Quiz #1 EconS 301 - January 29th, 2026

1. Consider the following utility functions

$$u(x, y) = 4x + \frac{1}{2}y \text{ and } v(x, y) = 10x^2y^2$$

   (a) Find the Marginal Rate of Substitution $MRS_{x,y}$ for $u(x, y)$ and $v(x, y)$. Does the consumer regard goods x and y as perfect substitutes or complements? Interpret your results.

   (b) Does utility $v(x, y)$ exhibit *diminishing marginal utility*?

   (c) Illustrate the indifference curves that represent the utility function $u(x, y)$, consider utility levels $u = 40$ and $u = 90$.

Solution

a. The Marginal Rate of Substitution is

$$MRS_{x,y} = \frac{MU_x}{MU_y} = \frac{4}{1/2} = 8$$

$$MRS_{x,y} = \frac{MU_x}{MU_y} = \frac{20xy^2}{20x^2y} = \frac{y}{x}$$

- In the case of $u(x, y)$ the consumer regards these two goods as perfect substitutes. However, when the utility is represented by $v(x, y)$, Cobb-Douglas utility function, the consumer regards goods as neither perfectly substitutable nor complementary.

b. No, since $\frac{\partial MU_x}{\partial x} = 40y^2 > 0$ and $\frac{\partial MU_x}{\partial y} = 40x^2 > 0$. Hence, this utility function does not exhibits *diminishing marginal utility.*

c. Since we know that utility function $u(x, y) = 4x + \frac{1}{2}y$ is a straight line and that desired utility level is $u = 40$, we can find her utility curve by just finding two bundles on this utility curve and connecting the dots.

- - *Indifference curve when reaching utility level* $u = 40$. If we set $x = 0$, we obtain $\frac{1}{2}y = 40$, and thus $y = 80$ units, which gives us our first bundle. If we then set $y = 0$, we find $4x = 40$, and thus $x = 10$ units, which gives us our second bundle.
  - *Indifference curve when reaching utility level* $u = 90$. We now perform the same steps but when utility level is $u = 90$. If we set $x = 0$, we obtain $\frac{1}{2}y = 90$, and thus $y = 180$ units, which gives us our first bundle. If we set $y = 0$, we have $4x = 90$, and thus $x = 22.5$ units, which gives us our second bundle.
  - Connecting the dots gives us our indifference curves, as detailed in figure 1.

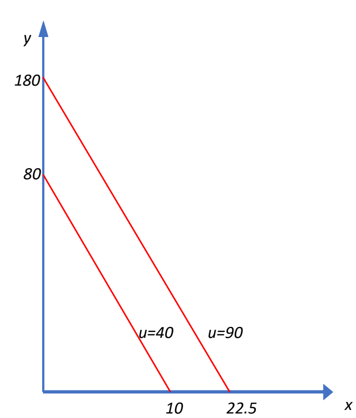

Figure 1. indifference curves for $u(x, y)$.