

EXAMINATION 1 VERSION B
"Labor Supply and Demand"
February 29, 2024

INSTRUCTIONS: This exam is closed-book, closed-notes. Simple calculators are permitted, but graphing calculators, calculators with alphabetical keyboards, computers, wireless devices and mobile phones are NOT permitted. Point values for each question are noted in brackets. Maximum total points are 100.

I. Multiple choice: Please circle the one best answer to each question. [1 pts each, 11 pts total]

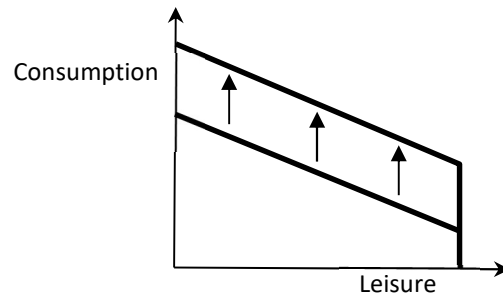
- (1) Recently in some parts of the United States, the number of workers employed in factories has fallen and the average wage in factories has decreased. This could have been caused by
- a rightward shift in the supply of factory workers.
 - a leftward shift in the supply of factory workers.
 - a rightward shift in the demand for factory workers.
 - a leftward shift in the demand for factory workers.

- (2) The flatter the labor demand curve,
- the more elastic labor demand.
 - the less elastic labor demand.
 - the more elastic labor supply.
 - the less elastic labor supply.
 - Steepness of labor demand is unrelated to the elasticities of labor demand or supply.

- (3) Suppose $\log(W) = 8.3 + 0.11 S$, where W is expressed in dollars. If S increases by one unit, then
- W increases by about \$0.11.
 - W increases by about \$8.30.
 - W increases by about 0.11 percent.
 - W increases by about 8.3 percent.
 - W increases by about 11 percent.

- (4) The shape and position of a person's indifference curves depend on the person's
- nonlabor income.
 - preferences.
 - wage.
 - all of the above.

- (5) In the graph below, the budget constraint is changing because of
- an increase in the wage.
 - a decrease in the wage.
 - an increase in nonlabor income.
 - a decrease in nonlabor income.
 - a change in preferences.



- (6) Worker X desires to work fewer hours in response to an increase in the hourly wage. For Worker X, the substitution effect of the wage increase is
- greater than the income effect.
 - less than the income effect.
 - exactly equal to the income effect.
 - cannot be determined from the information given.
- (7) Consider a cash grant welfare program, where a person is given \$3000 that is reduced by \$0.50 for every \$1.00 of labor earnings. According to economic theory, this program would cause
- an increase in labor force participation.
 - a decrease in consumption.
 - an increase in work hours by those already working.
 - a decrease in work hours by those already working.

(8) Consider a wage subsidy program, where a person is given \$0.50 for every \$1.00 of labor earnings. According to economic theory, this program would cause

- a. an increase in labor force participation.
- b. a decrease in labor force participation.
- c. an increase in work hours by those already working.
- d. a slight decrease in work hours by those already working.

(9) A dynamic model of labor supply predicts that, in periods where the wage is higher, labor force participation and hours of work will be higher because a temporary change in the wage

- a. creates only an income effect.
- b. creates only a substitution effect.
- c. creates both an income effect and a substitution effect.
- d. creates neither an income effect nor a substitution effect.

(10) If a wage increase affects a whole industry, then it will cause an increase in the output price. Therefore, the *industry's* demand for labor is

- a. perfectly inelastic.
- b. perfectly elastic.
- c. more elastic than an individual firm's demand.
- d. less elastic than an individual firm's demand.
- e. just as elastic as an individual firm's demand.

(11) According to the Hicks-Marshall rules, labor demand by an industry is *more* elastic in the long run,

- a. the greater the capital/labor ratio.
- b. the greater the elasticity of output demand.
- c. the greater the size of the industry.
- d. the greater the initial price of the output.
- e. all of the above.

