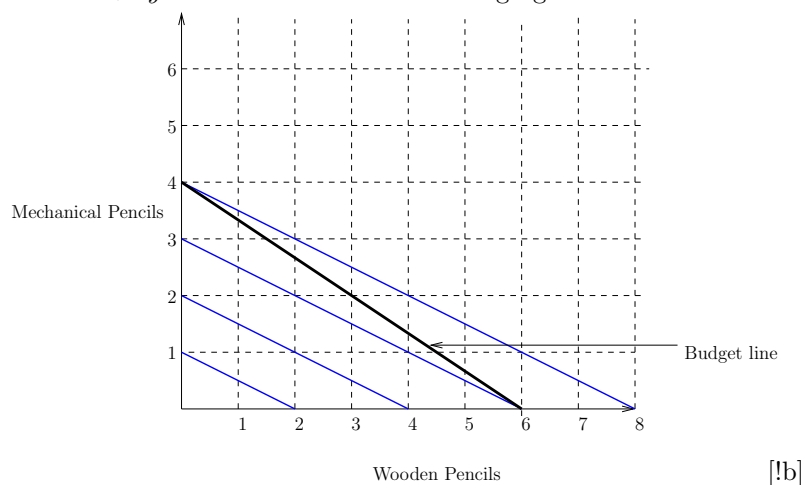


Wooden Pencils                                          [!b]

(c) Looking at the above figure, then clearly Sammy reaches his highest affordable indifference curve by consuming 4 mechanical pencils and zero wooden pencils.

**2.** Construct a table of the marginal utilities from each good and find the point where marginal utility per dollar spent is the same across goods, and uses all income available. That is, denote $MU_a$ to be the marginal utility of apples and $MU_t$ to be the marginal utility of tacos, and $p_a$ and $p_t$ to be the price of apples and tacos respectively. Then, find where $\frac{MU_a}{p_a} = \frac{MU_t}{p_t}$.

Clearly, the point where $\frac{MU_a}{p_a} = \frac{MU_t}{p_t}$ and total income of \$9 is spent is where Sally consumes 3 tacos and 3 apples.

| Apples | | | | Tacos | | | |
|---|---|---|---|---|---|---|---|
| Quantity | TU Apples | $MU_a$ | $\frac{MU_a}{p_a}$ | Quantity | TU Tacos | $MU_t$ | $\frac{MU_t}{p_t}$ |
| 0 | 0 | | | 0 | 0 | | |
| 1 | 5 | 5 | 5 | 1 | 10 | 10 | 5 |
| 2 | 9 | 4 | 4 | 2 | 18 | 8 | 4 |
| 3 | 12 | 3 | 3 | 3 | 24 | 6 | 3 |
| 4 | 15 | 3 | 3 | 4 | 28 | 4 | 2 |
| 5 | 16 | 1 | 1 | 5 | 30 | 2 | 1 |

Table 1:

**3.** (a) Simply find values of $x$ and $y$ that satisfy each different utility level. These are shown in the following fig-



