VERSION A

Midterm Exam – Econ 2400
October 6, 2025
Department of Economics, York University

Instructions: On this exam, unless otherwise asked, you should *not* show how you arrived at your answer, only write the answer in the space indicated on the relevant answer sheet. Answers must be given on the correct answer sheet, one for each problem. If you make a mistake, ask for a new answer sheet. Do not fold the answer sheets or write on the back, or outside of the indicated space.

Student name: SID number:

Problem 1. Real GDP Growth [4 marks]

Consider an economy with two (final) goods, A and B, and two periods, 1 and 2. The notation is the same as in class. Prices of good A are given by P_1^A and P_2^A in periods 1 and 2, respectively, and the corresponding prices of good B are P_1^B and P_2^B. Similarly, the quantities of good A equal Q_1^A and Q_2^A in each of the two periods, and the quantities of good B are Q_1^B and Q_2^B.

We let g_1 and g_2 be the (gross) growth rates in real GDP, using years 1 and 2, respectively, as base years:

$$g_1 = \frac{P_1^A Q_2^A + P_1^B Q_2^B}{P_1^A Q_1^A + P_1^B Q_1^B},$$

and

$$g_2 = \frac{P_2^A Q_2^A + P_2^B Q_2^B}{P_2^A Q_1^A + P_2^B Q_1^B}.$$

Now also assume that the quantities of goods A and B grow at the same rate from period 1 to period 2:

$$\frac{Q_2^A}{Q_1^A} = \frac{Q_2^B}{Q_1^B} = G. \tag{1}$$

We also assume that $0 < G < 1$.

(a) Determine which is true: (1) $g_1 > g_2$; (2) $g_1 < g_2$; (3) $g_1 = g_2$; or (4) it is not possible to say based on the information provided. [1 mark]

(b) Let GDP_2 denote nominal GDP in period 2. Write an expression for GDP_2 in terms of some, or all, of P_1^A, P_2^A, P_1^B, P_2^B, Q_1^A, Q_2^A, Q_1^B, and Q_2^B. [1 mark]

(c) Write an expression for g_1. Your answer should be expressed in terms of some (or all) of G, P_1^A, P_1^B, Q_1^A, and Q_1^B, but none of the period-2 prices or quantities. Simplify your answer as much as possible; note the "some-or-all-of" part of the question. [1 mark]

(d) Show how you arrived at your answer under (c). [1 mark]

Problem 2. Growth Rates and Per-Capita GDP [4 marks]

The table below shows some (incomplete) information about the natural logarithms of two macro variables: total GDP, Y_t; and total population, L_t.

t	$\ln(Y_t)$	$\ln(L_t)$
1	1.00	0.80
2	1.05	0.90
3		1.00

Let $y_t = Y_t/L_t$ denote (non-logged) GDP per capita. Also, let $g_t^Y = \frac{Y_t - Y_{t-1}}{Y_t}$ denote the net growth rate in Y_t, with analogous notation for the growth rates of y_t and L_t.

(a) Find the natural logarithm of GDP per capita in period 2, $\ln(y_2)$. [1 mark]

(b) Find the (approximate) non-logged GDP per capita in period 2, y_2. [1 mark]

(c) Find the (approximate) net growth rate in GDP per capita in period 2, g_2^y. [1 mark]

(d) Assume that $g_3^y = 0.10 = 10\%$. Find the (approximate) non-logged level of total GDP in period 3, Y_3. [1 mark]

Problem 3. Business Cycles [4 marks]

(a) The diagram provided on the answer sheet shows the time path for the percentage deviation from trend in real GDP. In the same diagram, draw another path showing deviations from trend for some other (imagined) macro variable that is (i) counter-cyclical and (ii) coincident with the business cycle. Also indicate the peak of the business cycle in the diagram. (There are multiple peaks, but you only need to indicate one.) [2 marks]