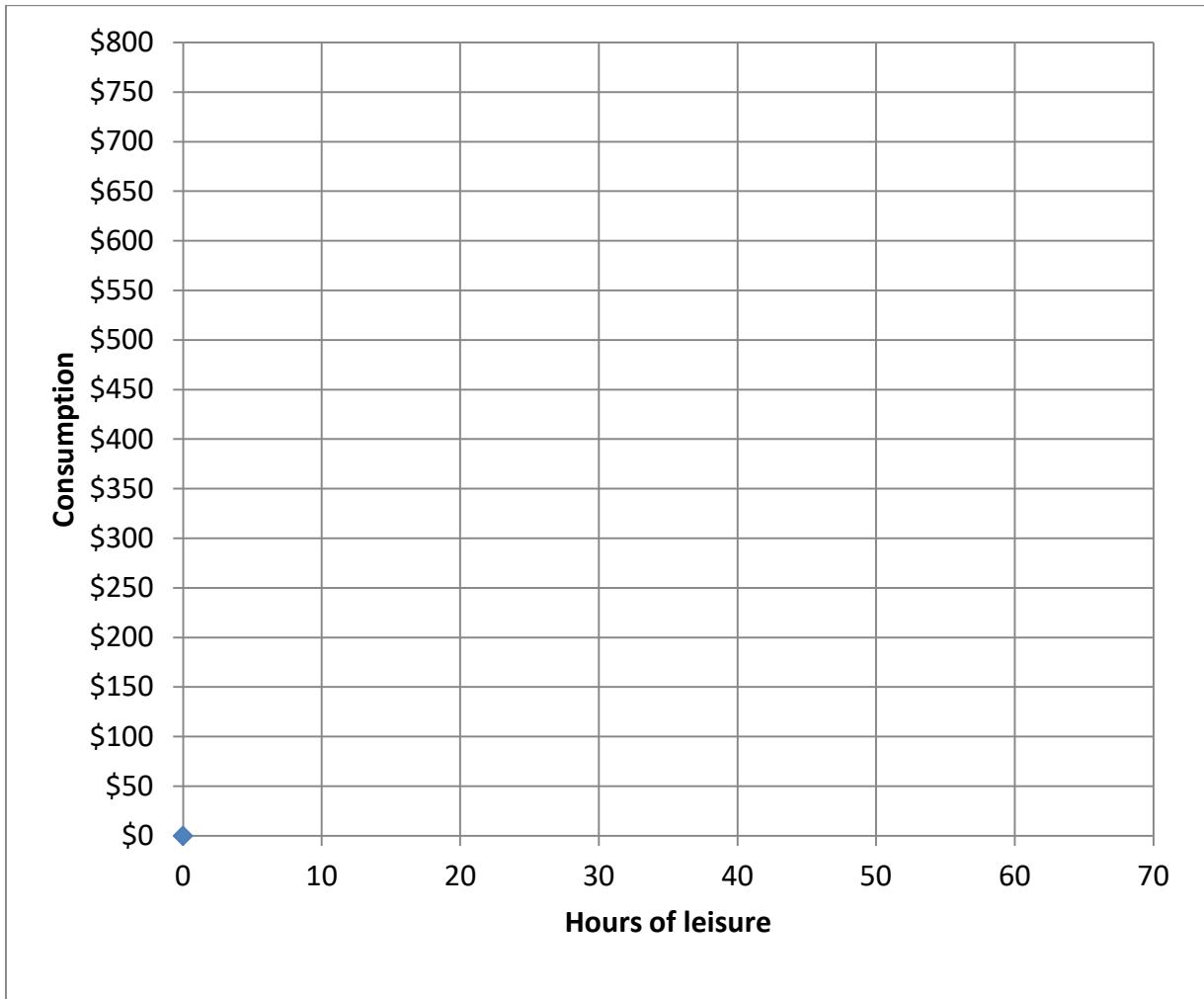
II. Problems: Please insert your answer to each question in the box provided. You may use margins and graphs for scratch work. Only the answers in the boxes will be graded. Work carefully—partial credit is not normally given in this section.

(1) [Elasticity of labor demand: 8 pts] Suppose the demand for package sorters in Des Moines has an elasticity of -0.3. Now suppose an increase in the minimum wage raises these workers' wage by 10 percent, but the demand curve does not shift.

- a. Will the number of jobs for package sorters *increase* or *decrease*?
- b. By about how much?
- c. Will the total income of package sorters (or their wage bill) *increase* or *decrease*?
- d. By about how much?

	%
	%

(2) [Budget constraint: 6 pts] Suppose Alex has 60 hours available each week for work or leisure, can earn a wage of \$10 per hour, but has no nonlabor income. Alex can receive a cash grant of \$200, but the grant is reduced by \$0.50 for every dollar of earnings. Using a straightedge, draw a graph of Alex's weekly budget constraint. Label any kink points.