$U(x,y) = 8$

$U(x,y) = 6$

$U(x,y) = 2$

$U(x,y) = 4$

ure.
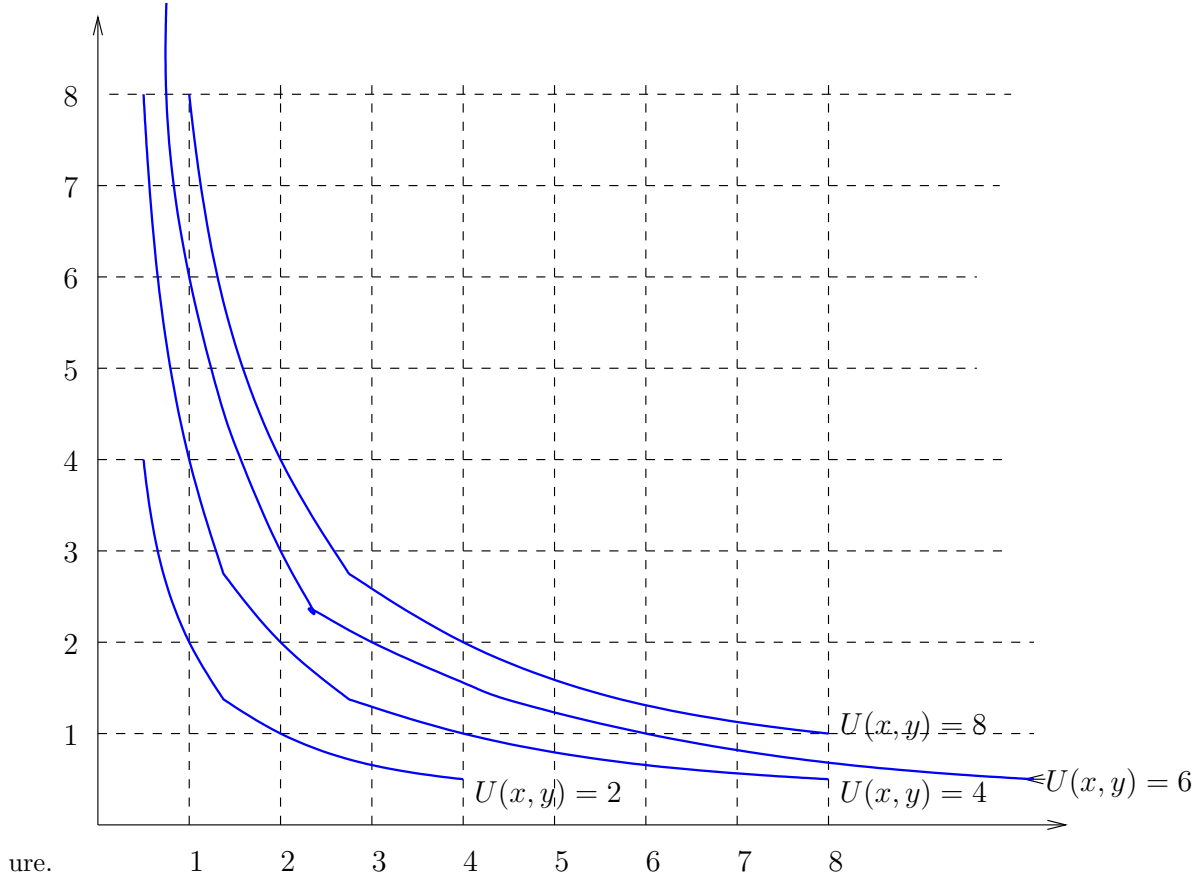
(b) With income of $I = \$16$ and and $p_x = \$4$ and $p_y = \$2$ the equation for the budget line is $I = p_x x + p_y y$ or $16 = 4x + 2y$. This is shown in the following figure and is given by $BL_1$.



