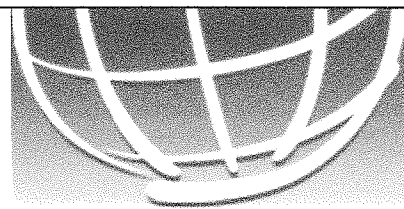


MAP4C: Foundations for College Mathematics, Grade 12, College Preparation

## Unit 4: Data Management

### Activity 7: The Interpretation, Use, and Application of Indices



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### Required Reading

An **index** relates a value to a **base level**. The base level is often the value on a particular date. The base level is set so that a number in the index can be compared and understood in reference to that base level value.

Indices are commonly used in many areas from business and economics (e.g., the Consumer Price Index (CPI), S&P/TSX Composite Index) to science and sports (e.g., Body Mass Index (BMI), Slugging Percentage (SP) in baseball).

#### Interpreting an Index

An index always has a base level. The Consumer Price Index (CPI) is an index that provides a general idea of how much it costs a typical family to purchase a range of over 600 items (goods and services) such as food, transportation, education, shelter, and fuel. The CPI is calculated by using a formula that combines the costs of all these items in one representative number. Each item is assigned a particular weight. Items that are purchased more frequently will have a greater weight than those purchased less frequently. For example, food items will have a greater weight than heating costs. The result is a representative number, or points, representing the cost to purchase the “basket” of all of these items that is compared to the number of the base year.



#### Example

The graph below shows the Consumer Price Index from 1987 to 2006. The notation “2002 = 100” means that the base year is 2002. This means that the values in all other years are compared to 2002.

For example, in 2002, the basket of items costs \$100 (100 points). In 2000, the same basket of items would have cost \$95 (95 points).

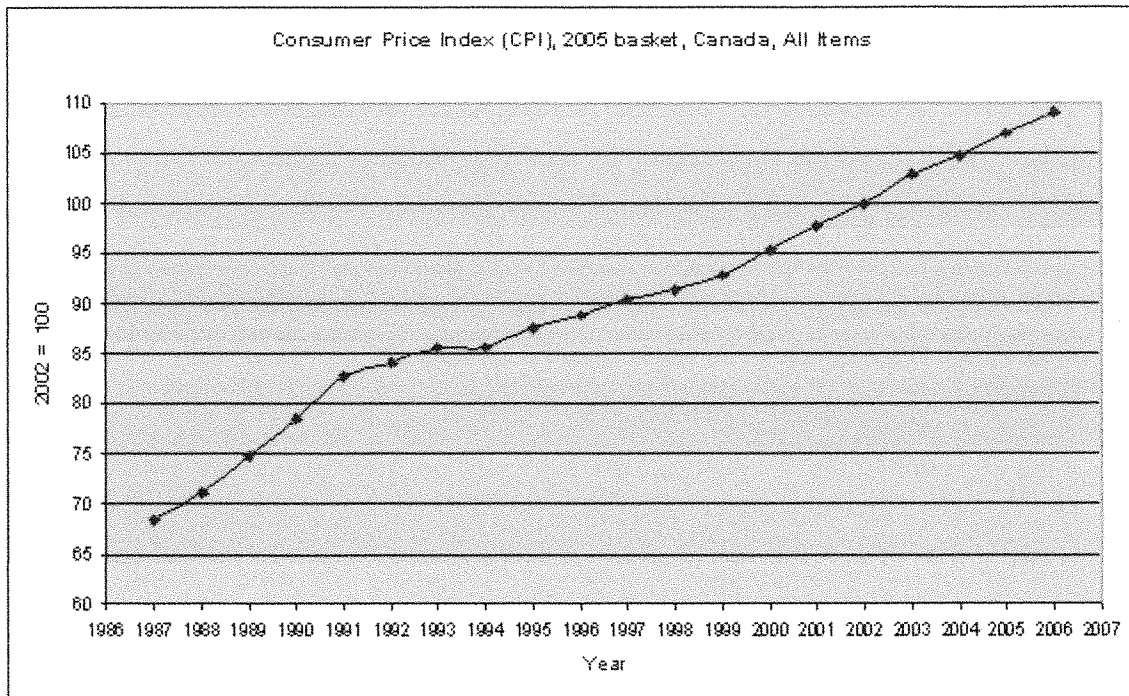


Figure 1

Source: Statistics Canada's Internet Site

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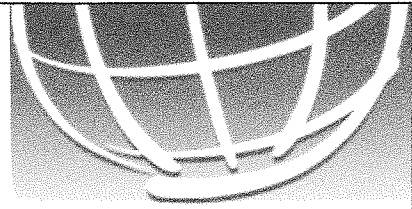
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### Using and Applying an Index

