

QUEEN'S UNIVERSITY FINAL EXAMINATION

FACULTY OF Arts and Science

DEPARTMENT OF Economics

Econ 212 001-003 Barber & Bui

December 9th, 2021

INSTRUCTIONS TO STUDENTS:

This examination is 3 HOURS in length.

There is section to this examination.

Please answer all questions in the answer booklets provided

The following aids are allowed:
Casio FX-991 calculator

Put your student number on all pages of all answer booklets, including the front.

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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1. Wenbo is a local carpenter who makes tables. His production function for the number of tables he produces is $f(x_1, x_2) = \sqrt{x_1} + x_2^2$ where x_1 is the amount of labour and x_2 is the amount of wood he uses. His tables sell for \$250 per unit. Labour costs \$12.50 per unit and wood costs \$500 per unit. That is, the variable cost to production is $12.50x_1 + 500x_2$. There is also an additional fixed cost for his workshop of \$50 that needs to be paid regardless of whether any output is produced.
- (a) Does this production function have increasing, decreasing, or constant returns to scale? Carefully explain. **(2 points)**
 - (b) What is the profit equation for this firm? **(1 point)**
 - (c) What is the profit maximizing amount of each input to use? How much does the firm produce when it is profit maximizing? How much profit does the firm make? **(4 points)**
 - (d) The government introduces a new tax of 10% profits. What is the after tax profit function? How much of each input does the firm use? How much profit does the firm make after tax? **(2 points)**
 - (e) Instead of introducing the profit tax in (d), the government decides to add a tax to input 2 of \$100 per unit. What is the profit maximizing amount of each input to use? How much does the firm produce when it is profit maximizing? How much profit does the firm make? **(2 points)**
2. The following problem is about two siblings, Thierry and Vivianne, who love to bake.
- (a) Vivianne has begun experimenting with substituting ingredients when baking cookies. Her production function for cookies $f(x_1, x_2) = 5x_1 + 2x_2$ where x_1 is the amount (units) of almond flour and x_2 is the amount of coconut flour. The cost of a unit of almond flour is \$2 and the cost of coconut flour is \$4. Draw a diagram of an isoquant for producing 30 cookies, as well as an isocost line that represents the lowest cost of producing these cookies. Be sure to label intercepts and slopes of both the isocost and isoquant line. **(3 points)**
 - (b) Thierry knows that for his cakes to come out perfectly he must use eggs and sugar in fixed proportions. Thierry knows he can get four perfect cakes if he combines 3 units of eggs with exactly 2 units of sugar. What is his production function of cakes? Draw an isoquant for producing 24 cakes. **(3 points)**
 - (c) What is Thierry's cost function for producing "y" cakes if the cost of eggs is w_1 and the cost of sugar w_2 ? **(2 points)**

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3. Tua is a local glass blower who makes holiday ornaments. His production function is $f(x_1, x_2) = (x_1^2 + x_2^2)^{\frac{1}{2}}$, a nice and smooth production function, where x_1 is the amount of labour used and x_2 is the amount of glass used.
- (a) Is the marginal product of labour increasing, decreasing, or constant? Carefully explain. **(2 points)**
 - (b) Set up (but don't solve, yet) the cost minimization problem for this firm to produce "y" ornaments if the cost of labour is w_1 and the cost of glass is w_2 . **(2 points)**
 - (c) Assuming the cost of labour is \$2 per unit, and the cost of glass is \$1 per unit, solve the cost minimization problem for the amounts of labour and glass that minimize the cost of producing "y" ornaments. The amount of these inputs should be a function of "y" **(4 points)**
 - (d) If the firm was minimizing costs, how much would it cost to produce 1 ornament? **(1 point)**
 - (e) Is the average cost function of this firm increasing, decreasing or staying constant as the amount of production changes? Carefully explain. **(2 points)** (*Hint: think about the returns to scale of this production function*)