(3) [Individual labor supply—optimal choice: 11 pts] Let L denote the weekly hours of leisure Sam enjoys and let C denote the dollars of consumption. Suppose Sam's utility function is $U = C(L-10)$. A little calculus shows that the marginal utility of consumption is $MU_C = (L-10)$ and the marginal utility of leisure is $MU_L = C$. Sam has \$200 in weekly nonlabor income and 60 hours per week available for work or leisure. Show your work below and circle your final answers.

a. [2 pts] Give a formula in terms of C and L for Sam's marginal rate of substitution of leisure for consumption (MRS).

b. [2 pts] Compute Sam's reservation wage per hour.

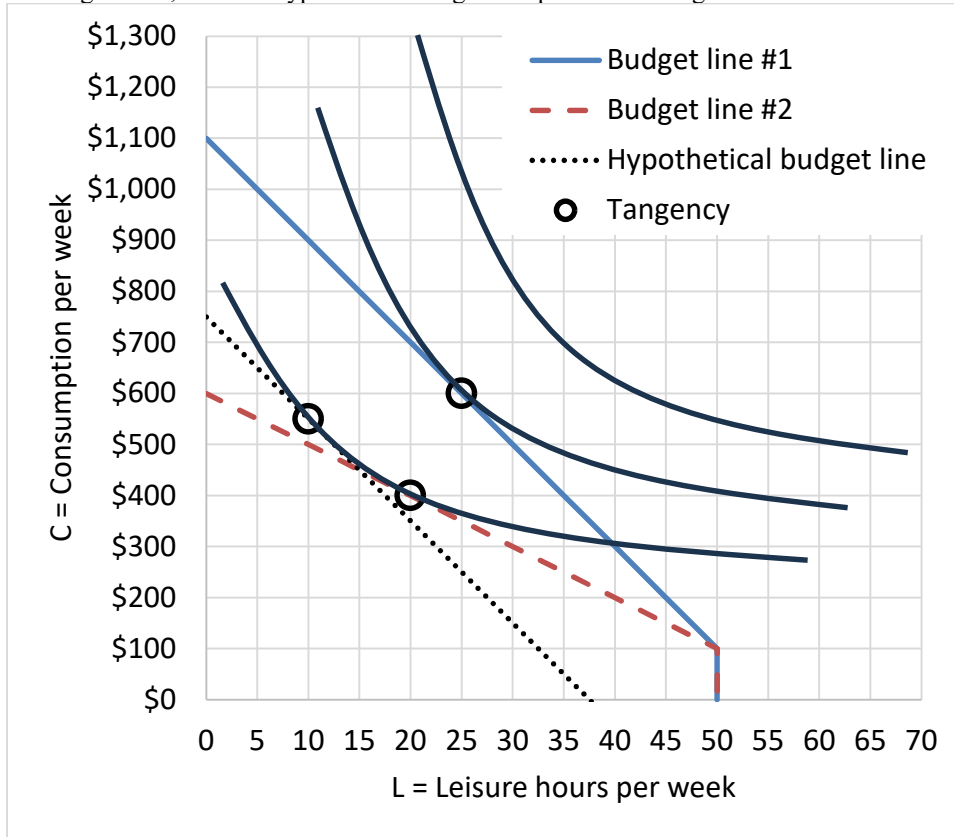
Suppose Sam can choose hours of work and is paid \$20 per hour.

c. [2 pts] Give an equation for Sam's weekly budget constraint. L and C should be the only unknowns.

d. [4 pts] How much leisure L and consumption C will Sam choose to enjoy each week?

e. [1 pt] How many hours will Sam choose to work per week?

(4) [Individual labor supply—income and substitution effects: 22 pts] The graph below shows Beth’s indifference curves, two true budget lines, and one hypothetical budget line parallel to budget line #1.



- a. According to this graph, what is Beth’s total available time for work or leisure?
- b. How much nonlabor income does Beth enjoy?
- c. What is Beth’s wage rate on budget line #1?
- d. What is Beth’s wage rate on budget line #2?

	hours
\$	
\$	per hour
\$	per hour

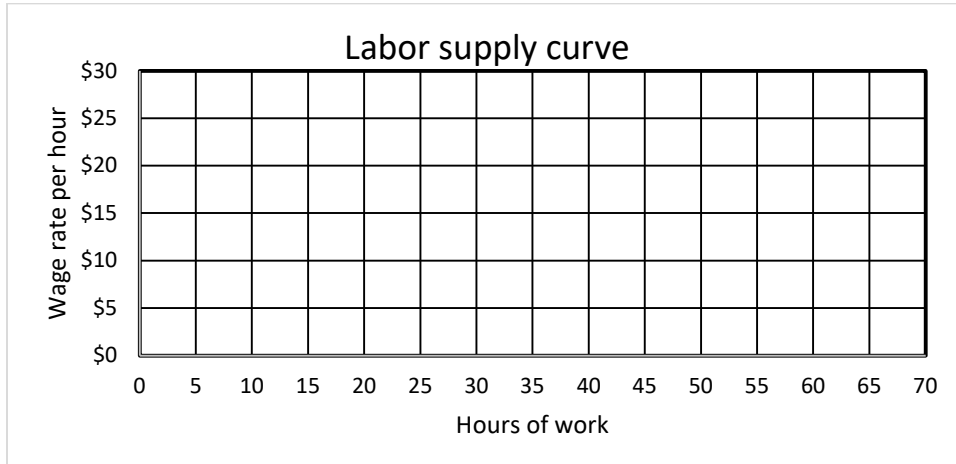
Consider Beth’s response to the change in the wage rate from budget line #1 to budget line #2.