(b) What do we call the curve that describes the relationship between fluctuations in employment (or GDP) and fluctuations in inflation (or nominal prices or wages)? Hint: it starts with a P. [1 mark]

(c) Mention one year in which Canada was in a recession after 1961. [0.5 marks]

(d) Mention one macro variable that is leading the business cycle in Canadian data. [0.5 marks]

Econ 2400 Midterm Exam October 6, 2025 – Answer sheet for Problem 1

Version A answers

Student Name:	SID Number:

Answer to 1 (a) (circle one):

(1) $g_1 > g_2$ (2) $g_1 < g_2$

(3) $g_1 = g_2$ (4) Not possible to say

Answer to 1 (b):

$GDP_2 = P_2^A Q_2^A + P_2^B Q_2^B$

Answer to 1 (c):

$g_1 = G$

Answer to 1 (d): (show derivation below)

$$g_1 = \frac{P_1^A Q_2^A + P_1^B Q_2^B}{P_1^A Q_1^A + P_1^B Q_1^B}$$

$$= \frac{P_1^A G Q_1^A + P_1^B G Q_1^B}{P_1^A Q_1^A + P_1^B Q_1^B}$$

$$= \frac{G[P_1^A Q_1^A + P_1^B Q_1^B]}{P_1^A Q_1^A + P_1^B Q_1^B} = G$$

Econ 2400 Midterm Exam October 6, 2025 – Answer sheet for Problem 2

Student Name: SID Number:

Answer to 2 (a):

$\ln(y_2) =$ 0.15

Answer to 2 (b):

$y_2 =$ 1.161834

Answer to 2 (c):

$g_2^y =$ −0.05 = −5%

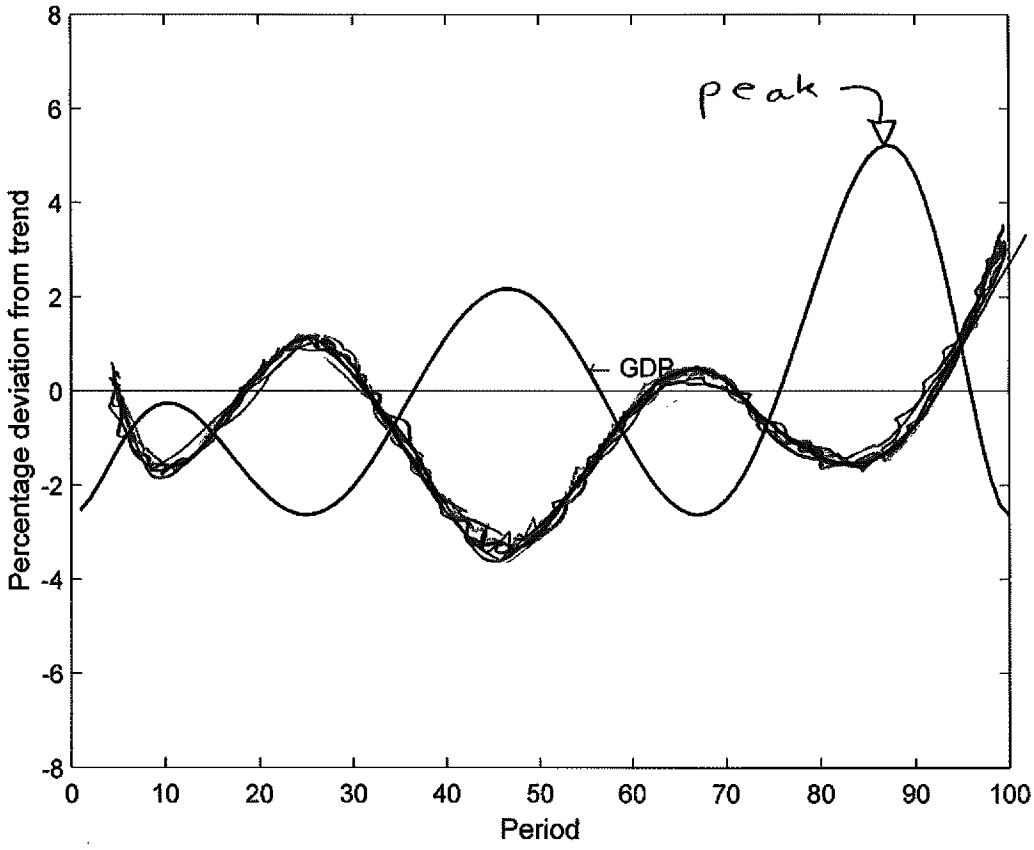
Answer to 2 (d):