An index is often used to determine values relative to the base year by calculating the percentage change. To do so, use the following formula:

$$\% \text{ change} = \left[ \frac{\text{recent value}}{\text{older value}} \times 100 \right] - 100$$



### Example

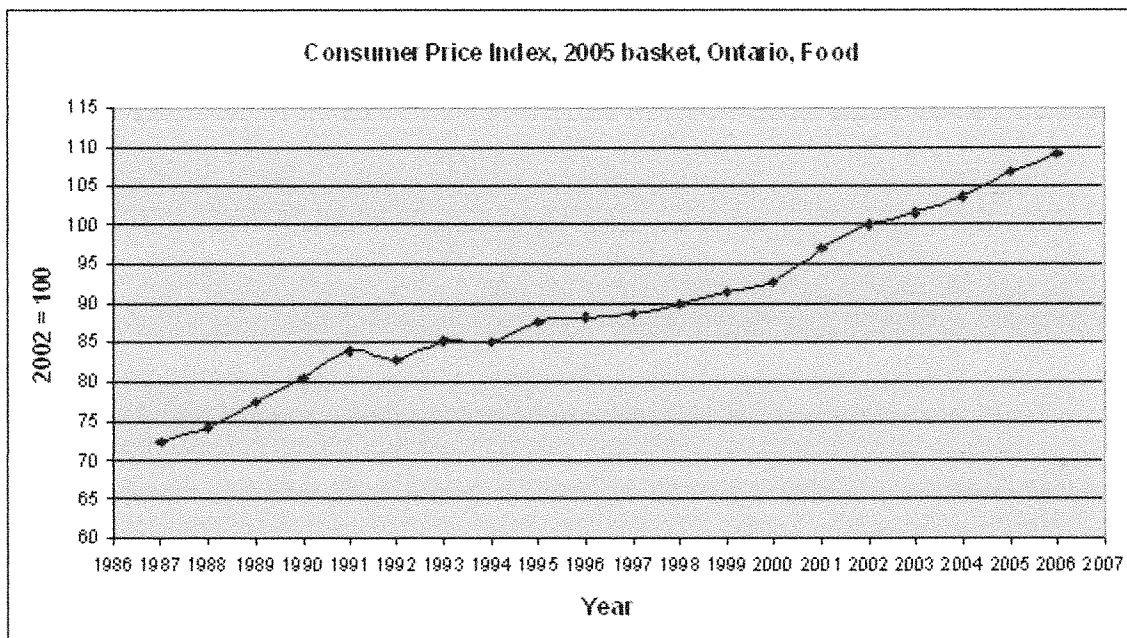


Figure 2

Source: Statistics Canada's Internet Site, <http://estat.statcan.ca/cgi-win/cnsmcgi.exe>, CANSIM table 326-0020, v41691920, December 8, 2007.

Referring to the Consumer Price Index graph for food in Ontario above,

- By how many index points did the CPI increase from 1990 to 2002?
- Express this increase as a percent.
- Estimate how much a food item that cost \$3.50 in 1990 cost in 1998.



## Solution

- In 1990, the CPI is approximately 80 while in 2002, the CPI is 100. Therefore the CPI increased by 20 points.

- $$\begin{aligned} \% \text{ change} &= \left[ \frac{\text{recent value}}{\text{older value}} \times 100 \right] - 100 \\ &= \left[ \frac{100}{80} \times 100 \right] - 100 \\ &= [1.25 \times 100] - 100 \\ &= 25\% \end{aligned}$$

- The index in 1990 was 80. In 1998, it was 90. Now, calculate the percent change:

$$\begin{aligned} \% \text{ change} &= \left[ \frac{\text{recent value}}{\text{older value}} \times 100 \right] - 100 \\ &= \left[ \frac{90}{80} \times 100 \right] - 100 \\ &= [1.125 \times 100] - 100 \\ &= 12.5\% \end{aligned}$$

The price in 1998 is  $100\% + 12.5\% = 112.5\%$  of the price in 1990 since there is an increase in the index. Therefore the new cost is:

$$\begin{aligned} \text{Cost in 1998} &= 112.5\% \times \$3.50 \\ &= 1.125 \times 3.50 \\ &= \$3.94 \end{aligned}$$

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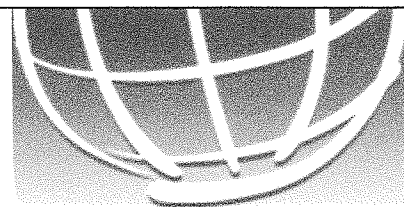
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### Practice



### Questions

The New Housing Price Index shows how selling prices of new residential houses changed over time for builders.

