1.5 Preferences II: MRS and Utility Functions - Practice Problems (Answers)

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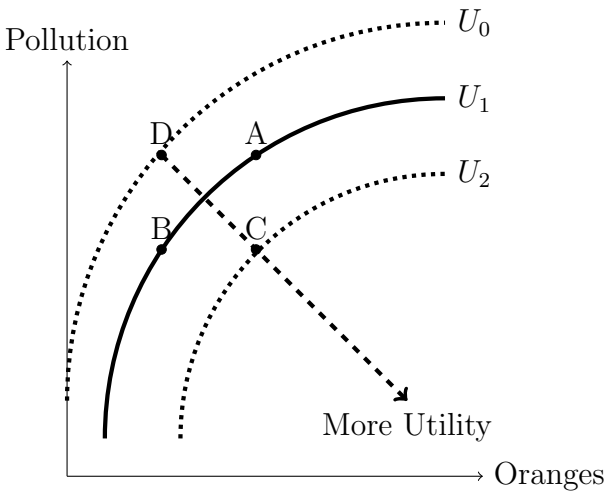
ECON 306 - Fall 2019

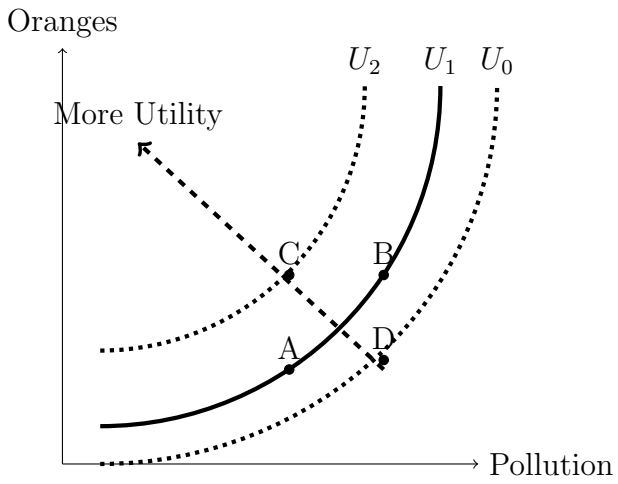
1. For each question, draw an indifference curve relating the two objects (label it I_1). Draw and label a *second* curve that gives *higher* utility (label it I_2), and a *third* curve that gives *lower* utility (label it I_0).
   (a) Oranges (a good) on the horizontal axis and Pollution (a bad) on the vertical axis.

Solution:



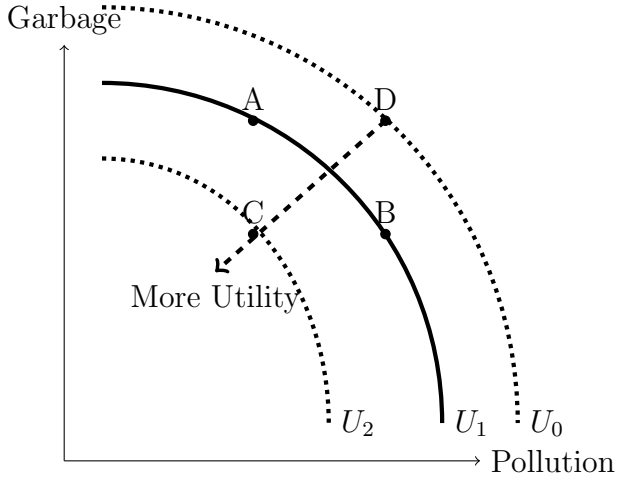
   (b) Pollution (a bad) on the horizontal axis and Oranges (a good) on the vertical axis.

Solution:



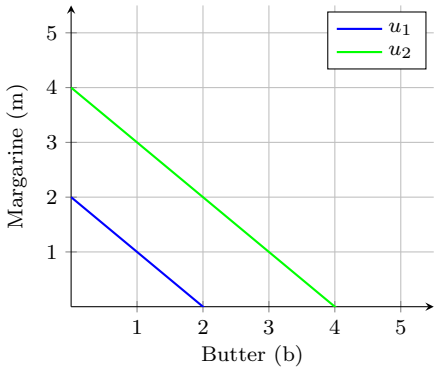
(c) Pollution (a bad) on the horizontal axis and Garbage (a bad) on the vertical axis.

Solution:



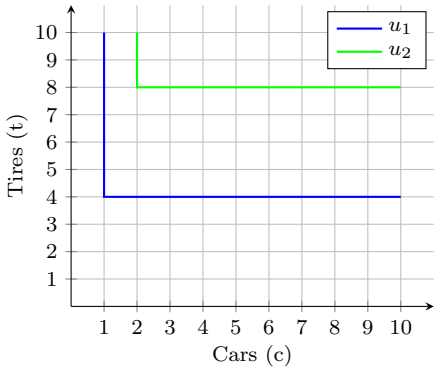
(d) Butter on the horizontal axis and Margarine on the vertical axis. Both are goods, and you are always willing to trade between them at a 1:1 rate.