Good $y$

$BL_1$

$U(x,y) = 8$

$U(x,y) = 6$

$U(x,y) = 2$

$U(x,y) = 4$

Good $x$
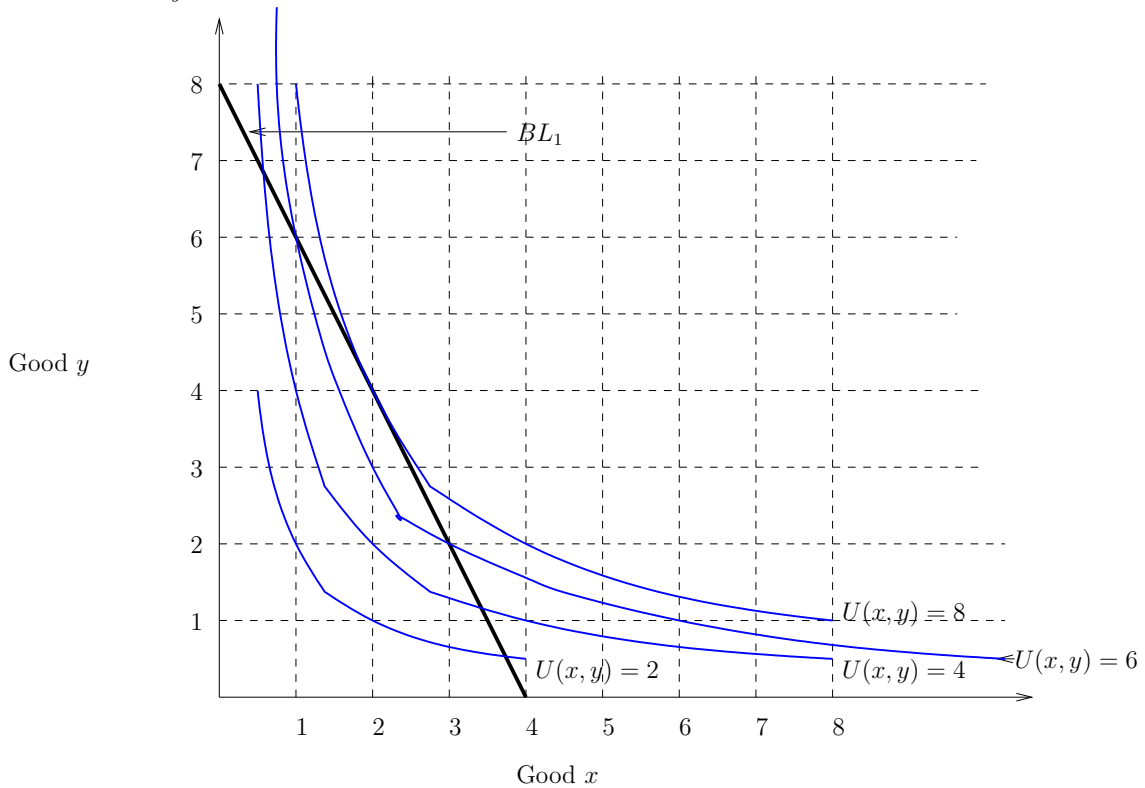
(c) It is clear from the above figure that the optimal consumption point that lies on the budget line is $x = 2$ and $y = 4$ (This is where the highest indifference curve is reached). However we can use the hint and construct a table as well to find this out, looking at integer values of $x$ and $y$ that satisfy the budget constraint.

| $x$ | $y$ | $U(x,y)$ | $p_x x + p_y y$ |
|---|---|---|---|
| 0 | 8 | 0 | \$16 |
| 1 | 6 | 6 | \$16 |
| 2 | 4 | 8 | \$16 |
| 3 | 2 | 6 | \$16 |
| 4 | 0 | 0 | \$16 |

Table 2:

(d) Clearly Jane recieves a utility level equal to $U(2,4) = 8$ at the optimal consumption bundle.

