Nominal GDP = Real GDP * Price Level

	Apples	Oranges
Q_1	50	100
P_1	$1	$0.80
Q_2	80	120
P_2	$1.25	$1.60

Nominal GDP_1 = $(50*1 + 100*0.80) = $130
Nominal GDP_2 = $(80*1.25 + 120*1.60) = $292
The ratio of nominal GDP = 292/130 = 2.25
Change in nominal GDP = (292/130-1) = **125%**

Real GDP Calculation:

- Assume base year = year 1 →

	Apples	Oranges
P_1	$1	$0.80

Real GDP_1 = $(50*1 + 100*0.80) = $130
Real GDP_2 = $(80*1 + 120*0.80) = $176
The ratio of real GDP, g_1 = (176/130) = 1.354 → Change in real GDP = **35.4%**

- Assume base year = year 2 →

	Apples	Oranges
P_2	$1.25	$1.60

Real GDP_1 = $(50*1.25 + 100*1.60) = $222.50
Real GDP_2 = $(80*1.25 + 120*1.60) = $292
The ratio of real GDP, g_2 = (292/222.50) = 1.312 → Change in real GDP = **31.2%**

- The base year matters in this case because the relative price of apple/orange changes from year 1 to year 2. For instance, RP_1 = 1/0.80 = 1.25 versus RP_2 = 1.25/1.60 = 0.78.

Chain-Weighted Real GDP:

The chain-weighted ratio = $(g\_1*g\_2)\wedge 1/2 = (1.354*1.312)\wedge 1/2 = 1.333$ ➔
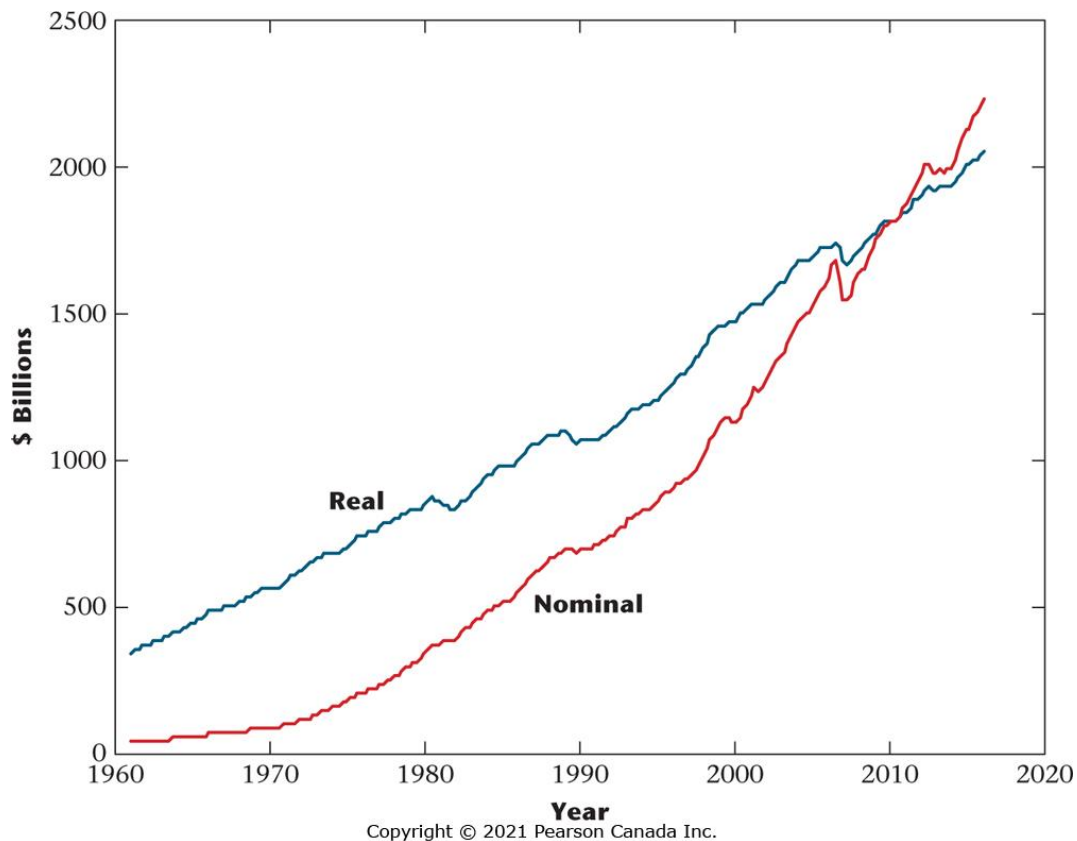Change in real GDP = 33.3%

If base year = year 1, then
Real GDP_1 = $130
Real_GDP_2 = $130*1.333 = $173.29
If base year = year 2, then
Real GDP_2 = $292
Real_GDP_1 = $292/1.333 = $219.05

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Measures of the Price Level:

1. Implicit Price Deflator = Nominal GDP/Real GDP * 100
2. CPI = Cost of base year quantities at current prices/ Cost of base year quantities at base year prices * 100

	Apples	Oranges
Q_1	50	100
P_1	$1	$0.80
Q_2	80	120
P_2	$1.25	$1.60

Quantity in Year 1:

Year 1 = base year >> P_1 ➔ Nominal GDP_1 = Real GDP_1 = $(50*1 + 100*0.80) = $130
Year 2 = base year P_2 ➔ Real GDP_1 = $(50*1.25 + 100*1.60) = $222.50

Quantity in Year 2:

Year 1 = base year >> P_1 ➔ Real GDP_2 = $(80*1 + 120*0.80) = $176
Year 2 = base year P_2 ➔ Nominal GDP_2 = Real GDP_2 = $(80*1.25 + 120*1.60) = $292

Implicit Price Deflator = Nominal GDP/Real GDP * 100

	Year 1	Year 2	% Increase
Year 1 = base year	130/130*100 = 100	292/176*100 = 165.9	[165.9/100 -1]*100 = 65.9
Year 2 = base year	130/222.50*100 = 58.4	292/292*100 =100	[100/58.4 -1]*100 = 71.2
Chain-weighting	100	100*1.685 = 168.5	[(1.659*1.712)^0.50-1]*100 = 68.5

CPI = Cost of base year quantities at current prices/ Cost of base year quantities at base year prices * 100

CPI = 222.5/130 = 171.2 ➔71.2%

GDP Deflator

CPI

20

15

10

5

0

−5

Inflation Rate in Percent

1960   1970   1980   1990   2000   2010   2020

Year