$Y_3 =$ 3.490343

Econ 2400 Midterm Exam October 6, 2025 – Answer sheet for Problem 3

Student Name:	SID Number:

Answer to 3 (a):



Answer to 3 (b):

Phillips curve

Answer to 3 (c):

2009 (for example)

Answer to 3 (d):

stock price index

VERSION B

Midterm Exam – Econ 2400
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Student name: SID number:

Problem 1. Real GDP Growth [4 marks]

Consider an economy with two (final) goods, A and B, and two periods, 1 and 2. The notation is the same as in class. Prices of good A are given by P_1^A and P_2^A in periods 1 and 2, respectively, and the corresponding prices of good B are P_1^B and P_2^B. Similarly, the quantities of good A equal Q_1^A and Q_2^A in each of the two periods, and the quantities of good B are Q_1^B and Q_2^B.

We let g_1 and g_2 be the (gross) growth rates in real GDP, using years 1 and 2, respectively, as base years:

$$g_1 = \frac{P_1^A Q_2^A + P_1^B Q_2^B}{P_1^A Q_1^A + P_1^B Q_1^B},$$

and

$$g_2 = \frac{P_2^A Q_2^A + P_2^B Q_2^B}{P_2^A Q_1^A + P_2^B Q_1^B}.$$

Now also assume that the quantities of goods A and B grow at the same rate from period 1 to period 2:

$$\frac{Q_2^A}{Q_1^A} = \frac{Q_2^B}{Q_1^B} = Z. \tag{1}$$

We also assume that $Z > 1$.

(a) Determine which is true: (1) $g_1 > g_2$; (2) $g_1 < g_2$; (3) $g_1 = g_2$; or (4) it is not possible to say based on the information provided. [1 mark]

(b) Let GDP_2 denote nominal GDP in period 2. Write an expression for GDP_2 in terms of some, or all, of P_1^A, P_2^A, P_1^B, P_2^B, Q_1^A, Q_2^A, Q_1^B, and Q_2^B. [1 mark]

(c) Write an expression for g_1. Your answer should be expressed in terms of some (or all) of Z, P_1^A, P_1^B, Q_1^A, and Q_1^B, but none of the period-2 prices or quantities. Simplify your answer as much as possible; note the "some-or-all-of" part of the question. [1 mark]

(d) Show how you arrived at your answer under (c). [1 mark]

Problem 2. Growth Rates and Per-Capita GDP [4 marks]

The table below shows some (incomplete) information about the natural logarithms of two macro variables: total GDP, Y_t; and total population, L_t.

t	$\ln(Y_t)$	$\ln(L_t)$
1	1.10	0.90
2	1.10	0.80
3		0.80

Let $y_t = Y_t/L_t$ denote (non-logged) GDP per capita. Also, let $g_t^Y = \frac{Y_t - Y_{t-1}}{Y_t}$ denote the net growth rate in Y_t, with analogous notation for the growth rates of y_t and L_t.

