

**For full credit, YOU MUST SHOW ALL YOUR WORK. Answer all questions, using diagrams where possible. Each question carries 25 points. Time allowed: 1 hour 20 minutes. Good luck!**

1. Tim's preferences over goods  $x$  and  $y$ , the only goods he consumes, are represented by the utility function

$$U(x, y) = \text{Min}[2x + y, x + 2y],$$

where  $x$  and  $y$  denote the quantities of the two goods he consumes.

- Draw Tim's indifference curve for utility level 24.
- Calculate the marginal rate of substitution at  $(x, y) = (10, 7)$ .
- Calculate Tim's optimal consumption bundle  $(x^*, y^*)$  when Tim has an income of  $I = \$24$  and  $p_x = \$1, p_y = \$1$ .
- If  $p_y$  increases to  $\$6$ , while  $I$  and  $p_x$  remain the same as in part (c), what will be Tim's new optimal consumption bundle  $(x^{**}, y^{**})$ ? Calculate how much of the change, if any, from  $y^*$  to  $y^{**}$  is due to the substitution effect and how much is due to the income effect.

2. Mary's utility function is

$$U(H, c) = \text{Min}\left[H, \frac{c}{50}\right],$$

where  $H$  is the number of leisure (non-labor) hours she has per day (maximum value, 24) and  $c$  is her daily consumption of goods, measured in dollars. She buys goods using all the income she earns from working.

- Find Mary's supply curve of labor and draw it in a clearly labeled diagram.
- How many hours would Mary work if her wage rate was  $\$100$  per hour?
- How many hours would Mary work if her wage rate was  $\$50$  per hour?
- Suppose Mary wins a lottery that pays her  $\$200$  per day. Her daily consumption of goods is now  $\$200$  plus what she earns from working. Find her new supply curve of labor. How many hours would she work if faced with a wage rate of  $\$50$  per hour?

3. The Widget Corporation's production function is

$$q(K, L) = \frac{KL}{K+L},$$

where  $K, L$  are the amounts of capital and labor it uses.

- What is the shape of a typical isoquant for Widget Corp? Prove your answer.
- Find Widget Corp's long run cost function.
- Draw Widget Corp's long run cost curve in a clearly labeled diagram.

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4. The market for gadgets is perfectly competitive. Currently, the price of gadgets is \$20 and 10 million gadgets are sold annually.
  - (a) The government decides to impose an excise tax of \$4 per gadget. In reporting this, the local newspaper concludes that the government can expect to collect \$40 million in tax revenue each year from this new tax. Under what circumstances would this conclusion be true?
  - (b) Suppose the elasticity of demand for gadgets is -1 and the elasticity of supply is 3. How much tax revenue can the government actually expect to collect per year from this tax?
  - (c) If, instead of the per-unit excise tax, the government was thinking of imposing a percentage sales tax on the sale of gadgets, what would the percentage tax have to be in order to raise the same amount of revenue as the \$4 excise tax?