Math 34: Fall 2015  
Section 8.3 (Inflation)

- **Inflation** the tendency of prices to rise over time

- **Campbell’s Tomato Soup** [http://www.foodtimeline.org/foodfaq5.html#campbells](http://www.foodtimeline.org/foodfaq5.html#campbells)

<table>
<thead>
<tr>
<th>Year</th>
<th>Price/can</th>
</tr>
</thead>
<tbody>
<tr>
<td>1900</td>
<td>$0.05</td>
</tr>
<tr>
<td>1925</td>
<td>$0.08</td>
</tr>
<tr>
<td>1950</td>
<td>$0.16</td>
</tr>
<tr>
<td>1975</td>
<td>$0.20</td>
</tr>
<tr>
<td>2000</td>
<td>$0.55</td>
</tr>
<tr>
<td>2015</td>
<td>$1.09</td>
</tr>
</tbody>
</table>

- **Oreos (14 oz)** [http://www.foodtimeline.org/foodfaq5.html#oreoprices](http://www.foodtimeline.org/foodfaq5.html#oreoprices)

<table>
<thead>
<tr>
<th>Year</th>
<th>Price/can</th>
</tr>
</thead>
<tbody>
<tr>
<td>1925</td>
<td>$0.28</td>
</tr>
<tr>
<td>1950</td>
<td>$0.43</td>
</tr>
<tr>
<td>1975</td>
<td>$0.83</td>
</tr>
<tr>
<td>2000</td>
<td>$2.62 – 3.18</td>
</tr>
<tr>
<td>2015</td>
<td>$4.41</td>
</tr>
</tbody>
</table>

- **Hershey Bar (1.5 oz)** [http://www.foodtimeline.org/foodfaq5.html#candybar](http://www.foodtimeline.org/foodfaq5.html#candybar)

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<tr>
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</tr>
<tr>
<td>1950</td>
<td>$0.08 (≈)</td>
</tr>
<tr>
<td>1975</td>
<td>$0.16 – $0.19</td>
</tr>
<tr>
<td>2000</td>
<td>unknown</td>
</tr>
<tr>
<td>2015</td>
<td>$1.19 (≈)</td>
</tr>
</tbody>
</table>
• We give inflation rates as rates that *compound annually* (So we use the compound interest formula).

• We’re concerned more with longterm averages for inflation (rather than what is has been for the past year or two).
  
  - In 2014 it was about 1.6%
  - In 2004 it was about 2.7%
  - In 1994 it was about 2.6%
  - In 1984 it was about 4.3%
  - In 1974 it was about 11.0%
  - In 1964 it was about 1.3%
  - In the US, the historical average of inflation over long periods has historically been 3% – 3.5%

• When we do retirement planning, and we say we want to be able to pay ourselves $2000 per month (or want $700,000 saved up by retirement) we mean in *Today’s Dollars*.

• $20 in *In Today’s Dollars* means ‘I want the same buying power as $20 today’
  
  - So it doesn’t matter what number $20 in todays dollars will be equivalent to in the future. You want enough money to be able to buy any one of the following:
    * 10 bags of Sour Patch Kids (8 oz)
    * 20 McDonalds Hamburgers (Dollar Menue Quality)
    * 1 Adult Movie Ticket and one Child movie ticket
    * Dinner for 2 (at a Chipotle-quality restaurant)
    * \( \frac{1}{4} \) the cost of a pair of sneakers.
Notice that in Question 2, we assumed our monthly payments would stay the same for the whole 35 years. Even as inflation make that $1000 feel like less and less money.

A more reasonable assumption might be that our salary and monthly payments should keep up with inflation.

• Projections in Today’s Dollars

  – We will assume all numbers are in today’s dollars.
    * Which means that a $50 payment means $50 in today’s dollars
    * (If inflation is 3.5%)
      So PMT = $50 means
      $51.75 next year and
      $53.56 the year after and
      $161.04 at the end of 35 years.

  – Find Real Rate Of Return
    (interest rate you expect to earn on the account) - (expected inflation rate)
  – Use Real Rate of Return as the interest rate in annuity calculations.
1. If we assume candy prices will rise at an effective rate of 3.6%, how much do we expect a bag of Sour Patch Kids that cost $1.99 today to cost in 30 years?

2. Suppose you want $800,000 in Today’s Dollars in your retirement account when you retire in 35 years. If we assume an inflation rate of 3.5%, and assume that our investments will earn 8.5% interest:
   (a) How much do we need in the retirement account to be worth $800,000 in today’s dollars?
   (b) How much should each (equal) monthly payment be to reach your goal?

3. You want $800,000 in Today’s Dollars in your retirement account when you retire in 35 years. If we assume an inflation rate of 3.5%, and assume that our investments will earn 8.5% interest. But suppose you also assume that you intend to increase your contributions to keep up with inflation:
   (a) What is the real rate of return you’re expecting on this investment?
   (b) How much should each monthly payment be (in today’s dollars) to reach your goal?
   (c) Under these assumptions, what are your monthly payments at the end of 35 years? Don’t answer in today’s dollars.

**Finding PMT needed into retirement account (with Inflation)**

For questions where you decide you need $X dollars (in today’s dollars) in your retirement account when you retire.

- **If you plan on keeping payments the same dollar amount:**
  - Adjust your goal amount ($X) for inflation
    (using Inflation Formula = Compound Interest Formula)
  - Calculate the PMT as an annuity, with the inflation adjusted goal amount as your FV
- **If you plan on increasing your payments to keep up with inflation:**
  - Find the Real Rate of Return on your retirement account.
  - Calculate the PMT as an annuity with the real rate of return used as the interest rate.
  - (If you want to know what your payment will need to be after so many years, just adjust your payment amount up using the inflation = compound interest formula)