Refer to the New Housing Price Index graph for house and land in Ontario from 1987 to 2002 below to answer the following questions.

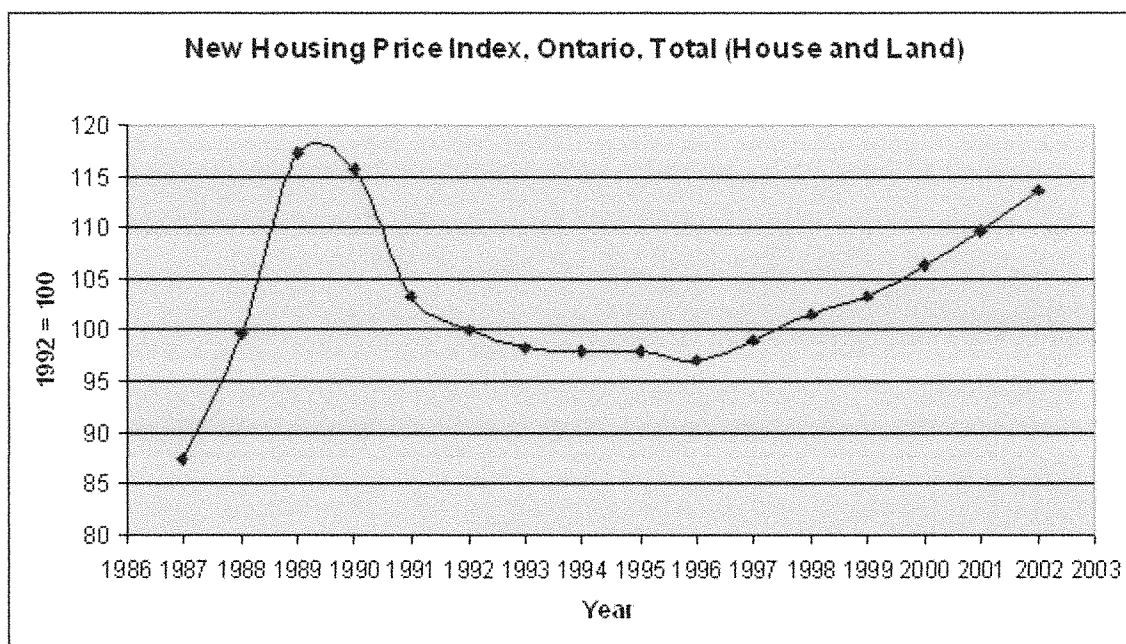


Figure 3

Source: Statistics Canada's Internet Site

1. By approximately how many index points did the New Housing Price Index change from 1990 to 1992?



Answer

2. Express this change as a percent to the nearest hundredth. Is this change an increase or decrease in the value of homes?



Answer

3. Estimate how much a home (house and land) that cost \$379 000 in 1988 cost in 2001.



Answer

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1. By approximately how many index points did the New Housing Price Index change from 1990 to 1992?

In 1990, the index was around 115. In 1992 the index was 100. Therefore, there was a decrease of 15 points.



2. Express this change as a percent to the nearest hundredth. Is this change an increase or decrease in the value of homes?

$$\begin{aligned}\% \text{ change} &= \left[ \frac{\text{recent value}}{\text{older value}} \times 100 \right] - 100 \\ &= \left[ \frac{100}{115} \times 100 \right] - 100 \\ &= [0.8696 \times 100] - 100 \\ &= 86.96 - 100 \\ &= -13.04\%\end{aligned}$$

Therefore there is a decrease in the value of homes between 1990 and 1992.



3. Estimate how much a home (house and land) that cost \$379 000 in 1988 cost in 2001.

The index in 1988 was around 99 and in 2001 it was 110. Now, calculate the percent change:

$$\begin{aligned}\% \text{ change} &= \left[ \frac{\text{recent value}}{\text{older value}} \times 100 \right] - 100 \\ &= \left[ \frac{110}{99} \times 100 \right] - 100 \\ &= [1.11 \times 100] - 100 \\ &= 11.1\%\end{aligned}$$

The value of homes in 2001 is  $100\% + 11.1\% = 111.1\%$  of the value in 1988 since there is an increase in the number of index points. Therefore the new value is:

$$\begin{aligned}\text{Value in 1998} &= 111.1\% \times \$379\,000 \\ &= 1.111 \times 379000 \\ &= \$421\,111\end{aligned}$$

Therefore the value of a \$379 000 home in 1988 is now \$421 111 in 2001.