- e. Does the *income effect* of this change cause Beth to work *more* or to work *less*?
- f. Compute the change in hours of work due to the *income effect* alone.
- g. Does the *substitution effect* of this change cause Beth to work *more* or to work *less*?
- h. Compute the change in hours of work due to the *substitution effect* alone.
- i. Does the *total effect* of this change cause Beth to work *more* or to work *less*?
- j. Compute the total change in hours of work caused by the change in the wage rate.

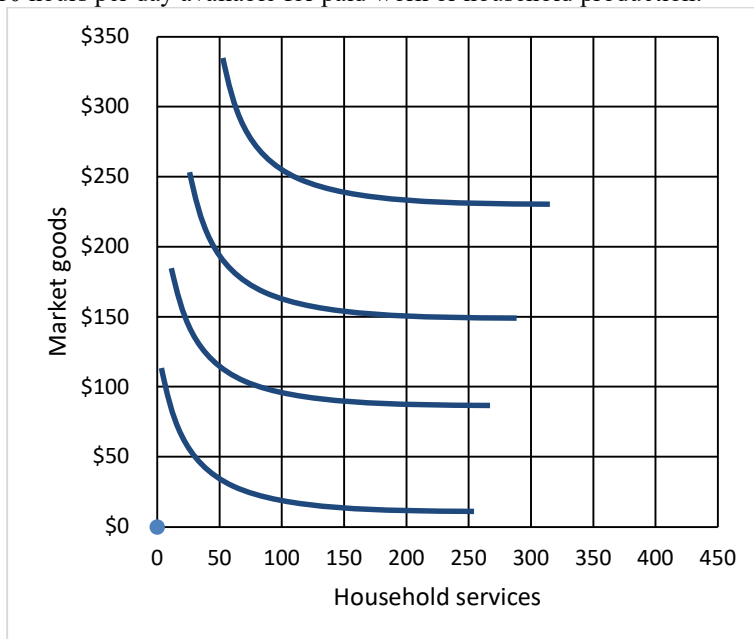
	hours
	hours
	hours
	hours

Question continues on next page.

k. Using the information in this indifference-curve graph, plot two points on Beth's *labor supply curve* in the graph below and sketch the curve.



(5) [Household specialization: 10 pts] Party A can earn \$20 per hour in the labor market and can produce 20 units of household services per hour. Party B can earn \$10 per hour and can produce 20 units of household services per hour. Each party has 10 hours per day available for paid work or household production.



Suppose Party A and Party B form a household. The graph above shows the household's indifference curves.

a. [6 pts] Draw the household's joint production-possibility curve in the graph above. Circle any kink points.

b. [2 pts] How many hours per day will Party A work in the labor market?

	hours
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c. [2 pts] How many hours per day will Party B work in the labor market?

	hours
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(6) [SR labor demand: 12 pts] Suppose Acme Manufacturing Company has the following production function.

$$q = 4 (K E)^{1/2} .$$

A little calculus shows that the marginal product of labor is,

$$MP_E = 2 (K/E)^{1/2} .$$

Assume that the price of output is \$5.

a. Give an expression for the value of marginal product of labor. The only unknowns should be K and E.

