73230 Intermediate Microeconomics
# Solution to Problem Set 1

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Due: In-class at 10:30am on February 06, 2019

Problem 1

This question concerns a consumer who is choosing how many of two goods to buy: watermelon and orange. The consumer has an income of \$20, and the cost of a watermelon is \$4 and an orange is \$2.
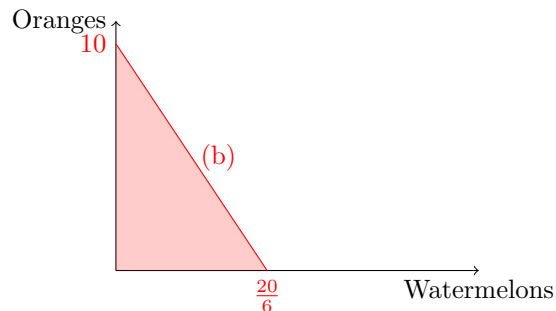
(a) Write down the equation for the consumer's budget constraint and graph it in the commodity space.
Solution: Budget constraint: $4w + 2o \leq 20$.
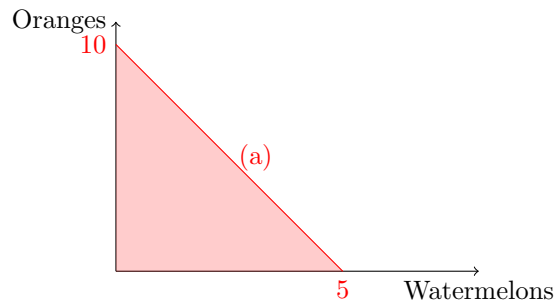
(b) The government decides that watermelon is evil and needs to be taxed. They introduce a 50% tax on each watermelon sold. Rewrite and regraph the budget constraint.
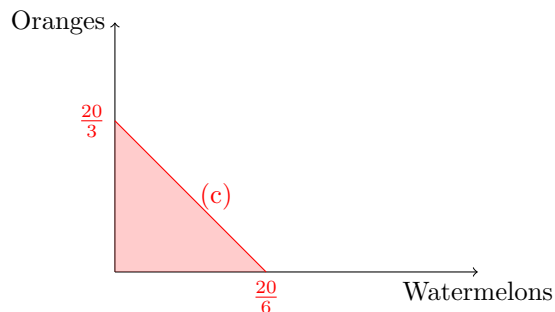**Solution:** Budget constraint: $4 \times 1.5w + 2o \leq 20 \iff 6w + 2o \leq 20$

(c) A new government is elected that hates all fruits. They now tax both watermelons and oranges at 50%. What does the budget constraint look like now?
Solution: Budget constraint: $4 \times 1.5w + 2 \times 1.5o \leq 20 \iff 6w + 3o \leq 20$

(d) Due to a threat of revolt amongst fruits fans, the government hands out a subsidy of \$10 to the consumer but still tax both oranges and watermelons at 50%. What does their new budget constraint look like? How would you expect consumer behavior to differ between this situation and the no-tax, no-subsidy situation described in part (a)

Solution: Budget constraint: $6w + 3o \leq 30$. Note that this is the same as the budget constraint in part (a) by dividing both side by 1.5. Consumer behavior should be the same as part (a) because the budget constraints are exactly the same.

(e) Revolution comes, and all taxes and subsidies are abolished. Even better, the consumer finds a new shop that offers bulk discounts. In this shop, watermelons cost \$4 each if you buy 3 or fewer. However, the cost of any additional watermelon after 3 is \$2. Rewrite and regraph the budget constraint.
Solution:

$$\begin{cases} 4w + 2o \leq 20 \text{ If } w \leq 3 \\ 2w + 2o \leq 14 \text{ If } w > 3 \end{cases}$$
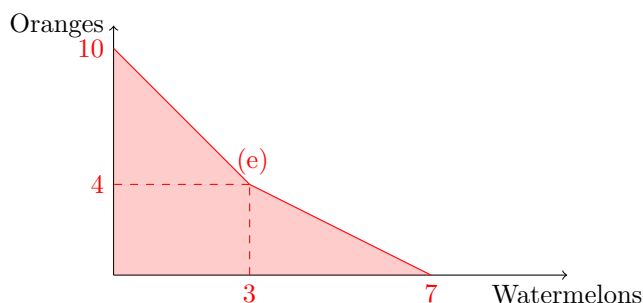
Problem 2

Edmund consumes two commodities, garbage and punk rock video cassettes. He doesn't eat garbage of course, but he gets paid for taking it away at \$2 per 1 sack. Edmund can accept as much garbage as he wishes at that price. He has no other source of income. Video cassettes cost him \$6 each. He has a utility function $u(g, v)$ on garbage (g) and videos (v) which is decreasing in g and increasing in v.

(a) If Edmund's accepts 0 sacks of garbage, how many video cassettes can he buy?
Solution: None.

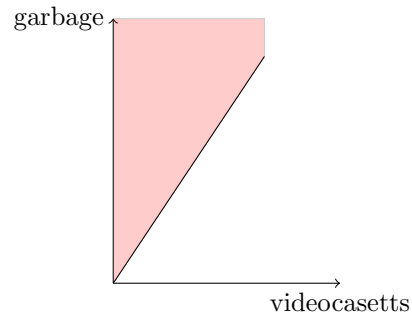(b) Write down Edmund's constrained optimization problem.
Solution:
$$\max_{v,g} u(v, g)$$
subject to: $6v \leq 2g$.

(c) Draw Edmund's budget line and shade his choice set.
Solution:

garbage

videocasetts

Problem 3

Suppose Bryan consumes bread (x_1) and olive oil (x_2) with his income. His utility function over these two goods is:

$$u(x_1; x_2) = x_1^2 x_2^2$$

The price of a unit of bread is $p_1 = 3$, and the price of a unit of olive oil is $p_2 = 5$. Bryan has \$20 to spend. How much bread and olive oil will Bryan consume?

Solution:

$$\frac{\frac{\partial u}{\partial x_1}}{\frac{\partial u}{\partial x_2}} = \frac{3}{5}$$

$$\implies \frac{2x_1 x_2^2}{2x_1^2 x_2} = \frac{3}{5}$$

$$\implies x_2 = \frac{3}{5}x_1$$

Using the budget constraint, $3x_1 + 5x_2 = 20 \implies 3x_1 + 5\frac{3}{5}x_1 = 20 \implies x_1 = \frac{10}{3}, x_2 = 2$