(a) Find the natural logarithm of GDP per capita in period 2, $\ln(y_2)$. [1 mark]

(b) Find the (approximate) non-logged GDP per capita in period 2, y_2. [1 mark]

(c) Find the (approximate) net growth rate in GDP per capita in period 2, g_2^y. [1 mark]

(d) Assume that $g_3^y = 0.05 = 5\%$. Find the (approximate) non-logged level of total GDP in period 3, Y_3. [1 mark]

Problem 3. Business Cycles [4 marks]

(a) The diagram provided on the answer sheet shows the time path for the percentage deviation from trend in real GDP. In the same diagram, draw another path showing deviations from trend for some other (imagined) macro variable that is (i) pro-cyclical and (ii) leading the business cycle. Also indicate the trough of the business cycle in the diagram. (There are multiple troughs, but you only need to indicate one.) [2 marks]

(b) In Canadian data, deviations from trend in GDP have the feature that when it is above trend it is likely to stay above trend, and vice versa when it is below trend. That is, the current deviation is positively correlated with the deviation in the previous period. What we call this feature? Hint: it starts with a P. [1 mark]

(c) What do we call the most recent recession in Canada? Hint: Two words starting with G and P. [0.5 marks]

(d) Mention one macro variable that is more variable (or volatile) than GDP in Canadian data. [0.5 marks]

Econ 2400 Midterm Exam October 6, 2025 – Answer sheet for Problem 1

Version B answers

Student Name: SID Number:

Answer to 1 (a) (circle one):

(1) $g_1 > g_2$ (2) $g_1 < g_2$

(3) $g_1 = g_2$ (4) Not possible to say

Answer to 1 (b):

$GDP_2 = P_2^A Q_2^A + P_2^B Q_2^B$

Answer to 1 (c):

$g_1 = Z$

Answer to 1 (d): (show derivation below)

$$g_1 = \frac{P_1^A Q_2^A + P_1^B Q_2^A}{P_A^1 Q_1^A + P_1^B Q_1^B}$$

$$= \frac{P_1^A Z Q_1^A + P_1^B Z Q_1^B}{P_1^A Q_1^A + P_1^B Q_1^B}$$

$$= \frac{Z \left[P_1^A Q_1^A + P_1^B Q_1^B \right]}{P_1^A Q_1^A + P_1^B Q_1^B} = Z$$

Econ 2400 Midterm Exam October 6, 2025 – Answer sheet for Problem 2

Student Name:	SID Number:

Answer to 2 (a):

$\ln(y_2) =$ 0.30

Answer to 2 (b):

$y_2 =$ 1.349859

Answer to 2 (c):

$g_2^y =$ 0.10 = 10%

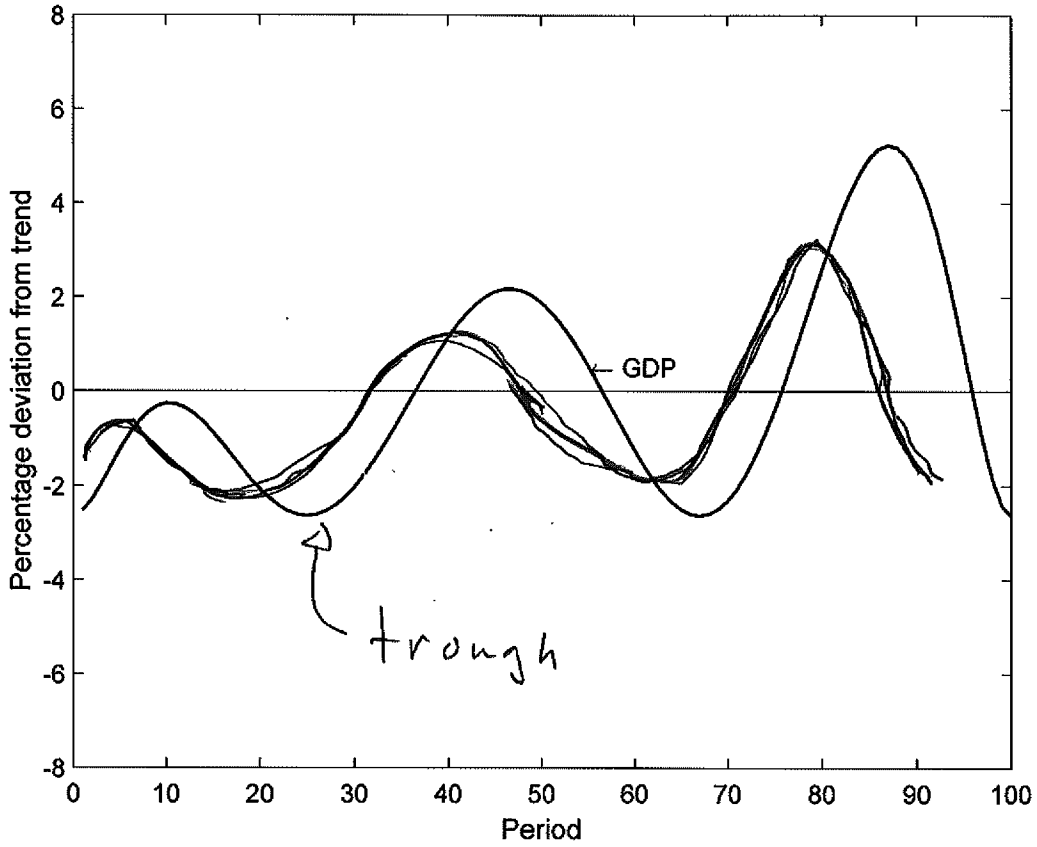
Answer to 2 (d):