(e) Simply write her new budget using the new price. $I = p_x x + p_y y$ or $16 = 4x + 28y$. This is shown in the following figure and is given by $BL_2$.
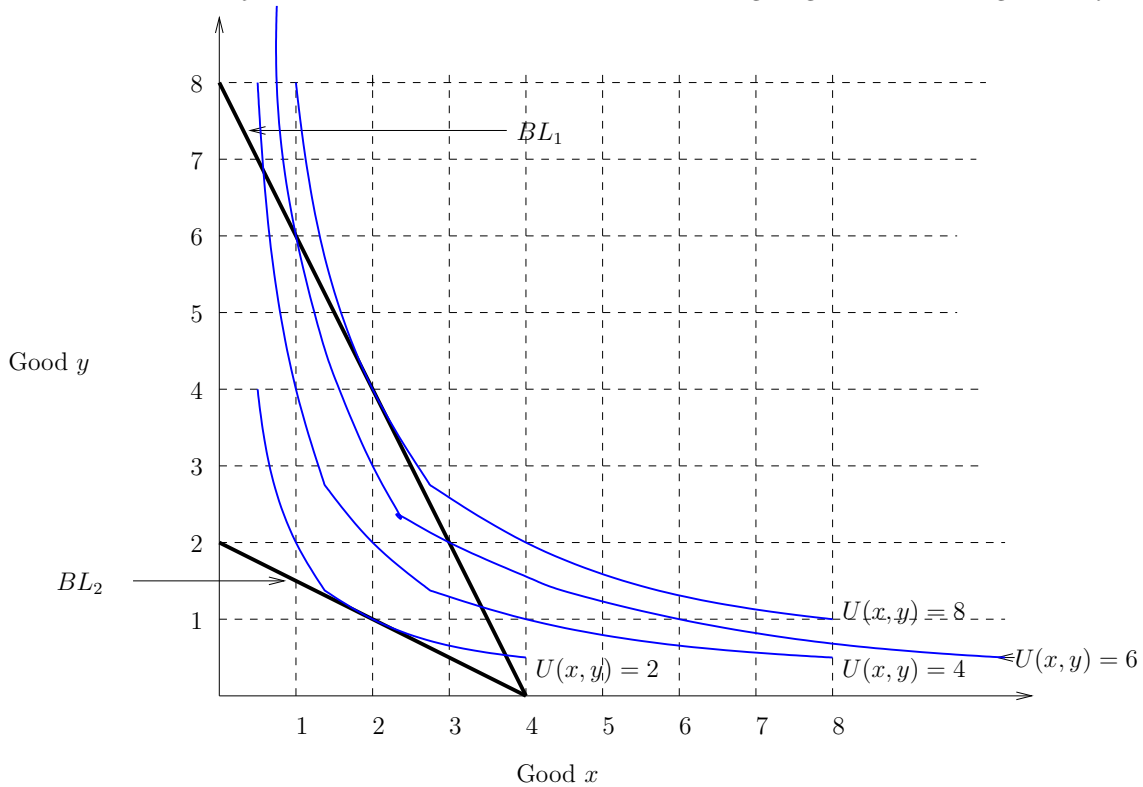


(f) We seek an amount of income that gets Jane back to her original utility level from part (d) given the new prices. We'll use the hint and find consumption bundles that that gives us the old utility level of 8 at the new prices, and select the one that requires the least amount of income.
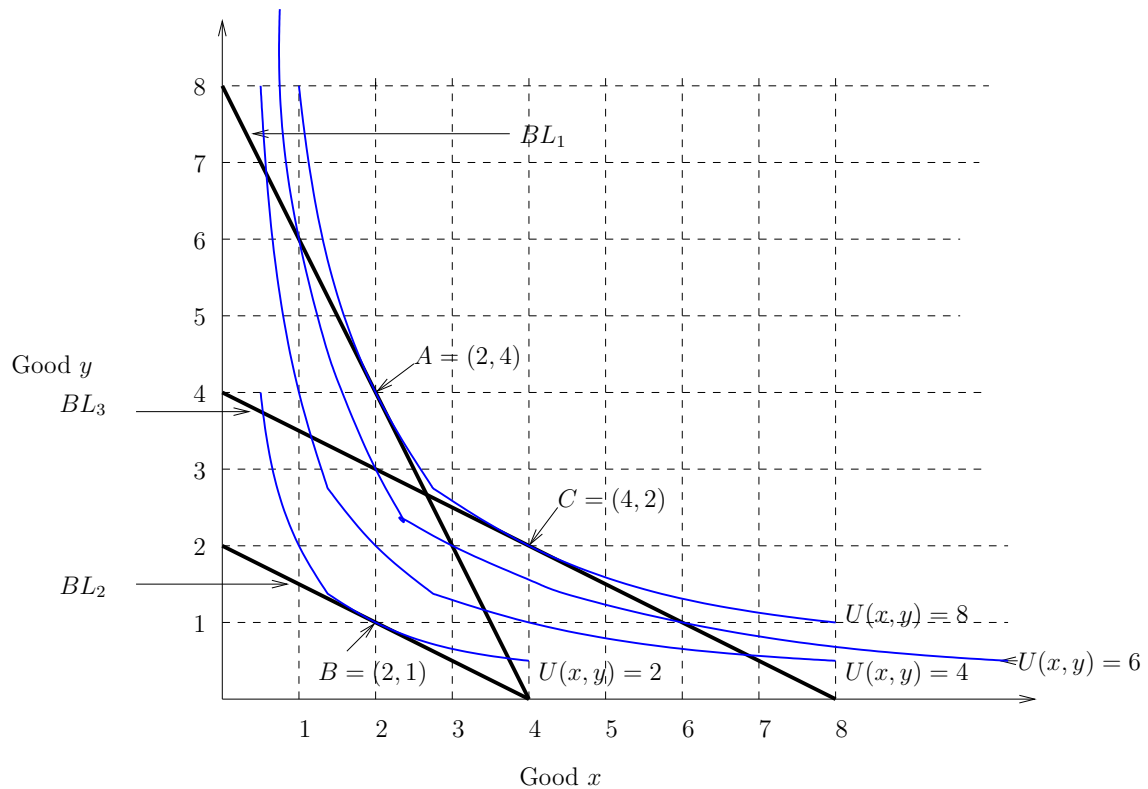
| $x$ | $y$ | $U(x,y)$ | $p_x x + p_y y$ |
|---|---|---|---|
| 1 | 8 | 8 | \$68 |
| 2 | 4 | 8 | \$40 |
| 4 | 2 | 8 | \$32 |
| 8 | 1 | 8 | \$40 |

