

**HAND IN**

Answers recorded on exam paper

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**QUEEN'S UNIVERSITY FINAL EXAMINATION**  
FACULTY OF Arts and Science  
DEPARTMENT OF ECONOMICS

ECON 212 001 Barber  
April 13th, 2025

**INSTRUCTIONS TO STUDENTS:**

This examination is 3 HOURS in length.

There is 1 section to this examination.

Please answer all questions on the exam paper.

**The following aids are allowed:**  
Casio FX-991 calculator

**GOOD LUCK!**

**PLEASE NOTE:**

**Proctors are unable to respond to queries about the interpretation of exam questions.**

**Do your best to answer exam questions as written.**

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First name (please write as legibly as possible within the boxes)

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Last name

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Student ID number

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This exam contains four questions with four parts each. Show your work. Be clear. *Answers without any explanations will receive zero marks.*

1. Waluigi runs a side hustle making artisanal “Waa-bons,” delicate pastries shaped like his mustache. To produce these pastries he uses two inputs - labour ( $x_1$ ) and mustache-shaped moulds ( $x_2$ ). His production function for the firm is  $f(x_1, x_2) = x_1^{\frac{1}{4}}x_2^{\frac{1}{4}}$  and the price he can sell each pastry for is \$13.50.
  - (a) Suppose  $x_2$  is fixed at 16 in the short run. If the price of his labour is  $w$  and the price of each unit of  $x_2$  is  $r$  how much labour should he use to maximize profits in the short run? **(8 points)**

- (b) Suppose the price of labour is \$1 and the price of each mould ( $x_2$ ) is \$2. How much labour should the firm use? How many pastries would he produce? What are Waluigi's profits? (5 points)

- (c) Given the prices in (b), suppose the government announces a \$2 lump sum tax on businesses, as well as a \$1.25 tax on each unit of labour he uses. How does this influence how much labour a firm uses? What about production and profits? Carefully explain. (6 points)

- (d) Draw a diagram of your solution to (b) and (c). Be sure to carefully label all intercepts and slopes of both the production function as well as the isoprofit line. (**6 points**)

2. Keyser Harmonia has branched out into selling mini cursed pianos. Each piano must be crafted using labour ( $x_1$ ) and wood ( $x_2$ ). These must be combined in fixed proportions. In particular the production function is:
- $$f(x_1, x_2) = \min\{4x_1^{\frac{1}{2}}, 2x_2^{\frac{1}{2}}\}.$$

(a) Does this firm have increasing, decreasing, or constant returns to scale? **(2 points)**

- (b) Suppose the cost of labour  $w_1$  and the cost of wood is  $w_2$ . What are the conditional factor demand functions of each input to produce “y” pianos? What is the cost function? **(6 points)**

(c) If the price that he can sell each piano for is \$18 ( $P = 18$ ),  $w_1 = 16$ , and  $w_2 = 8$ , How many pianos should Keyser Harmonia produce if he is maximizing profit? (use the cost function from (b)) **(6 points)**

(d) Is the average cost this firm increasing, decreasing, or constant? What about marginal costs? Draw a diagram of the cost functions with output along the x-axis and AC/MC on the y-axis. **(4 points)**

3. Gertrude Jekyll is an avid gardener. Gertrude considers two ways to grow her flower garden: either planting them herself using her labour ( $x_1$ ) or hiring shy guys to plant them using their labour ( $x_2$ ). Either method works — they're perfect substitutes. The production function is:  $f(x_1, x_2) = x_1 + 2x_2$ , where output is the number of flowers.

(a) What is the technical rate of substitution for this production function? **(2 points)**

(b) Suppose she wants to grow  $y$  flowers, and the cost of using per unit of Gertrude's labour ( $x_1$ ) is  $w_1$  and the cost per unit of shy guy labour ( $x_2$ ) is  $w_2$ . What are Gertrude's conditional factor demand functions for her labour,  $x_1(w_1, w_2, y)$ , and shy guy's labour  $x_2(w_1, w_2, y)$ ? **(8 points)**

(c) If  $w_1 = 3$  and  $w_2 = 8$  What is the cost function,  $c(w_1, w_2, y)$ ? **(2 points)**

(d) Draw a diagram of an isoquant for producing 2 flowers, as well as an isocost line representing the lowest cost of producing this output level. Show the optimum point on the diagram. Place  $x_1$ , on the X-axis and  $x_2$ , on the Y-axis. Be sure to label the axes, all the intercepts and slopes. **(6 points)**

4. Peach makes custom artisanal gelato. Her production function is:  $f(x_1, x_2) = x_1^{\frac{1}{4}} x_2^{\frac{1}{4}}$ , where  $x_1$  is the amount of cream and  $x_2$  is the amount of sugar. Let  $w_1$  denote the cost of cream (per unit) and  $w_2$  be the cost of sugar (per unit). Let  $p$  denote the market price of her gelato.

(a) Given  $w_1$  and  $w_2$ , derive her cost function  $c(w_1, w_2, y)$ . (7 points)

(b) If  $w_1 = 4$  and  $w_2 = 16$ , what is Peach's supply function  $S(p)$ ? (7 points)

- (c) The market price of output is \$64. How much gelato should Peach produce to maximize its profit? How much profit does Peach make at this optimum? (5 points)

- (d) Now, suppose Peach has to pay a quasi-fixed cost of \$32 for electricity. That is, if Peach makes any gelato at all, she has to pay \$16 for electricity but she does not have to pay this if she produces no gelato. At what price should Peach shut down/not produce at all in the short-run? (**4 points**)

5. You can also use this page for extra space...just indicate on the actual question you are doing so.

*Thanks for a great term. Best of luck in everything ahead.*

**-Mike**