$Y_3 =$ 3.158193

Econ 2400 Midterm Exam October 6, 2025 – Answer sheet for Problem 3

Student Name:	SID Number:

Answer to 3 (a):



Answer to 3 (b):

Persistence

Answer to 3 (c):

Global Pandemic

Answer to 3 (d):

Investment

Calculations for Problem 2

Version A:

(a)

$$\ln(y_2) = \ln(Y_2) - \ln(L_2) = 1.05 - 0.90 = 0.15$$

(b)

$$y_2 = e^{0.15} \approx 1.161834$$

(c)

$$\ln(y_1) = \ln(Y_1) - \ln(L_1) = 1.00 - 0.80 = 0.20$$
$$g_2^y \approx \ln(y_2) - \ln(y_1) = 0.15 - 0.20 = -0.05 = -5\%$$

(d)

$$\begin{aligned} g_3^y &\approx \ln(y_3) - \ln(y_2) = \ln(y_3) - 0.15 = 0.10 \\ \ln(y_3) &\approx 0.10 + 0.15 = 0.25 \end{aligned}$$

$$\begin{aligned} \ln(y_3) &= \ln(Y_3) - \ln(L_3) = \ln(Y_3) - 1.00 = 0.25 \\ \ln(Y_3) &= 0.25 + 1.00 = 1.25 \\ Y_3 &= e^{1.25} \approx 3.490343 \end{aligned}$$

Version B:

(a)

$$\ln(y_2) = \ln(Y_2) - \ln(L_2) = 1.10 - 0.80 = 0.30$$

(b)

$$y_2 = e^{0.30} \approx 1.349859$$

(c)

$$\ln(y_1) = \ln(Y_1) - \ln(L_1) = 1.10 - 0.90 = 0.20$$
$$g_2^y \approx \ln(y_2) - \ln(y_1) = 0.30 - 0.20 = 0.10 = 10\%$$

(d)

$$\begin{aligned} g_3^y &\approx \ln(y_3) - \ln(y_2) = \ln(y_3) - 0.30 = 0.05 \\ \ln(y_3) &\approx 0.05 + 0.30 = 0.35 \end{aligned}$$

$$\begin{aligned} \ln(y_3) &= \ln(Y_3) - \ln(L_3) = \ln(Y_3) - 0.80 = 0.35 \\ \ln(Y_3) &= 0.35 + 0.80 = 1.15 \\ Y_3 &= e^{1.15} \approx 3.158193 \end{aligned}$$