Table 3:

From the above table, the smallest possible income Jane can have to get back to her old utility level is given by \$32. This budget line is given by $BL_3$ and is shown in the following figure:
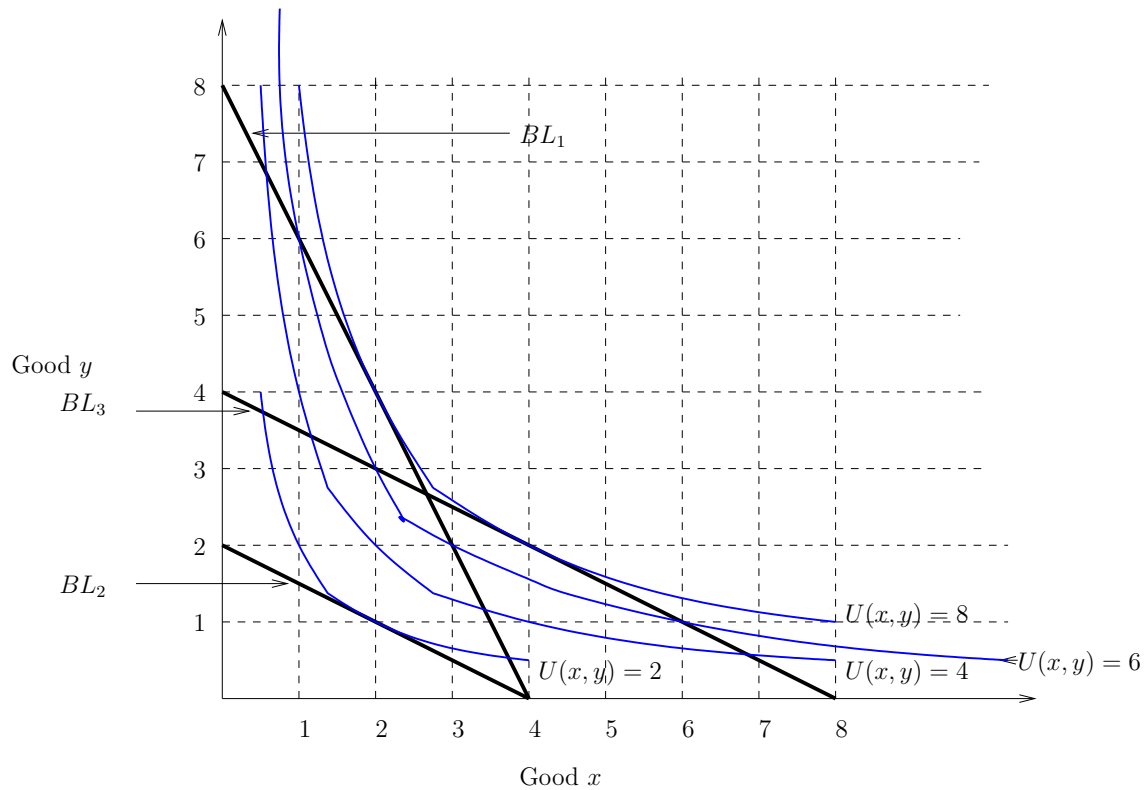
(g) Now we just have to label each of our points. This is done in the following figure:



(h) The substitution effect on good $y$ is simply the change in good $y$ from points A to C. This amount is 2.

(i) The income effect on good $y$ is the change in good $y$ from points C to B. This amount is 1. These are both illustrated in the last figure. Yeah! we are done :)
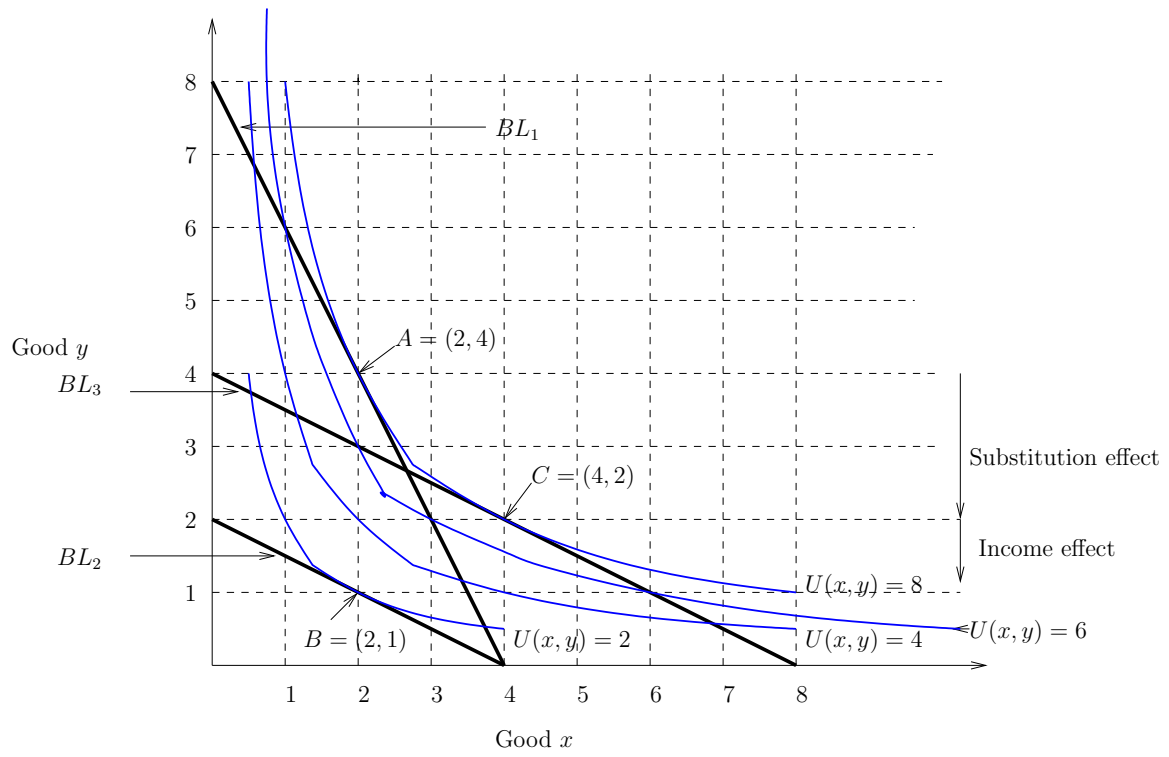
(j) Because an increase in the price of good $y$ has a resulting income effect that is negative (causes consumption of good $y$ to decrease) $y$ is a normal good.