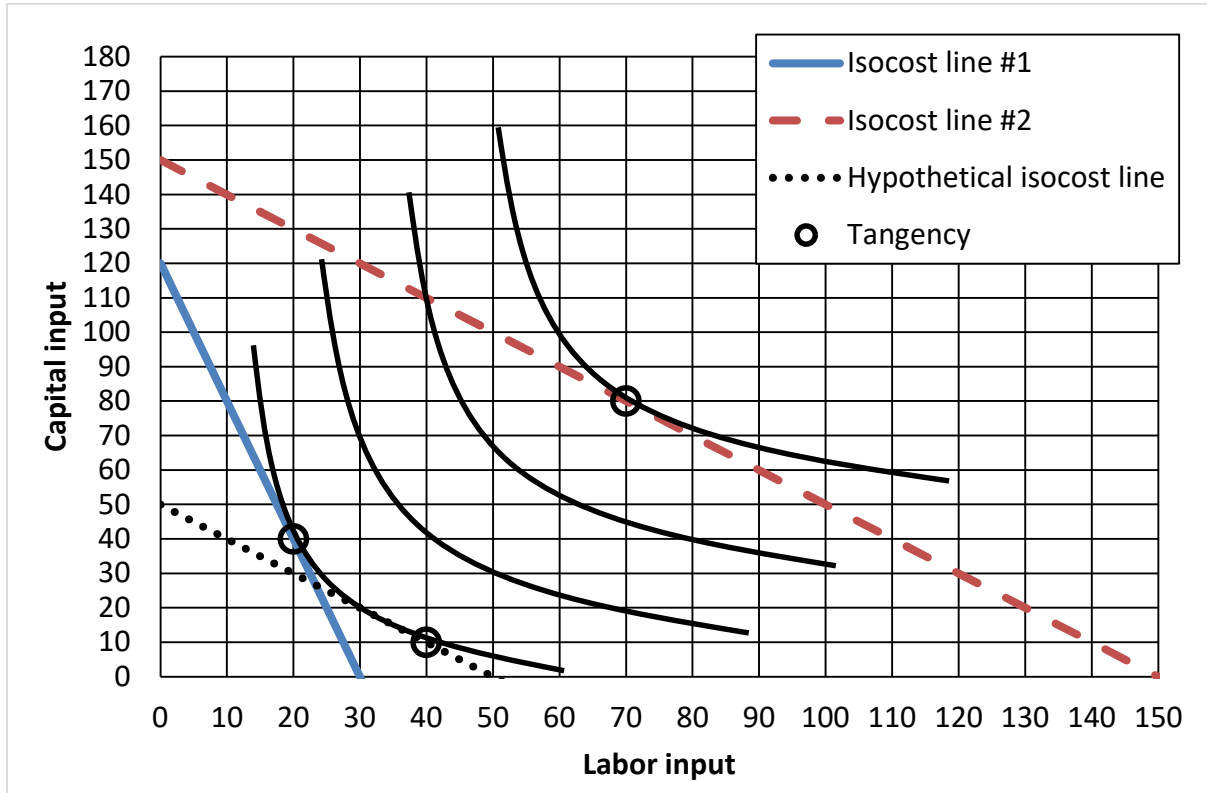
Assume further that the wage is \$10 per hour, the price of capital is \$5, and the capital stock is fixed at $K=25$ units.

b. How much labor E should Acme employ in the short run?

c. How much output q will Acme produce?

d. How much profit will Acme enjoy?

(7) [LR labor demand—scale and substitution effects: 16 pts] SuperDuper Manufacturing Company uses labor and capital to make insulated coffee mugs. The graph below shows SuperDuper’s isoquants, two true isocost lines, and one hypothetical isocost line parallel to isocost line #2.



The price of capital used by SuperDuper is always \$10. However, the wage (the price of labor) changes.

- a. Initially, SuperDuper is on isocost line #1. What is the wage on isocost line #1?
- b. Then in response to a change in the wage, SuperDuper moves to isocost line #2. What is the wage on isocost line #2?

	\$
	\$

Consider the effects of this change in the wage on SuperDuper’s use of labor input.

- c. Does the substitution effect cause SuperDuper to use *more* labor or *less* labor input?
- d. How much? That is, give the *change* in labor input caused by the substitution effect of the wage change.
- e. Does the scale effect cause SuperDuper to use *more* labor or *less* labor input?
- f. How much? That is, give the *change* in labor input caused by the scale effect of the wage change.
- g. Does the total effect cause SuperDuper to use *more* labor or *less* labor input?
- h. How much? That is, give the *change* in labor input caused by the total effect of the wage change.

	units
	units
	units

III. Critical thinking: Write a one-paragraph essay answering *only one* question below (your choice). [4 pts]

- (1) Why is a worker's budget line usually straight? What might cause it not to be straight? Explain your answer with a diagram. Label all curves and axes.
- (2) In a diagram with labor input on the horizontal axis and other inputs on the vertical axis, why must a firm's isoquants typically slope down? Explain your answer with a diagram. Label all curves and axes.

Circle the question you are answering and write your answer below. Full credit requires correct economic reasoning, legible writing, good grammar including complete sentences, and accurate spelling. Label all curves and axes.



[end of exam]