Solution:



(e) Cars on the horizontal axis and Tires on the vertical axis. Both are goods, and you are always want to consume them at a 1:4 proportion. (Draw these carefully!)

Solution:



2. Suppose you can watch movies in the theater (t) and streaming at home (s), and earn utility according to the utility function:

$$u(t, s) = 4ts$$

Where your marginal utilities are:

$$MU_t = 4s$$
$$MU_s = 4t$$

(a) Put t on the horizontal axis and s on the vertical axis. Write an equation for $MRS_{t,s}$

Solution:

$$\begin{aligned} MRS_{t,s} &= \frac{MU_t}{MU_s} \\ &= \frac{4s}{4t} \\ &= \frac{4s}{4t} \\ &= \frac{s}{t} \end{aligned}$$

(b) Would bundles of $(2, 2)$ and $(1, 4)$ be on the same indifference curve?

Solution: Simply plug in each bundle to see how much utility it generates. If they have the same utility, they are on the same indifference curve.

$$u(t, s) = 4ts$$
$$u(2, 2) = 4(2)(2)$$
$$u(2, 2) = 16$$

$$u(t, s) = 4ts$$
$$u(1, 4) = 4(1)(4)$$
$$u(1, 4) = 16$$

Since both bundles generate utility of 16, they are both on the same curve.

(c) Is this curve convex? Hint: Does $MRS_{t,s} \downarrow$ as $t \uparrow$?

Solution: We need to find the slope of the indifference curve at each bundle, and we know the slope is the MRS. If the curve is convex, the slope should decrease as we move to the right (add more t).

$$MRS_{t,s} = \frac{s}{t}$$
$$MRS_{t,s}\Big|_{1,4} = \frac{(4)}{(1)}$$
$$MRS_{t,s}\Big|_{1,4} = 0.25$$

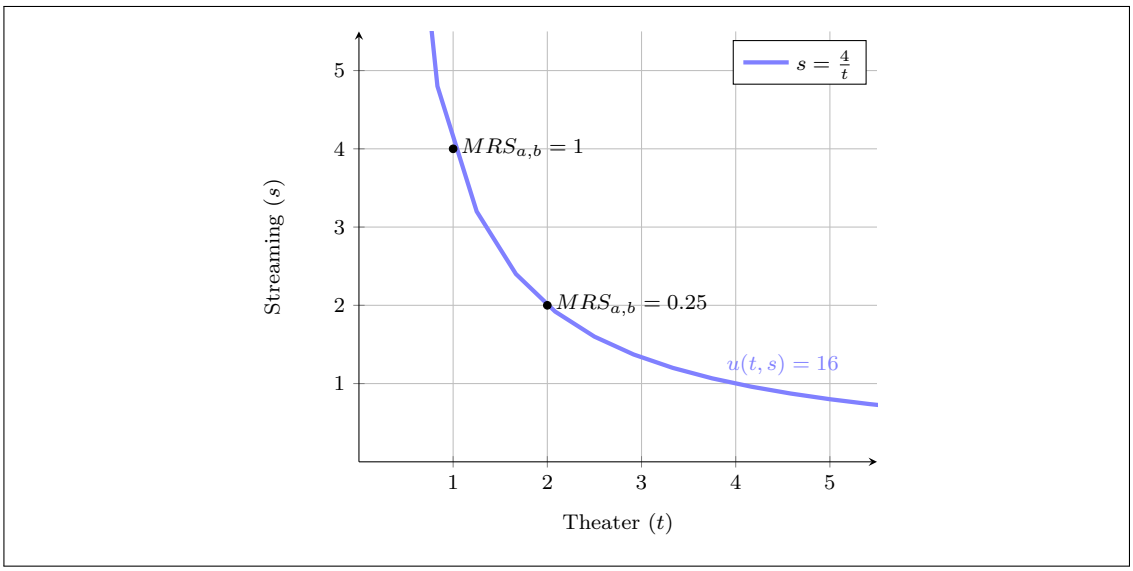
$$MRS_{t,s} = \frac{s}{t}$$
$$MRS_{t,s}\Big|_{2,2} = \frac{(2)}{(2)}$$
$$MRS_{t,s}\Big|_{2,2} = 1$$

As we get add more t, the MRS decreases, so the curve is convex.

(d) Sketch this indifference curve.

Solution: If we actually wanted to plot the graph correctly, take the utility function, set it equal to 16, and solve for s (on the vertical axis):

$$u(t,s) = 4ts$$
$$16 = 4ts$$
$$4 = ts$$
$$\frac{4}{t} = s$$


$s = \frac{4}{t}$
$MRS_{a,b} = 1$
$MRS_{a,b} = 0.25$
$u(t, s) = 16$
Streaming (s)
Theater (t)
1
2
3
4
5